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BUSINESS ADMINISTRATION

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Business Economics.
Business Organization and Management.
Advertising and Salesmanship.
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Transportation.
Money, Banking and Insurance.
Investments and Speculation.
Accounting.
Auditing and Cost Accounting.
Business Law and Legal Forms.

BUSINESS ADMINISTRATION

THEORY, PRACTICE AND APPLICATION

Editor-In-Chief

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GENERAL MANAGER, THE CHICAGO ASSOCIATION OF COMMERCE,
AUTHOR, "MEN WHO SELL THINGS."

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This work is especially designed to meet the practical every-day needs of the active business man, and contains the fundamental and basic principles upon which a successful business is founded, conducted and maintained. To

those looking forward to a business career, this work forms the basis for a practical and systematic course in "Business Administration"

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CHICAGO

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BUSINESS ECONOMICS

¶ This treatise has been especially prepared by E. L. Bogart, Ph. D., Associate Professor of Economics, University of Illinois, and Author of Economic History of the United States; Hon. O. P. Austin, Chief of Bureau of Statistics, Department of Commerce and Labor; and John Bascom, D. D., LL. D., former President University of Wisconsin. It is supplemented by the writings of recognized experts in the production, preservation and distribution of wealth. The treatment is modern, popular and authoritative. The volume contains many timely and practical suggestions which can be applied with profit to any business. It is also arranged to serve as a quick reference work, and includes a complete table of contents, a comprehensive index and test questions.

WALTER D. MOODY,
Editor-in-Chief.

INTRODUCTION TO BUSINESS ADMINISTRATION.

BY WALTER D. MOODY.

General Manager, The Chicago Association of Commerce.
Author of "Men Who Sell Things."

"The recipe for perpetual ignorance is: Be satisfied with your own opinion and content with your knowledge."

Business a contest of wits

This is an era of the greatest commercial activity the world has ever known. The development of business is one of the marvels of the new century. A few years ago science, as a factor in commerce, was little known and less appreciated. The amazing advantages to business of intellectual attainments were utterly without recognition. Today, however, business has become a contest in which the quickest perception wins, thus transforming the counting room into a battle ground upon which brain matches brain for supremacy and success.

Success—educated enthusiasm

Ah, that enchanting word, S-U-C-C-E-S-S. It does not require a magic key to unlock the door to business efficiency. There is nothing mystic, nothing mysterious in the applied method of the really resourceful men in this day of great successes, of marvelous achievements in business enterprise. The sum total is contained in two words, words that electrify, nevertheless. EDUCATED ENTHUSIASM.

Changing conditions make opportunities

The most formidable barrier to progress has always been the senseless opposition of those to whom it would be of the greatest benefit. Changing conditions are the order of the day, for enlightenment has worked wonders. In olden times, a man of affairs was obliged to guard his property and his loved ones by building a moat around his house and posting sentinels in and around his estate. The time is not long past when, because of prejudice, perversity or ignorance, many men believed that opportunity knocked only once at any man's door.

Today, thanks to deeper insight, most men believe that life itself is opportunity; that the very air we breathe is opportunity; that each new day presents broader opportunities for accomplishing more because of better directed energy. This is not alone the accepted dogma of the man who is making his way in the world. It is the creed, doctrine, tenet or religion, whichever you may care to term it, of the great captains of industry everywhere.

New ideas count

The more successful the man, the more does he think, study, plan, as a part of his daily occupation in the development of the affairs in which he is interested. Newer and better ways to get things done is the business standard employed today by successful men in all lines. Only yesterday if a man of genius advanced a new idea, he found himself ridiculed and his innovation opposed on all sides because it was a new idea. Today, it is different. The man of ideas counts in the trend of affairs as he has never counted before.

Must keep step with changing times

Everything has a subjective reason. Progress is acting as a mighty dynamic force in changing men’s viewpoint of life and things. Suppose the stroke oar on a varsity crew, while in a race against an opposing crew from a competitive institution, should suddenly stop rowing in harmony with his associates and begin to row backwards—that crew would not get very far without trouble. Suppose a lawn mower should be reversed and forced to run backwards—there would not be much progress made in cutting grass on that lawn. Varsity crews and lawn mowers must move forward. Business men must advance with the times.

A great merchant in Chicago tells a good story of his youth. He was a member of a state regiment of militia. On a certain occasion, his company was sent out on dress parade. An old maiden aunt, with considerable colonial blood in her veins, took much pride in her nephew and his company. While reviewing the parade, she was suddenly heard to exclaim: “Why, every single man in that company is out of step excepting my nephew.” Most men who fail to get on in the world do not realize that success lies in keeping step—in making progress with changing conditions. They generally make the mistake of thinking that the world and everything in it is out of harmony with themselves.

New ideas worth searching for

A business man of successful experience realizes that ideas—newer and better principles of conducting business—are of the greatest value, and he also knows that it pays him to search for them. The same old way of doing things cannot longer be successfully employed month after month and year after year as under the old regime. The business man must be modern, up-to-date. The physician or lawyer finds that to compete successfully he is compelled to search without ceasing in order that he may comprehend the advancement in treatments or procedures. “To the man who fails belong the excuses.”

Demand for trained men

President James, of the University of Illinois, was asked if there was any demand from business houses for college-bred men. His reply was: “The demand has been far in excess of the supply since courses in business administration were established in our institution seven years ago. Each year has brought many more requests than we have men to recommend.” Ten years ago President James would have been ridiculed for advancing this new idea for the establishment of a school of commerce in connection with a university. Today, commercial schools are a part of the regularly established courses of nearly all of the great universities of our country. Men trained in the theory, practice and administration of business will always occupy the best positions and will always command the greatest salaries.

Value of new ideas in business emergencies

All men fail at times in the accomplishment of satisfactory results in the various enterprises in which they are engaged, without being able to give an explanation. The principles that have been applied successfully for many years seem apparently to have counted for nothing. It is frequently evident that in such cases a very insignificant thing, a mere oversight perchance, has been the direct cause of the failure. To be able to put the finger on the precise cause of the lack of success in one’s method would locate the cause of the disaster. Then it is that a real appreciation of new ideas is fully realized.

Men paid for what they know—not for what they do

Failure is more often chargeable to a refusal to learn by mistakes how to avoid them than it is in making them. Experience is a good teacher, but who can deny the value to be gained in learning from the experience of others, for we cannot all have the same experience or the same view of similar

experiences. There are many pathways to success, but the road of individual experience is narrow and rugged. It is a commonly accepted fact that for every ten dollars a high-salaried man draws, he receives nine dollars for what he knows and one dollar for what he does. On the same basis the successful business man, employing a large force of other men, realizes that his own greatest worth, as applied to his affairs, lies not so much in what he can do himself as how much he can encourage his employes to do. In either case, his own personal knowledge is the power behind the throne.

Knowledge in excess of present needs necessary

The man who would secure the largest net return from his individual effort in the field of endeavor, and he who would realize the greatest possible advantage from the efforts of those under his command must, of necessity, possess knowledge—indispensable perception far in excess of the needs of the moment. Discernment, like a bank account, soon runs out if it is overdrawn or if it is not continually replenished. In business the "checking system" of knowledge is the sort of account that pays best—not the "savings account system." Knowledge that is simply corked up and allowed to accumulate cobwebs and rust can avail nothing. The sharpest vinegar is procured by constantly replenishing the old stock with new.

90% failures vs. 10% moneymakers

Reliable statistics prove that only about ten per cent of all people who engage in business are successful and make money; the other ninety per cent become insolvent and fail. That is, they do not actually encounter the sheriff, or go into the hands of a receiver, but they fail nevertheless to succeed in the sense of making money, and what other possible reason can anyone have for engaging in business if not to accumulate money?

Failures due to lack of intellectual capacity

Why do so many fail? Ask any credit man and he will tell you that it is not because of the lack of capital, or other material resources, but it is due primarily to a lack of intellectual capacity, the sort of brains that dig and work and sweat until they find a way to accomplish things; brains that go to the bottom of things; brains that are always looking for better results; brains that never abandon a problem until they have found a way to solve it. A friend once told me that he inquired of the manager of a house employing some three hundred traveling men how many salesmen they had. The manager replied, "Three."

My friend asked, “How’s that? I am told your force of traveling men numbers nearly three hundred.” “Ah, that is quite different,” replied the manager; “we have two hundred and ninety-seven traveling men, but only three salesmen.” Quite likely that manager’s estimate was intended to be taken figuratively rather than literally, but it serves to illustrate the fact that in this great United States there are millions of men, young, middle-aged and old, who are content to plod along in a mediocre sort of way, heedless or unmindful of the fact that opportunity, knowledge, possibilities, are calling, calling, calling to them to come up higher. There are hundreds of thousands of other men engaged in business who sit idly by while their trade, like the sands in the hour glass, slowly ebbs away, and eventually is absorbed by their more progressive business neighbors.

Moneymaking and business literature

There is still another vast army of business men—salesmen, clerks and wage-earners of all classes—who are beginning to catch a glimpse of the dawning of a new business era, the greatest the world has ever known, an era impregnated with possibilities and opportunities for those who are ready with wicks trimmed and oil in their lamps. To the earnest latter class which is really desirous of profiting by the experience of others, there is no need of elaborating the possibilities embodied in this course of reading in Business Administration. This set of books, containing valuable business data on many subjects, thousands of pages telling the story of success illustrated by trained men whose names are respected everywhere, is intended to reach all classes. There is absolutely nothing in print that can even approach or can begin to compare with it in value as a reference library for business men or excel it as a complete course of instruction for any man desirous of making the best of his possibilities and opportunities in the kaleidoscopic age through which the business world is now moving.

Practical ideas best

The more practical the ideas, the better the basis for good work. Not long since, business men generally pooh-poohed the idea of employing in the conduct of their business anything new, which was taken from the writings and experience of others, such as is contained in this remarkable series, contributed to by some of the brightest minds in the business world today. There is, however, in these days unmistakably a hungering and thirsting for just this new sort of literature. It fills a long-felt need—fills it exactly, completely, satisfactorily.

Being the author of a work on salesmanship which has had a countrywide circulation, I have been literally besieged by business men everywhere asking me to recommend books treating of successful business methods, and have been chagrined to find how limited was the supply. The man who formerly was prejudiced against such sources of information must now step aside and make way for progress or unite with the popular demand for more education and better methods.

Cannot afford vs. can afford

Show me the man who says he has no patience for such things, and I will show you a man, like the stroke oar and the lawn mower, who does not believe in moving forward in progress. Show me the man who says he has no time to read of new methods and principles, and I will show you the one who utterly fails to perceive that familiarity with business literature of this kind means pecuniary advancement. Show me the man who says he cannot afford to invest in such a set of books, and I will show you one who apparently CAN afford to waste his energy in misdirected effort—that energy and effort which are to every wage-earner and tradesman both his stock in trade and his invested capital.

Failures unnecessary

Someone has said, “There are three kinds of people in the world—the Can’ts, the Won’ts and the Wills. The first fail at everything; the second oppose everything; the third succeed at everything.” I would add a fourth kind—the largest class of all—the Don’t Trys, the “Oh-what’s-the-use,” “It-doesn’t-interest-me” sort of people. Their name is legion; their fault is lack of confidence. Knowledge is the greatest inspiration of confidence to be found on earth. You may not personally be held in the hope-paralyzing bondage that produces the “Oh-what’s-the-use,” or “I’m-not-interested” germ, but if you are not, you are exceptional. Most people are, and that is the reason that such persons are just about what luck, good fortune or chance make them, succeeding if fortune favors them, failing if they are left to depend upon their own resources. Result: Nine fail where one succeeds.

It is very fortunate, indeed, for most men that so much of their happiness depends upon success. There is nothing on earth quite so terrible to think of as failure, especially that due to lack of effort, unless possibly it be the failure of a man who lacks the courage or initiative to try to make the most

of himself, and thus lets his best opportunities escape him. And this last is really the most pitiful thing that can befall a man. It is well enough to plan opportunities, but if we had the wisdom to take advantage of such opportunities as naturally come to us, results would more often be found in the balance on the right side of the ledger. And so I am of the opinion that a clear explanation of why a very large class of people do not succeed is found in some of these expressions—"I don't care," "I can't," "It doesn't interest me," or "Oh, what's the use."

Basis of all business success

One of the great objects set forth in this Business Administration series is to supply the positive energy which begets courage, confidence, initiative and success. We want to make you feel the necessity of doing some reading, a little plain thinking, and to make as clear as possible the important things that are involved in the serious but very fine game of business.

With business becoming with each succeeding day more and more of a science, it is high time to understand what is essential to it. Speaking of the subject of "Organized Business," a great authority recently said, "It is time even for business men to understand business." Again, the purpose of this course in Business Administration is, if possible, to measure the power and principles of business, to trace their ramifications, define their elements, get hold of their vital fundamentals, and so comprehend them, both in technical detail and as a mighty unit. And I am confident we have done all this. I find that at the foundation, the machinery of business is simple, but whether it is plain or complicated, all who would succeed must make every effort to comprehend it thoroughly. All I care to emphasize at present is the great truth that knowledge, established and classified, is the basis of all business success. This is clearly established in this course of reading, and I am trying to incite your imagination in writing of its merits just as I would endeavor to enable you to realize it if I could talk to you personally right across my desk. The observant man can see clearly the things I am talking about, but to most men the mind's eye perceives not by observation, but only when the imagination is stimulated. So I would stir all men to look earnestly into these things, with a view to their personal betterment.

Business axioms simple to understand

Business is far more than business as it is commonly understood. It is a science, and it is the eager, practical minds

of business men that we shall endeavor to convince first of that fact, and our reasons for addressing those principally concerned are especially good. Why? I have found that in writing about business whenever I was able to make the principles so plain that business men understood them, everybody else did, so it is to be expected that if business axioms can be made simple enough for business men to understand them, everyone will apprehend them. Everybody. And it is everybody that we are attempting to reach.

Knowledge is power

For nearly thirty centuries men have recognized the concrete wisdom of Solomon's proverb: "A wise man is strong; yea, a man of knowledge increaseth in strength." Yet we have been slow in making its application universal to the race. But we are beginning to understand that the power inherent in knowledge applies as well to commercial and industrial as to scholastic, political and social life, as well to the counting room as to the pulpit, as well to the shop as to the university, as well to the farm as to the bar. Knowledge is power and is the only source of real intellectual sovereignty that the Creator has ever entrusted to men.

In conclusion, I would say that these words are addressed to the business men of America, and this designation includes the banker and his clerks, the farmer and his sons, the lawyer and the law student, the financier and the man who sells bonds and stocks, the merchant and his clerk, the accountant and the bookkeeper, the manager and his assistants—the ambitious young men of the Twentieth Century type, contemplating the pursuit of any business, trade or occupation.

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PRACTICAL ECONOMICS.

BY ERNEST LUDLOW BOGART, Ph. D.

[Born Yonkers, N. Y., 1870; A. B., A. M., Princeton University, 1890, 1896; Ph. D., University of Halle, 1897; Graduate Student, University of Halle, 1894, 1896-7, University of Berlin, 1894-5, Princeton University (Fellow), 1895-6, Columbia University, 1897-8. Assistant Professor Economics and Social Science, Indiana University, 1898-1900; Professor Economics and Sociology, Oberlin College, 1900-1905; Assistant Professor Economics, History and Politics, Princeton University, 1905-9; Associate Professor Economics, University of Illinois, 1909. Author of Economic History of the United States (Longmans Green & Co., 3rd edition, 1909), and several monographs and periodical articles.]

INTRODUCTION.

In the preparation of this text the author has endeavored to apply the principles of economic science to some of the more important problems of the modern industrial world, and especially those now confronting the people of the United States. He has attempted in doing this above all to make the text practical. The student or teacher of economics will recognize at once that the sections are arranged into groups corresponding with the traditional divisions of economic text-books into production and distribution (land, capital and organization, and labor), consumption, exchange, and the relation of the government to the individual. It is hoped that the text may not be without profit and interest to the general reader as well as the students of the La Salle Extension University.

I. THE MODERN INDUSTRIAL SYSTEM.

We shall probably get the clearest idea of the complexity of our modern industrial society if we contrast it briefly with the simpler state of social organization which preceded it. For this purpose we may take the English manor of the eleventh century. At that time England was a purely agricultural country, and the whole country was divided into manors, of which the lord was regarded as the owner, under feudal conditions, while those who cultivated the land were his tenants. These tenants—villeins and cotters—worked on the lord's land two or three days in the week, and the rest of the time cultivated their own holdings. The whole of the land of the manor, both that of the lord and that of the tenants, was cultivated on an elaborate system of joint labor. The land was divided into strips of about half an acre each, and a man's holding might consist of a dozen or more of these strips scattered about in different parts of the manor. This was done in order to secure equality in the fertility and location of each man's land. At that time the prevailing method of agriculture was known as the three-field system, in which one field, comprising about one-third of the manor and containing a portion of the scattered strips of the lord and every tenant, was planted with wheat, a second field comprising another third of the cultivated land was planted with barley or oats, while the third field was left fallow. The second year saw the second stage of this three-year rotation, one-third of the manor lying fallow each year to recuperate from this exhausting method of cropping; artificial manures were unknown.

Now the significant characteristics of such a manorial society were three. First, it was economically self-sufficient, that is, practically everything that was needed or was consumed on the manor was produced there. There was no need of intercourse with the outside world and there was little contact with it. Salt, iron, and millstones were almost the only things that the inhabitants of such a manor had to buy from outsiders. Consequently there was no production of goods for a market, little money, and almost no trade. The few things that were purchased were paid for at prices fixed by custom. Secondly, agriculture was carried on under a system of joint labor, and

under customary methods which did not change from generation to generation. It is clear that as long as all the land of the manor was thrown together, for purposes of cultivation, into fields on which were planted wheat or barley or which lay fallow, no one individual could cultivate his land differently from his neighbors. Indeed, the holdings of the different tenants were not even separated by fences, but only by ridges of grass. On the land which lay fallow the cattle were turned out to graze; if any man had attempted to plant a new crop the third year, his neighbors' cattle would have devoured it under such a system. Production was regulated absolutely by custom, and no opportunity was given for the development of the inventiveness or initiative of the progressive individual. Thirdly, the tenants were personally unfree, that is, they did not have the liberty of moving freely from place to place, but were bound to the soil which they cultivated. A man could not freely choose either his occupation or his residence. There was no mobility or freedom of movement. Labor was wholly or partly compulsory, and on terms rigidly fixed by custom or by superior authority.

Such a society differs from that of today in almost every point, and offers a startling proof of how far we have progressed in the past eight or nine hundred years. For many of these characteristics, however, we do not need to go back to the English mediaeval manor; the plantation of the South two generations ago, with its system of slave labor, furnishes an illustration more familiar to most of us. With such a condition of industrial development we may now profitably contrast our own of the twentieth century. The chief characteristics of the modern industrial system are the institutions of private property, of competition, and of personal liberty.

The institution of private property is so familiar to us and so fundamental in modern economic life, that we commonly regard it as a natural right. Nevertheless, private property, like most other economic institutions, is the result of a long evolution. Primitive man can hardly have had the conception of private property, and when it did begin to emerge, it was at first confined to movables. Indeed we may say that on the mediaeval English manor the private ownership of land did not yet exist in the modern sense. It was found however that, when each cultivator was permitted to fence in his holding and to call it his own, he cultivated it much more carefully and produced much more. Inclosure led to private property in land and to individual freedom in its use. Today in the United States the

possession and transfer of landed property is almost as easy as that of movables. Private property must be justified on the ground of social utility, because under this method of control so much more is produced than under any system of commercial ownership yet tried. But there are not wanting objectors who contend that limits should be placed upon this institution, and that the right of use, of bequest, and possibly of unlimited acquisition should be brought under social control. The beneficence of private property turns largely upon the existence of competition and individual liberty and to these we must now turn.

Competition is defined as “the act of seeking or endeavoring to gain what another is endeavoring to gain at the same time.” But competition in modern industrial life is not merely a struggle to appropriate an existing good. The very contest, as over the control of a market, may and probably will lead to cheaper and larger production, and thus to the benefit of society. Competition is a selective process in our modern economic society, and through it we have the survival of the fittest. “Competition,” so runs the proverb, “is the soul of trade.” There is, to be sure, a dark side to the picture, for economic competition involves the defeat of the weaker party, but this does not necessarily mean his destruction, for his very failure may sharpen his faculties and secure his ultimate success, or at worst he may find employment under his successful rival. But here again it is being urged that competition is brutal and that we should go back to the mediaeval method of regulation by custom, or resort to combination and monopoly. We are now witnessing experiments in both directions, but competition still remains the controlling force of modern economic society, and bids fair to continue so. It should however be the function of society to raise the ethical level of competition.

Industrial liberty has been developed even more slowly and painfully than the institution of private property, and has in some instances not yet been wholly won. Slavery and serfdom have given way before the higher and more beneficent conception of freedom or liberty. We believe today that a man generally knows what is best for him and will utilize his opportunities to the best advantage; that by giving him a maximum of freedom the welfare of society will at the same time be best promoted. Consequently, in our modern industrial society, a man is given not only social and religious liberty, but is free to move, to choose his occupation, to produce and to

trade, to associate with his fellows, and to expend his income as he will. But here again, while the prevailing rule is liberty, society has found it necessary to lay restrictions upon the abuse of this liberty. It is not enough even to regard the industrial world as a great game in which each may act as he pleases provided only he observes the rules of the game. A higher conception of responsibility and duty must accompany freedom of action if we are to secure the best results.

The term “industrial society” has already been frequently used and needs a somewhat fuller explanation. About the year 1760 there took place in England what is usually called the Industrial Revolution. A number of inventions were made which rendered it possible to use steam-driven machinery in the manufacture, first of textile and then of other goods. Manufactures were removed from the home, where they had hitherto been carried on, to the factory. Capital began to be used in large masses, machinery displaced hand tools, and the laborer ceased to own the implements with which he worked. Men, machines, and capital were massed in the factory and organized under the management of a new set of industrial organizers for the purpose of producing goods for a world market. The development of such an industrial society has been attended by the minute division of labor, by a growing separation of classes, by concentration of the population in urban centers, by the increasing cost and complexity of machinery, by the development of improved methods of transportation and of credit, by the combination of labor and of capital, by the enormous increase of production, and by the growing concentration of wealth.

The introduction of power manufacture completely revolutionized industry. The independent workman with his own tools was superseded by the factory, the small producer has given way in turn to the trust. With the introduction of expensive machinery it became necessary to organize capital on a large scale. Corporations with limited liability were organized for the manufacture of goods, the exploitation of mines, the building of railroads, and the carrying on of trade. As methods of production improved industry became more and more concentrated, and finally huge trusts took over the operation of combined plants. The business unit has grown increasingly larger, and the need and power of capital have become increasingly important. Capital has played a role of growing significance

and has become more and more powerful in modern economic life. Indeed the name “capitalistic production” has been applied to modern industry because of the predominant importance of capital in all lines of wealth production. Impersonal, growing by sheer force of its own momentum, capital is often thought of as intensely selfish and even cruel. Abuses which have arisen in the development of modern capitalistic industry must be remedied, but attacks upon capital itself are misguided and rest upon a mistaken analysis of methods of production.

Before the introduction of the factory system, under the so-called “domestic” system of industry, the laborer carried on his work in his own home, where he provided the raw material, owned his own tools, furnished the motive power—his muscles—and was his own master. Today every one of these conditions is changed—the work is carried on in the factory, the raw material, the tools, the motive power are all provided by the capitalist, the laborer contributing only his own more or less skilled labor, while the conditions under which he carries on his work are largely determined for him. He is no longer his own master. To protect himself against the growing power of capital the worker has organized with his fellows into trade unions. These seek to meet the monopolistic power of capital by exerting a monopolistic control over labor. While they realize that modern productive processes cannot be carried on without capital, they also insist that labor is equally essential. They claim that capital has received more than its fair share of their joint production and has exploited labor; consequently they insist that labor must now demand its just reward and enforce the claim by strikes and by raising wages. To enforce their monopoly, the policy of the closed shop is often enforced. The interests of capital and labor have thus often been made to appear antagonistic instead of complementary to one another. Frequently in their struggles the interests of the consumer have been entirely lost sight of.

These conflicts in the productive processes of modern economic society have led many people to look to the state as the regulator of industry and to invoke state aid or state interference along many lines. Maladjustments in the labor contract, mistaken production, leading perhaps to speculation and financial panics, abuses of power by corporate interests, discriminations by railroads, and similar irregularities are made the excuse for an appeal to state authority. Some would even go so far as to have the state take over and

manage all productive enterprises; but socialism is as yet a protest rather than a constructive force. In the last analysis the state is the regulator of all industrial undertakings, for they all concern society. The state must hold the balance even and see that fair play is given to all groups and all classes; but the greatest amount of freedom compatible with economic justice must be sought for. It is a difficult question how far the state must interfere in the conduct or management of industrial enterprises in order to secure social justice. There is a decided tendency at present to a strengthening of the regulative power of the state for the protection of the weaker classes of society. And yet on the whole the institution of private property, free competition, and a maximum of individual liberty remain the fundamental conditions of our economic life.

But while under the system of individualism, industrial activities have been multiplied, wealth has been enormously increased, and human progress has been greatly advanced, many abuses and evils still remain. Many practical economic problems still await solution. Some of these have already been suggested in the preceding paragraphs; others remain to be presented. It is the purpose of this text to apply to some of the more important practical current problems of our modern industrial life the principles of economic science, and to endeavor to reach fair and just conclusions on controverted points.

II. THE AGRICULTURAL RESOURCES OF THE UNITED STATES.

The land area of the United States, exclusive of Alaska and our island possessions, is a little less than 3,000,000 square miles, or an area somewhat less than the whole of Europe (3,700,000 square miles). Of this about 840,000 square miles, or a little more than one-fourth, still remains in the possession of the Federal Government and constitutes the public domain. The rest belonged to the original thirteen states, has been given to railways or to the states for educational purposes, or has been sold and given away to individual settlers. The policy of the Government in the disposition of the public domain has, on the whole, been to place it as rapidly as possible in the hands of cultivators, and also to use it as a fund to promote internal improvements and education. About 200,000,000 acres had been granted to railroads down to 1871, at which time land grants were discontinued, to secure their early construction. This policy has often been bitterly condemned, and it has been contended that the land should have been saved for actual settlers. It may however be said that without such grants the railroads would not have been built at as early a date as they actually were, and that without railroads the land was practically worthless, as it was too far removed from any navigable waterway to have access to a market. Moreover, the Federal Treasury lost nothing, for the sections of land alternating with those granted to the railroads were sold to settlers for $2.50 an acre instead of $1.25, the customary price for the public lands.

The grants of land for educational purposes have been generally approved. Upon such grants rests the establishment of our state agricultural colleges.

The unique and characteristic feature of the land policy of the United States has been the granting of land to the settler upon actual residence and cultivation for five years. Such a grant of 160 acres is called a “homestead,” and since 1862 has been made to any citizen who is the head of a family or above the age of twenty-one years. In this way over 230,000,000 acres have been placed without cost in the possession of the actual cultivators. The newer public land states are peopled by proprietors, and there has never

grown up in the United States a large class of rich land owners whose land is cultivated by a tenant peasant class, such as exists in England and parts of Europe. For this we must thank not only our land policy, but also the vast extent of unoccupied land that might be had almost for the asking.

Now, however, the public lands available for agriculture have been exhausted; practically all that remains is situated in the arid zone, and needs systematic irrigation before it can be made available for any use except that of grazing. There are still about 100,000,000 acres of choice land in Indian reservations, and as a consequence of the pressure upon this resource and also because of the unwisdom of the old reservation system, the policy has now been adopted of dividing these lands among the Indians in individual ownership, under careful safeguards, and of assimilating the Indians to the rest of the population.

The exhaustion of the fertile and well-watered lands of the Mississippi Valley has forced the later comers to have recourse to the arid soils in the almost rainless region west of the one hundredth meridian of longitude. The character of farming under such climatic conditions must of necessity be very different from what it is in the rainy districts, and the versatility and adaptability of the American farmer is well illustrated by the development which has taken place there. The first effort at the solution of the problem was in irrigation, a method which had been early practised by the Pueblo Indians, and later and most successfully by the Mormon settlers in Utah. By 1900, according to the census, 7,539,545 acres were under irrigation. While most of the work up to that time had been done by private initiative, a demand arose for irrigation at government expense, in response to which Congress in 1902 provided for the building of irrigation works out of the proceeds of the sales of public lands. Regulation and conservation of the limited water supply by governmental authority, either state or national, is indeed essential to the success of irrigation and will probably be the policy of the future.

A second and even more interesting development of American agriculture is the so-called dry-farming which is being successfully introduced into the semi-arid regions. Carefully selected seeds and plants of crops especially adapted to these climatic conditions are used, and then a very careful and intensive method of tillage is followed. The soil is plowed deep and

thoroughly pulverized so that the roots can strike down to the deeper levels and absorb all the moisture available. Extraordinary results have already been attained, and the region that the older geographies labeled “The Great American Desert” bids fair to become one of the most flourishing districts in the country.

That part of the area of the United States which has already been reduced to private ownership is divided into 5,700,000 farms. As almost half of the land in these farms is uncultivated, being forest, waste land, or pasture, it is evident that there is still room for a great increase in the agricultural production of the United States without bringing additional land into the field. The average size of these farms is 146 acres, which looms large indeed when compared with the 20-acre farms of France and the 60-acre farms of Great Britain. The difference is of course due to the difference in the methods of agriculture and the character of the crops, the European conditions demanding intensive cultivation while our methods are still largely extensive.

A more important question even than the number and size of farms, from an economic point of view, is that of ownership. In 1880, when for the first time the federal census collected the statistics of farm tenure, the gratifying result was announced that three-quarters (74.5 per cent) of the farms in the United States were cultivated by their owners. The last census however showed that the proportion had fallen to 64.7 per cent in 1900, and alarm has been expressed that our democratic conditions of land ownership are giving way to a system of tenantry, that the ownership of our farms is being concentrated in fewer hands, and that methods of large-scale production in agriculture are crushing out the independent farmer as effectively as they have crowded out the small manufacturer and retailer in other fields. Correctly interpreted, however, the statistics seem to indicate that the growth of the tenant class marks the endeavor of farm laborers and farmers’ sons to establish themselves as independent farmers rather than the fall of former owners to the rank of tenants. The great majority of the young men are laborers, the majority of those in middle life are tenants, while the older men are for the most part owners of farms. There seems to be a healthy progress upward in the advancement of wage laborers and farmers’ children, first to tenancy, and finally, with increased ability and capital, to

farm ownership. Moreover most of the rented farms are hired by negroes, the change in whose status from slave to tenant marks a great advance.

Another change in our farming population that has been viewed with considerable misgiving is the movement from the farm to the city and the decline in the proportion of the agricultural population to the whole. Indeed the change has been startling, as the United States has passed from a primitive agricultural stage of development to a highly organized manufacturing and commercial stage. From 86.3 per cent of the population in 1820 the percentage of those engaged in agriculture fell steadily until it reached 35.7 per cent in 1900. Many persons have thought that such a movement indicated the desertion of our farms owing to the greater attraction of the cities, and the disappearance of a healthy agricultural population. It has indicated rather a great improvement in the arts of agriculture, whereby one person today, working with improved machinery and better knowledge, can produce nearly three times as much as his grandfather did. The labor set free has gone to the cities—cities of over 8,000 inhabitants now contain one-third of our population as compared with one-thirtieth one hundred years ago—and there produces the thousand and one things which contribute to our modern well-being. A smaller number can now raise all the food necessary to feed the population; that the rest are free to do other things must certainly be counted again, though the conditions under which work in the factory and life in the city are at present constructed leave much to be desired.

Writing about 1865 an eminent English traveler, Sir S. Morton Pets, apologized for calling the United States an agricultural country; today he would be spared this worry, for the Census of 1900 gave the net value of products of the farm as $3,764,000,000 and of pure manufactures as $5,981,000,000. Indeed since 1890 the value of the manufactures of the country has been larger than of the farm products, and the United States now ranks as one of the leading manufacturing nations of the world. Nevertheless the value and amount of the agricultural products are stupendous; the United States leads all countries in the production of dairy products, corn, and wheat, and the greater part of the lumber, meats, tobacco, and cotton which enter into the world’s trade come from her forests and fields.

While the territory of the United States is well adapted by nature to the cultivation of a great variety of agricultural products, as a matter of fact only four branches of agriculture showed a total product in 1900 of more than one million dollars. These were the raising of live stock, and the production of hay and grain, cotton, and dairy produce. The regional distribution of these products was fairly well marked, over half of the live stock and of the hay and grain farms being situated in the North Central States, nearly half of the dairy farms being located in the North Atlantic division, while practically all the cotton is confined to the southern zone; the same may also be said of tobacco and sugar. The semi-arid region of the West is given over almost exclusively to stock-raising. Iowa and Illinois lead as agricultural states.

The character of agriculture in the United States, as in all new countries, has hitherto been extensive, that is, a small amount of labor and capital has been applied to a relatively large amount of land, and only the cream of the soil has been skimmed off, as it were. Where labor is dear and land is cheap this is the most economical method for the farmer; and, although European critics have severely criticized our system of “earth butchery,” whereby the fertility of the soil has been exhausted by constant cropping, with no effort to restore the exhausted properties by fertilizing, the practice has been justified by the conditions which produced it. Already the practical exhaustion of the free public domain has had the effect of raising the price of lands in the Middle West, and this in turn will cause a more careful and intensive system of cultivation. In other words, as our social and industrial conditions approach those of Europe more closely, we may expect our agricultural methods to do so also. One of the most serious practical problems now confronting the American farmer is the change from the old, wasteful, extensive methods to the new, careful, intensive methods of farming. Those who cannot make the change will complain of the unprofitableness of agriculture, but to those who successfully meet the new conditions the future offers much greater rewards than even the era of free land could produce.

It has been said that the year 1887 marked the beginning of a new stage of development in American agriculture—that of reorganization—because in that year Congress passed the Experiment Station Act. This marked the application of the principles of experimental science to agriculture on a

more comprehensive and systematic scale than had ever been attempted before. Stimulated by the increased activity of the government experiment stations, the agricultural colleges have expanded their work. They are offering practical courses to the farmers, and in co-operation with the railroads, some of them have recently been sending out special lecturers, with moving laboratories, to bring the teachings of science as close home to the producers as possible. Finally, the wonderful work being done by Burbank and others in selecting and crossing, by travelers for the federal Agricultural Department in securing plants from all over the world suited to our varied climatic conditions, and by the experiment stations and agricultural colleges in spreading the new knowledge among the farmers and putting it into actual practice—all these departures promise to revolutionize agriculture, and to make it, as one writer has said, a learned profession.

The production of cereals is the most important branch of agriculture, comprising corn, wheat, oats, barley, rye, buckwheat, and rice. Since the building of the trunk railroads, by which the western territory was given access to a market, the progress of cereal production has been extremely rapid, nor does there seem to be any observable slackening. With the introduction of improved varieties of spring wheat, cereal production is being pushed further up into British Canada and our own Northwest. The center of cereal production has moved steadily westward, from eastern Indiana in 1860 to eastern Iowa in 1900. With the practical exhaustion of unoccupied land suitable for grain-raising in the United States, it is clear that the future extension of the industry depends rather upon improvements in the methods of agriculture than upon the addition of new lands. The very practical problem here presented to the American farmer if he wishes to maintain his supremacy in the world’s markets is being nobly and successfully met by the agricultural experiment stations. They are teaching the farmer how to increase his yield of wheat, for example, by scientific seed selection and more careful methods of tillage, from an average of 12.5 bushels per acre for the whole country in 1900 to treble that amount.

Of the separate crops corn is by far the most important, representing 60 per cent of the total value of all cereals produced in 1900. Most of the corn is fed to stock throughout the so-called “corn belt” and comes to market in the form of pork and beef. Although corn is very nutritious and is a favorite

article of diet in this country in various forms, astonishingly little of it is exported. The development of a foreign market still awaits the enterprise of the American farmer and food manufacturer.

The production of live stock is essentially a frontier industry, and while it will probably always be carried on in the semi-arid grazing districts of the West, which can be reclaimed for agriculture only at considerable expense, it already shows a relative decline. Owing to the great growth of the population the domestic demand now consumes almost all the meat produced and the exports are declining. This is one of the reasons for the recent rise in the price of meat. The industry is extensive. Quite the opposite is true of the dairy industry, which is intensive, being carried on for the most part in the vicinity of large cities where land is expensive. The changing character of agriculture and the fact that it is itself a business enterprise demanding a knowledge of market conditions and business methods is well illustrated by the nature of the dairy industry. Dairies are inspected and must conform to certain standards, the milk must be sterilized and shipped, often by special trains, to the cities. Over a third of the butter and practically all of the cheese is now made in factories instead of on the farm, so that it is a question whether the latter at least should not be classified as a product of manufacture rather than of agriculture.

Of the last of the four important branches of agriculture, namely cotton-raising, there is not so much to be said. Owing to the intensive nature of its cultivation, machinery has never been applied on a large scale to its production, as was done in the case of hay and grain. The wasteful methods that prevailed before the Civil War in the South have been largely corrected, and the tendency to sterility of the soil has been met by the increased use of fertilizers. The statistics of cotton crops for the past thirty years do not indicate any decrease in productiveness, and show that the point of diminishing returns has not yet been reached. A peculiar and interesting feature about cotton production is that it is largely in the hands of tenants. The old slave plantations of the South have been broken up into small holdings and many of these are operated by tenants, negroes and whites, who are too poor or too improvident to buy the land outright. The main problems connected with cotton culture are labor problems; and the question has often been anxiously asked whether the free negro will produce as much as the former slave. This can now be confidently answered

in the affirmative, though it yet remains to be seen whether he can be made as efficient a producer as his white competitor. Upon the answer to that question depends not merely the future of cotton production, but the economic salvation of the negro himself. The constantly expanding use of cotton goods assures a brilliant future to the cotton-growing states of the South, for not merely is there an assured market in America and Europe, but the primitive peoples of Asia and Africa may be depended upon to absorb increasing quantities of cotton fabrics.

Hand in hand with the heedless extensive methods of agriculture in the past went wasteful use and even destruction of our forest resources. The annual cut of lumber in the United States is today about forty billion feet board measure; at this rate of consumption it is estimated that the present available supply will last only 35 to 50 years. It will doubtless surprise most readers to learn that about three-quarters of the annual wood cut is consumed as fuel, probably half of our population still depending upon wood instead of coal for fuel. The rapid exhaustion of our forest supplies, with the attendant effects upon moisture, floods, etc., has brought the question of forest preservation to the front as a practical economic problem. We have been squandering the heritage of our children and efforts are now being made to repair some of the loss before we are declared bankrupt. In 1898 the Federal Government began practical work in the introduction of forestry; this received a great stimulus in 1905 when the care of the national forest reserves, embracing over 60,000,000 acres, was put under the control of the Forest Service. Over 150 trained foresters are employed, who manage the forests on the public lands and co-operate with private owners in the introduction of scientific forestry. Several states have taken up the movement, and there is every indication that scientific methods of culture such as prevail in Prussia and other European states, will supplant our destructive denudation of the land. That it is high time to devote attention to the better conservation of this natural resource is made evident by the high and increasing price of lumber.

There is one other natural resource the conditions of whose supply resemble those of forestry and of agriculture in general; this is the fisheries. With careful use, providing for depreciation, and restoring the elements destroyed, all of these should prove inexhaustible and should continue to furnish man with food and lumber for all time. But as in the case of the

other two industries, so with the fisheries, we have been using up our capital and declaring enormous dividends at the expense of the future. The value of the annual catch of fish is $40,000,000, which is exceeded only by that of Great Britain. The problem of the better conservation of this resource has been taken in hand by the Federal Government, through the Fish Commission, and much has been done to repair our early prodigality by restocking lakes and streams with fish. More stringent fish and game laws have also been passed by most of the states, designed to prevent the extermination of the supply.

III. THE MINERAL RESOURCES OF THE UNITED STATES.

The natural resources of any country may be divided into two broad groups, which call for different treatment and give rise to very different problems. There are, on the one hand, resources which are exhaustible but which can be restored again; and on the other, resources which, once exhausted, can never be replaced again by human agency. Under the first head come the soil, the forests, the fisheries, and even the water power, for all of these can be made to yield steady returns to man for thousands of years, if used intelligently. Under the second head belong coal, petroleum, natural gas, and all the minerals; man may discover substitutes, he may economize in the use of these substances, but he can never augment their supply. In the previous section we considered some of the problems that arise in the use of the soil in agriculture, and those connected with our forests and fisheries. For the most part they had to do with the intelligent use of these agencies and the restoration or repair of the elements destroyed. In this section we are met by a very different problem, namely, the conservation of a limited supply of resources and their most economical application to the needs of mankind.

We can distinguish two contrasting answers to this problem, one careless and optimistic, and the other pessimistic and fearful of the future. According to the former point of view we should not borrow trouble of the future; man's career has been one of constant progress; when he has been confronted with a difficulty he has invariably met it. Indeed necessity has been the most prolific mother of invention. If our coal supplies are exhausted, man will devise means of utilizing the heat of the sun, the force of the tides, the motion of the waves, the stores of electrical energy in the air, all of which will yield inexhaustible supplies of heat and energy. If our stores of iron should fail, some enterprising inventor would surely discover a practicable and commercially profitable method of extracting aluminum from clay. New sources of raw materials will undoubtedly be discovered before the old ones give out, and we may confidently expect that, while the

material bases of a high civilization may shift somewhat, they will never crumble and fall.

The other school has sounded a louder note of alarm. At the present rate of consumption the coal and iron deposits of Europe and America must soon be exhausted. The supplies of copper, lead, and other metals in favorable locations are also being consumed at an alarming rate, and no other known supplies are in sight. Within the past century scientific knowledge and engineering skill have combined to unlock the storehouses of the geologic ages, and now like prodigals we are dissipating our fortunes. To treat these exhaustible sources of supply as permanent sources of income, without regard for the future, is based upon unsound theory and must lead to reckless practice.

As so often in opposing counsels, there is an element of truth in each of these contrasting points of view. But the safer plan is not to wait until we have exhausted our natural resources before remedying the evil, but to heed the warnings now. A long step in this direction was taken in May, 1908, when a conference of the governors of all the states, together with college and railroad presidents, business men and others, was held at the White House upon invitation of President Roosevelt. As a result of this gathering a National Conservation Commission was appointed, which will make an exhaustive investigation into the amount and rate of consumption of the natural resources of the country and suggest measures for their better utilization and preservation through national, state, and local action. In line with this movement two other commissions have been established, one on inland waterways and one on country life. As a result of the national awakening we may expect to see a more rational use made of the gifts of nature, and a better organization of our national life. Heretofore the ideal of our business men has been to exploit, one might almost say pillage, the stores of nature as rapidly as possible; it was a pioneer stage of industry, inevitable but wasteful. From now on the new conception must be the restoration where possible of exhausted elements, as of the soil and the forests, and the careful use of the non-renewable stores of wealth so that at least we shall not make them engines of destruction, as in the case of floods and devastation occasioned by careless hydraulic mining in the West. Let us now turn to a more detailed consideration of the separate items in our inventory of national wealth.

Our modern civilization may be said to rest upon coal, for upon its possession depends man's ability to utilize most of the other items of his wealth. Passing over its utility as a fuel to heat our houses, without coal it would be impossible to smelt the iron needed in all our industries, to drive the machinery, to run our locomotives or steamboats, or in a word to carry on the manifold activities of our industrial life. According to the United States Geological Survey there are 335,000 square miles of coal-bearing strata in this country, but the larger part of it is too thin or impure to be useful for industrial purposes; it serves in many localities however as domestic fuel, as in the case of the lignite deposits of the Northwest. An estimate of Professor Tarr places the coal-producing area in the United States at not over 50,000 square miles. At the present rate of consumption —over 350,000,000 tons in 1905—it has been estimated that the anthracite coal deposits will last for only fifty years longer, while we have only enough bituminous coal for one hundred years.

The large deposits of coal in England and their early development gave that country a great advantage over Europe. But as long ago as 1861 Professor Jevons, a noted English economist, sounded a note of alarm: he prophesied that because of the superior size and character of the coal deposits of America, industrial supremacy must inevitably pass to this country. His prediction has already been verified in the case of coal and iron production, and will probably soon prove true of textiles also. The coal deposits of the United States are thirty-seven times as great as those of England, but at the present rate of mining are threatened with exhaustion at no distant date. It has been estimated that there are in China coal deposits capable of supplying the world with fuel for another thousand years. But such estimates are, in the present state of our knowledge about China, the merest guesses, and if true would seem to point rather to the future industrial supremacy of that country in the world's markets.

Two-thirds of the coal mined in the United States is obtained from the Appalachian field, extending from New York to Alabama, Pennsylvania being the largest coal-producing state in the Union. In the iron and steel industries most of the coal is coked, as it is better for blast-furnace use in this form, giving greater heat and containing less sulphur or other injurious substances than coal. Owing to the smaller bulk and cost of transporting

ore, most of the iron and steel industries are situated in the vicinity of the coal supply, as in Pennsylvania, Ohio, Alabama, etc.

Petroleum or coal-oil is closely allied to coal in its origin and distribution and must be classed with it as a most important product, not only for industrial uses, but also because of the contributions it has made to the comforts of living. In its production the United States ranks first, being closely followed by Russia; together these two countries furnish over 90 per cent of the world's supply of petroleum. Enormous economies have been effected in its production and distribution, which is done by piping the crude oil underground to the refineries. For illuminating purposes it is the cheapest form of artificial light; as a fuel it is supplanting coal, where the latter is dear or its cost of carriage high, as on ocean steamers. Finally, the construction of light and convenient gasoline motors has given it great importance as a source of motive power. Natural gas is closely related to petroleum, but the supply has been so reduced by rapid and reckless use that it has but a limited economic outlook and is of local significance only.

Of all the metals iron must be considered the most useful for man, far surpassing the so-called precious metals in economic importance. Its great value is so evident that its production and use have often been taken as a criterion of the material progress of a community. Iron is the only metal that can be welded, and is accordingly of great significance, whether in making strong machinery, as the shafts of ocean steamships or the framework of a twenty-story building, or, in the form of steel, the most delicate surgical instruments or watch springs. Judged by the test of iron ore production the United States ranks high, for it turns out about four-fifths of the world's supply; all of this is used for domestic consumption, in its own blast furnaces, though much of it is afterwards exported in the form of pig iron or structural iron or steel. Though iron is universally distributed throughout creation, it must occur in large beds or deposits before it can be profitably mined. "The most favorable situation of an iron ore for profitable extraction is near good coking coal for smelting and limestone for a flux, as in the Birmingham district of Alabama; and in such a situation even low-grade ores can be worked profitably. Unless this is the case, iron ore cannot be extensively mined excepting under conditions of great abundance and economical methods of transportation, as in the Lake Superior district, where thick and remarkably uniform beds of good ore occur in such a

position that water transportation to the market is possible. Where these conditions do not exist, iron-mining is feasible only on a small scale for the local market. Thus, in the Rocky Mountains there are almost inexhaustible supplies of iron, often of a high grade, which are at present of no value whatsoever."[1]

The most wonderful iron-mining region in the United States and probably in the world lies in the northern part of Michigan and Minnesota, where five ranges or lines of hills contain immense deposits. These lie so near the surface that they can be dug out of open pits at a cost of from 10 to 50 cents a ton, against $1 a ton in a shaft or underground mine. Three-quarters of the iron ore produced in the United States is mined in this district. Its proximity to the lake ports makes possible its transportation to the iron and steel manufacturing centers at very low rates. Machinery has been applied on an immense scale to the work of mining, loading and unloading the ore. Steam shovels scoop up the ore from the open pit, filling cars at the rate of almost one a minute; the work of loading this into the ore ships at the ports is equally expeditious, only about two hours being required to load an ore ship of 6,000 tons, while the work of unloading is performed for the most part by an endless chain of buckets and traveling cranes. By these means an ultra-intensive exploitation of these magnificent deposits is taking place and it is a question whether they will not soon be exhausted. "But the Americans," writes Professor Leroy-Beaulieu, a friendly but keen critic of our industrial development, "relying on the constant good-will of nature, are confident that they will discover either new and productive ranges in this district, or rich deposits in other districts."

The precious metals have received more than their fair share of attention, for the industrial progress of the world is much less dependent upon their presence in large and easily obtained quantities than it is upon the more common metals. Nevertheless they are of importance both in the arts and especially because of their use as money. In their production the United States stands second, being surpassed in the output of gold by the Transvaal in Africa and in that of silver by Mexico. The production of these metals has always in the world's history proceeded spasmodically, and a speculative spirit has usually been present. More recently, however, scientific geological knowledge and improved metallurgical methods are removing the industry of gold and silver mining from a gambling venture to

a legitimate industry. The practical problem at present confronting American gold-mining companies is to reduce expenses, some of the principal bearings having for some years shown signs of exhaustion, as for instance in the Cripple Creek district of Colorado. There is always a chance however that new gold fields may be discovered to make good the exhaustion of the old. In the case of silver, on the other hand, the metal is found in such abundance that the present rate of production seems almost indefinitely assured; a slight increase of the price or improvements in the art of extracting the metal will at any time bring enlarged supplies on the market. Africa, Australia, and the United States produce almost all the world's supply of gold, Colorado being the leading state in the last-named country. Mexico and the United States together produce over two-thirds of the world's silver, the leading rank in this country being held by Montana.

Among the other metals copper is by far the most important. In primitive civilizations, before the art of smelting iron had been discovered, copper was indispensable as it was so easily malleable; in Homeric times, for instance, armor, utensils, money, etc., were made of copper or alloys of copper (bronze and brass). After an eclipse of some centuries copper has again risen to the front rank by reason of its qualities as a conductor of electricity. The new use of electricity to transmit power and the development of electrical industries has greatly increased the demand for this metal and has caused a great expansion in its production. Here again the United States holds first rank, contributing over half of the world's copper supply. As in the case of iron the northern peninsula of Michigan is the most important center of copper production, with Montana a close second and Arizona contributing most of the remainder. Like petroleum, copper production is controlled by a small number of operators, five mining companies alone furnishing one-half of the American supply. It is far from being monopolized, however, as petroleum is, for new and rich supplies lie just on the margin of profitable working and will always be brought into the market whenever the price is artificially raised. One reason for American pre-eminence, aside from the rich stores of the metal, lies in the progress made in the art of refining it by the electrolytic process, considerable foreign ore being brought here to be treated by this method.

Nature has not blessed the United States so abundantly with the minor metals, lead, zinc, and aluminum, while almost all the tin used here has to

be imported.

It is apparent from even this brief and hasty survey of the mineral resources of the United States, comprising those extractive industries which once exhausted can never be restored by man, that this country is wonderfully well equipped with the material means of civilization. Minerals and metals are remarkably abundant and accessible. The wonderful material progress of the United States during the nineteenth century is abundantly explained by this fact, though due credit must also be given to the enterprise, industry, and genius of those who developed these natural resources. The industrial supremacy of the American nation seems well assured, founded on such a stable material basis. We of this country have been rather inclined to boast of our industrial progress and our material bigness, whereas it must now be apparent that we owe much, if not most, to the bounty of nature. We should therefore see to it, in a proper spirit of humility and thoughtfulness, that we do not waste our heritage, but hand it on as nearly undiminished as possible to our children.

There is one other asset in our national wealth which has already contributed much to our progress, and is destined to play an even more important role in the future—and that is our water power. In colonial days, before the invention of the steam engine and the use of coal, this was of prime importance and determined the location of many a town, most of them being located at the “fall line” of the rivers, where water power was obtainable. With the invention of the steam engine and the use of steam as a motive power, industry became less dependent upon water power and moved away from the rivers to the vicinity of coal mines. Now again has come another swing of the pendulum, and with the rise of electricity as a motive power and the harnessing of our streams and waterfalls for the creation of electrical energy, we are beginning to value more highly this source of power. Here again we find the United States wonderfully blessed as compared with other countries. “It is probable,” says Shaler, “that, measured in horse power or by manufactured products, the energy derived from the streams of this country is already more valuable than those of all other lands put together.” The total amount of direct water power used by manufacturing establishments in 1900 was 1,727,000 horsepower.

Prior to 1890 the largest use of water power was in its direct application to machinery at the immediate point of development. Since that time, however, the use of electricity as an agency whereby the energy developed by falling water can be transformed and applied to the driving of machinery has entirely changed the conditions under which the power of our streams can be utilized. The practical possibility of transmitting electrical power over long distances—for example, over 200 miles from the Sierras to San Francisco—has removed the necessity of building factories immediately adjacent to water powers, but permits its utilization where most convenient and often where the lack of coal has made the use of steam power impracticable. The best-known example of the development and transmission of electrical energy for industrial purposes is the case of Niagara Falls, but more striking illustrations may be found on the Pacific coast, while the existence of enormous opportunities on the Atlantic seaboard give brilliant promise for the future of manufacturing in this region. So valuable indeed are these sources of power now seen to be that there is danger that their control may be monopolized by a few shrewd and far-sighted individuals before the general public awakes to a realization of their importance. It has recently been asserted in a reputable magazine that there is a “water power trust” already organized for this purpose. The opportunities for wealth-getting have hitherto been so great in this country, and the great task of the American people has thus far been so exclusively the task of developing its wonderful natural resources, that we have grown careless of our common rights and have permitted the monopolization by private individuals of a number of limited resources of this character. One of the great practical problems of the future is that of securing the growing value of these natural monopolies to the whole people, without at the same time retarding the energy and industrial development of the American people.

IV. CAPITALISTIC PRODUCTION.

Modern production is usually called capitalistic because it involves in its processes the use of a large amount of capital. In a primitive stage of culture man appropriated directly from nature's bounty the food and shelter which he required. But today man has adopted long and roundabout methods of producing goods, involving numerous steps between his first efforts and the turning out of the finished articles. He invents tools and machinery to assist him in his work, and while he multiplies the processes of production he also enormously increases the results. Capital has become absolutely indispensable in modern production and is yearly playing a more important role. At the same time various problems, born of the new conditions, have arisen, such as the growth of large-scale production, the elimination of the small producer and the independent artisan, the growth of trusts, the rhythmic recurrence of speculative periods and industrial crises, the relations of labor and capital, and others similar in character.

The most striking phenomenon of the nineteenth century was the great industrial progress of the more developed nations; this is best shown in a table taken from Mulhall's "Industries and Wealth of Nations," which follows:

Growth of Manufactures in the Nineteenth Century.

Countries	Millions of Dollars.			
	1820	1840	1860	1894
United Kingdom	1,411	1,883	2,808	4,263
France	1,168	1,606	2,092	2,900
Germany	900	1,484	1,995	3,357
Austria	511	852	1,129	1,596
Other States	1,654	2,516	3,455	5,236
Europe	5,644	8,341	11,479	17,352
United States	268	467	1,907	9,498
Total	5,912	8,808	13,386	26,850

Extraordinary as has been this universal growth, the development of manufactures in the United States has been still more marvelous, both absolutely and in relation to other branches of industry Between 1850 and 1900 the population and the products of agriculture both trebled; but the value of manufactured products increased twelvefold and that of capital invested in manufactures nineteenfold The United States, though politically younger than the countries of Europe, is industrially one of the most advanced The application of labor-saving machinery and of improved and economical methods of production and distribution has probably proceeded further here than in any other place Nowhere can we study to better advantage, therefore, than in America the problems that have grown out of this advanced capitalism

The causes of this rapid industrial development are enumerated by the census report as five in number: the agricultural resources of the country, the mineral resources, the highly developed transportation facilities, the freedom of trade between states and territories, and the absence of inherited and over-conservative ideas We have already considered the wonderful agricultural and mineral resources of the country, and have seen how greatly the American people are indebted for their industrial prosperity to the bounty of nature. The magnificent system of inland waterways, comprising over 18,000 miles of navigable rivers, and the railroad system, with over 200,000 miles of track, facilitate a rapid and cheap exchange of products. The enormous domestic market afforded the American manufacturer, larger in consuming capacity than that in any other country in the world, has permitted the economic production of goods on a large scale and a consequent reduction in cost. Foreigners have often asked the question why, if freedom from tariffs and trade restraints has been a good thing within the United States, freedom of trade with other countries would not prove equally advantageous. In answer to this, James G. Blaine, formerly Secretary of State, wrote, “It is the enjoyment of free trade and protection at the same time which has contributed to the unexampled development and marvelous prosperity of the United States.” Finally, the absence of tradition and of over-conservative ideas handed down from a former and more primitive system of industry has been a great boon. There have been developed traits of energy, inventiveness, and ingenuity, which, aided by a

universal system of compulsory free education, have contributed greatly to the material progress of the people.

The system under which the production of wealth in a modern industrial nation is carried on is usually called the factory system, and to this we must now turn, for it is in the factory that the utilization of machinery and capital finds its greatest development. The term is not easily defined, but we may adopt the description given by the late Carroll D. Wright: “A factory is an establishment where several workmen are collected for the purpose of obtaining greater and cheaper conveniences of labor than they could procure in their own homes, for producing results by their combined efforts which they could not accomplish separately, and for preventing the loss occasioned by carrying articles from place to place during the several necessary processes to complete their manufacture.” The essential elements in such a system are the minute division of labor, the large use of labor-saving machinery, the increasing specialization and localization of industry, and the concentration of production in fewer and larger establishments with consequent increase of product and reduction of cost.

The division of labor may mean either the separation of occupation or the division of a process into minute parts. An illustration of separation of occupations may be found in the manufacture of a carriage: one factory produces hubs, another wheels, a third axles, a fourth the body, a fifth manufactures upholstery, a sixth the hardware, and a seventh (the carriage factory, so-called) assembles the parts and places the completed product on the market in the form of a carriage.

As an example of an extreme division of labor the slaughtering and meat-packing industry offers a classical example, though in this case the use of complex machinery is not involved. “It would be difficult,” writes Professor Commons,[2] “to find another industry where division of labor has been so ingeniously and microscopically worked out. The animal has been surveyed and laid off like a map; and the men have been classified in over thirty specialties and twenty rates of pay, from 16 cents to 50 cents an hour. The 50-cent man is restricted to using the knife on the most delicate parts of the hide (floorman) or to using the axe in splitting the backbone (splitter) and, wherever a less skilled man can be slipped in at 18 cents, 18½ cents, 20 cents, 21 cents, 22½ cents, 24 cents, 25 cents, and so on, a place is made for

him, and an occupation mapped out. In working on the hide alone there are nine positions, at eight different rates of pay. A 20-cent man pulls off the tail, a 22½-cent man pounds off another part where the hide separates readily, and the knife of the 40-cent man cuts a different texture and has a different ‘feel’ from that of the 50-cent man. Skill has become specialized to fit the anatomy.”

Usually, however, when the division of labor becomes as minute as that described, the routine-like process is handed over to a machine. Indeed Mr. John A. Hobson states as a law of machine industry the fact that as soon as a process becomes perfectly automatic and mechanical a machine is invented which can do the work better and more rapidly than human hands. Hand in hand, therefore, with the subdivision of labor goes the extension of labor-saving machinery. Labor becomes relatively of less importance than capital in the new methods of production, and man becomes a machine tender rather than an independent producer. There are practical benefits and disadvantages connected with this system. Many writers insist that the effect on the worker is narrowing in the extreme, but Professor Marshall points out that his labor as tender of a machine demands a higher order of intellectual development than that of a handicraftsman, and that he has more leisure, while the product of the present system is immeasurably greater than under the old hand methods. The manufacture of products by machinery has in turn required the making of machines by machinery, as the complex machines of today could not be turned out by hand methods. A characteristic feature of the modern factory system therefore has been the growth of the machine trades, which supply the equipment of the new industry.

With the growing specialization of industry there has gone on an increasing localization in some favored spot or locality. Thus most of the collars and cuffs (85 per cent) manufactured in the United States are made in Troy, N. Y.; 64 per cent of the oyster canning is carried on in Baltimore; 54 per cent of the gloves are made in Gloversville, N. Y.; 48 per cent of the coke in Connellsville, Pa.; 48 per cent of the brassware in Waterbury, Conn.; and 46 per cent of the carpets in Philadelphia. While there are undoubted advantages in such localization and specialization in a particular industry, such as reputation, growth of special skill, etc., there are also offsetting disadvantages, as the complete prostration of the whole community if the

particular trade upon which it depends is disastrously affected by trade depression or by a shifting of the industry to some other locality.

More striking than the concentration of manufactures in particular places has been its concentration in a few large establishments and under the control of fewer individuals. Without entering into the discussion, as yet, of the trust problem, we may at this time take up the earlier and important tendency of industry to be conducted on a large scale. This concentration into a relatively smaller number of establishments has been going on pretty steadily since 1850 and shows no signs of abatement at this time. In the case of the iron and steel industries, cotton manufactures, and leather goods, the movement is positively startling, an actual decrease in the number of establishments having occurred in the half century. This is most marked in the monopolized industries. At the same time there has gone on an enormous increase in the size of the individual plant, in the capital employed, the number of men employed, and the value of the product. Almost the only industries which have not yet displayed this tendency are those which are essentially local in their nature, as grist mills, cheese and butter factories, etc. But in general it is characteristic of manufactures in the United States. The same tendency has been manifest in the countries of Europe, though there a system of well-developed and fairly vigorous hand trades has resisted the movement and made the development in this respect much less rapid than in this country.

Large-scale production is more profitable than production on a small scale in all industries which are subject to increasing returns. By this is meant that the return in product for each additional dollar’s worth of labor and capital employed grows greater the larger the scale on which the enterprise is conducted. When this is true the big enterprise will be able to undersell the little enterprises and eventually to drive them out of business. This is true not only in the competitive industries, but also in those which enjoy a legal or a natural monopoly, as street railways, gas and water plants, etc., all of which show an irresistible tendency to consolidation. Before drawing any conclusions as to the desirability of such a movement, let us examine some of the economies of large-scale production. The most striking and the most important is the economy in fixed capital. Concentration is a result of machine production. As machinery becomes more expensive, the breaking up of the processes of manufacture into small parts requires more complex

and detailed machinery; a larger outlay is requisite for an up-to-date plant. Thus the average amount of capital invested in each iron and steel establishment in the United States increased from $47,000 in 1850 to $858,000 in 1900. The head of a steel company in Pittsburg recently testified before the Industrial Commission that to build and equip a plant for the manufacture of iron and steel under modern conditions would call for an investment of from $20,000,000 to $30,000,000. It is clear that under such conditions of expensive machine methods a small plant would have little chance of existence. Steam railways afford another good illustration of an industry in which enormous economies are effected by the concentration of a number of small, independent lines under one unified control. Every machine is utilized to the utmost; there is no needless duplication of machinery such as would occur if several small plants divided up the business, while expensive machines to carry on relatively small processes can be profitably installed.

But other economies than those in the use of capital are present in large-scale production. A large concern can hire more expensive and better managers, can afford to experiment with new methods, can effect a more minute and economical division of labor, as for example in the slaughtering business above referred to. A striking economy can also be effected in the utilization of what were formerly waste products, and still are in small concerns. This has been carried furthest in the oil-refining and meat-packing industries; a recent statement of Swift and Co., for instance, alleged that the dividends on the stock were paid out of the by-products, such as neatsfoot oil, land fertilizer, glue, fats, etc. Owing, however, to the generally wasteful methods prevailing in the United States not so much attention has been given to this point as in England and Germany. A final economy may be mentioned that can be secured by a large business, namely, carrying on allied or subsidiary processes. Thus the Standard Oil Company builds its own pipe lines, makes its own barrels, tin cans, pumps, tanks, sulphuric acid, etc.

Such an extension in the size of the single establishment would of course not have been possible if improvements in the arts of communication and transportation had not at the same time immensely widened the market. As long as the market was local, and a factory could afford to send its goods over only a limited territory there was of course a fixed limit to the

expansion of that industry. Now, however, when markets are often world-wide and the demand for goods has so enormously increased, while the modern railway and steamship can transport goods cheaply and quickly half around the globe, enterprises can be expanded and carried on on a scale commensurate with the expanded market and improved methods. It is clear then that the tendency to production on a large scale is the logical result of machine methods, that it secures great economies, and that in industries of increasing returns it is absolutely inevitable.

But not only in manufacturing is this movement observable. More recently concentration in large establishments has revolutionized the retail trade. Department stores have supplanted the small shops because they can buy on better terms, get transportation cheaper, offer a greater variety to the customer at a lower price, and save time and trouble to the customer. The growing ease of communication with central shopping districts, the rapid changes in fashion with the consequent large variety which only a large establishment could afford to carry—all these factors have helped along the movement. There are limits to such a movement, for small tradesmen will always hold the repairing trades, and the sale of perishable goods; thus there are no businesses so scattered as the small stores of the "butchers and grocers." But on the whole we may safely conclude that the small storekeeper is doomed now just as the small manufacturer was two or three decades ago. In the carrying trade country carriers and a few cabmen in the cities are the only survivals of the small independent business; the steam railroad and the electric railway have driven the small carrier out of business. In agriculture alone, where concentration is strictly limited by the necessity for intensive cultivation, and in professional and personal service, where the very nature of the business prevents it, is there little or no development in the direction of large-scale methods.

The industrial and social effects of this development have been marked in all countries. In the United States the main attention has been given to the organization and development of machinery, and a wonderful industrial advance has followed the movement. The economic readjustments have consequently been made with comparative ease, and the labor set free by the invention of new machines has been reabsorbed in the same or other industries. Consequently the social effects have not been so marked as to call for special emphasis; as the same question presents itself, however, in

connection with the more recent trust movement we may profitably defer its discussion to the next section.

There is one other characteristic feature of modern capitalistic machine industry which deserves special mention, especially as its development has been carried furthest in the United States. Reference is made to the system of standardization and of interchangeable parts. In no single feature is the contrast between modern machine methods and those of the old hand trades greater. By standardization is meant the production of so-called “standard products” according to some acceptable size, form, or shape. In the manufacture of screws or iron beams, or even ready-made clothing, for example, certain dimensions and sizes which are best adapted for general use, are selected as standard sizes and these are then turned out in large quantities by automatic machinery. The advantages of such a system, in cheapness, quickness of delivery, ability to replace a single broken part, etc., are numerous and manifest. “The possibilities of standardization are strikingly shown in a recent international incident. The Egyptian Government desired a bridge for the Atbara at the earliest possible moment; inquiry was made of the English bridgemakers, but no promise of prompt delivery could be secured. Within twenty-seven days after the tender of the contract was made to an American firm the bridge was ready for shipment. The feat, not a remarkable one, was due to the standardization of bridge material. This in itself was a guarantee of quick delivery and construction.”[3]

Standardization was followed by the system of interchangeable parts, according to which each part of an intricate machine or product is made exactly like the same part in every other machine. The parts can thus be turned out in large quantities and “assembled” at a single operation. From the standpoint of the consumer or user of the machines thus made, the great merit of the system lies in the fact that he can quickly and at small expense duplicate any broken part. It is today applied to almost every product of large consumption, from agricultural implements and steam engines to watches and nails. By producing machinery on this plan it has been possible for American manufacturers to extend their trade very materially in foreign lands. It was recently reported in the newspapers that Mr. E. H. Harriman had expended $65,000,000 in standardizing the equipment on his railroad

systems; while this sum is enormous, it will undoubtedly be justified by the increased economy of repairs and operation.

V. TRUSTS AND MONOPOLIES.

We have already seen how production upon a large scale has superseded production upon a small scale in most important branches of manufactures. We have now to inquire whether production upon a large scale is in turn to be supplanted by single consolidated enterprises, by those combinations of capital known as trusts. Under one of these three conditions industry must be carried on; few people wish to revert to the stage when production was carried on in small establishments, but warm controversy and difference of opinion still exist as to whether centralized management by a single company or combination offers superior advantages to production by independent competing establishments. The concentration of production in a few large establishments has been followed by the consolidation of these larger units into a single whole. Since the days of Adam Smith capital has tended to combine for the purpose of fixing prices, and these combinations have passed through several phases. The earliest form is the agreement of independent concerns to fix prices, as was done by the American railroads in their early traffic agreements. The next step was to divide the field, as has been done by the French railways and the American express companies. A third phase of combination was the pool, which attempted to regulate the output rather than to fix the price or divide the field. Railway, whisky, beam, and other pools were organized for this purpose, but all broke down because of the difficulty of enforcing the agreement and the temptations to each member to break it secretly for the sake of the large profits obtainable. By this time it had become clear that if a real permanent consolidation of interests was to be secured by the competing enterprises some closer form of combination must be devised which could not be broken at will by any member. An industrial union and not a loose confederation must be attained. Accordingly the next step was taken in 1882 by the formation of the Standard Oil Trust, so called because the constituent concerns handed over their business to the complete control of a central board of trustees, receiving in return trust certificates which entitled them to dividends. Similar “trusts” were formed in the whisky, sugar, and other industries, but

were speedily declared illegal by the federal Supreme Court. By this decision the form of combination was changed, but the movement was not at all checked. The next phase and the last was the establishment of holding corporations, which are organized to buy up and hold the stock of a number of individual corporations, which still retain their corporate existence. In this way unity of control is secured, to which is added a certain flexibility; but it is really the trust under another legal form. Where pooling and combination by means of holding companies have been forbidden by law, as in the case of railroad companies, actual consolidation has often taken place, though when trusts are spoken of the other form of combination is more often meant. From the point of view of business organization the holding company is simply an extension of the principle of the corporation, and to a consideration of this we must therefore turn.

There are three classes of establishments by which industry is carried on—those that are the property of an individual, those which belong to partnerships or firms of unlimited liability, and those belonging to corporations of limited liability. The usefulness of the individual system is of course limited to small undertakings, where but little capital and credit are necessary; this form of organization still dominates the field in agriculture, in the small retail trade, and in the repairing industries. The partnership is a joint undertaking by two or more individuals, and makes larger enterprises possible, but as each individual is liable for all obligations of the firm or his partners his personal liability is greatly increased. While it is well adapted to certain undertakings, as moderate mercantile establishments and professional firms, owing to a certain elasticity in the contractual relations of its members, it is not suited to large industrial ventures, both because of the excessive personal liability, and because of the necessity of dissolving the partnership upon the death, withdrawal, or insolvency of any member. The advantage of the corporation lies in the fact that it has a continuous existence, and that the liability of the shareholders is limited to the amount of capital actually contributed by each; it is well adapted to modern enterprise because it permits the summation of large amounts of capital from a number of small savers and centralizes the use of this capital in the most economical manner. There may thus be concentration of management without concentration of ownership. The federal census of manufactures in 1905 showed that, although less than one-

quarter of the manufacturing establishments were organized as corporations, yet they produced three-quarters of the total manufactures in money value. In the field of transportation, corporations are in almost exclusive control, most banks and insurance companies are organized under this form, while mercantile and industrial undertakings are being more and more generally organized as corporations. Not merely are most of our business enterprises being conducted under corporate form and organization, but most recently, as has been already pointed out, there has been a movement to combine individual corporations into larger concerns, or trusts. The trust is usually thought of as a monopoly and, while not necessarily so, it usually does exercise monopoly control; but for the present we shall consider the trust problem from the standpoint of business organization, deferring to the end of the section the discussion of monopoly.

The trust movement may be said to have begun with the formation of the Standard Oil Trust in 1882, but down to 1898 its progress was slow. Beginning with the revival of prosperity in 1898, however, there ensued a veritable stampede of business managers to enter into combinations. During the next three years 149 large combinations, with a capital of over $3,000,000,000, were formed. The movement spent most of its force by 1902, though it is by no means at an end yet, as the recent floating of the Dry Goods Trust indicates. A few figures from reliable authorities will make clear the extent of the movement. According to the New York Journal of Commerce, industrial (i.e., manufacturing and commercial) and gas trusts were organized in the United States between 1860 and 1900, not including combinations in banking, shipping, railroads, etc., as shown in the accompanying table.

Another more recent list by John Moody[4] gives the number of “industrial” trusts organized down to Jan. 1, 1904, as 318; these have acquired or control 5,288 plants, and have a total nominal capital of $7,246,342,533. A movement so general and widespread, and of such gigantic proportions, must have had some powerful and intelligible causes behind. For it was not confined to the United States, but was equally observable in such industrial diverse countries as England, France, Germany, Russia, and other European nations.

Decade.	Number Organized.	Total Nominal Capital.
1860-69	2	$ 13,000,000
1870-79	4	135,000,000
1880-89	18	288,000,000
1890-99	157	3,150,000,000
Total, 40 years	181	$3,586,000,000

The most important and general cause was the desire to secure the legitimate economies of large-scale production. A combined or federated industry may secure even greater economies than a single large factory. These have been concisely stated as follows[5]: “The cost of management, amount of stock carried, advertising, cost of selling the product, may all be smaller per unit of product. A large aggregation can control credit better and escape loss from bad debts. By regulating and equalizing the output in the different localities, it can run more nearly full time. Being acquainted with the entire situation it can reduce the friction. A strong combination has advantages in shipment. It can have a clearing-house for orders and ship from the nearest source of supply. The least efficient factories can be first closed when demand falls off. Factories can be specialized to produce that for which each is best fitted. The magnitude of the industry and its presence in different localities strengthens its influence with the railroads. Its political as well as its economic power is increased.”

Many of these economies of production are not new to these trusts, but have been secured equally by large-scale manufacturing establishments. Some of the savings, especially in buying raw material and marketing their products, are peculiar to the trusts and mark a more efficient mode of organization than mere concentration of industry in single large establishments. Thus, it has been found possible to dispense with a great number of traveling salesmen, of whom it was said that 30,000 lost their positions in the year 1898 alone. When the whisky trust was formed only twelve of the eight distilleries entering into the combination were kept running, but as these were the largest, best located and best equipped, and were run at their full capacity, they were able to turn out as much as all had done before and at an immense economy. The saving of cross freights by having an order filled

from the plant most conveniently located is considerable; Mr. Gates estimated the saving of the American Steel and Wire Company in this single point at $500,000 a year. Such an economy could not be secured by a single establishment, no matter how well organized or on how large a scale. The specialization of particular factories to do special processes is well illustrated by the organization of the United States Steel Corporation.

The growth of this latter combination is an example not only of consolidation, but of the integration of industry, that is, the grouping together under one control of a whole series of industries. From the mining of the ore and coal, through the processes of carrying it to the furnaces, coking the coal and making the pig iron, manufacturing the latter into the finished forms of iron and steel products, and down to the marketing of the latter, every step is carried on under the control of the United States Steel Corporation. The assets of the company were stated as follows soon after its organization, and illustrate the magnitude and scope of its operations:

Iron and Bessemer ore properties	$ 700,000,000
Plants, mills, machinery, etc.	300,000,000
Coal and coke fields	100,000,000
Railroads, ships, etc.	80,000,000
Blast furnaces	48,000,000
Natural gas fields	20,000,000
Limestone properties	4,000,000
Cash and cash assets	148,251,000
Total	$1,400,281,000

In addition to economies due to improvements in methods of organization, production and marketing, another cause for the sudden and vigorous outburst of trust promotion in the years 1898-1902 may be found in the profits to be secured by promoters and organizers. After the successful launching of the first few trusts, with their undoubted economies and advantages, the movement was taken in hand by professional promoters, who organized combinations, often with the help of underwriters, in every branch of industry where there was any promise of profit. That many of these were artificial or premature is evident from the financial results: of the 183 industrial combinations enumerated by the census in 1900, one-third paid no dividends whatever after their formation and another one-third paid no dividends to the holders of common stock. As an indication of the profits obtained by the successful trust promoter may be cited the testimony given before the Industrial Commission in the case of the Tin Plate Trust stating that this promoter realized from $2,000,000 to $3,000,000 profit from the undertaking. When to this is added the profit obtained by the owners of the constituent plants, which were usually taken over by the trust at an exorbitant valuation, it is clear that the stimulus of financial gain was probably stronger in many cases than that of economy in production. The bill was of course paid in most cases by the investing public, which absorbed large amounts of industrials in the years of their active promotion.

Other causes have sometimes been adduced to explain the growth of combinations, such as the tariff and railroad freight discriminations, but these are too local in their influence to explain adequately the world-wide movement toward combination. Trusts exist in free-trade England, and in

Germany where freight discriminations on the state-owned railroads are practically unknown. It is, however, true that in the United States both these factors have been of decisive importance in building up certain powerful trusts. “There can be no doubt,” said the conservative report of the Industrial Commission, “that in early times special favors from railroads were a prominent factor, probably the most important factor, in building up some of the largest combinations. The receipt of discriminating favors from railroads has been conceded repeatedly by representatives of the combinations themselves.” The Standard Oil, beef, coffee, steel, and other trusts may be cited as illustrations. In the matter of the tariff Mr. Havemeyer’s statement that “the mother of all trusts is the customs tariff law” may be set down as the rather peevish utterance of a disappointed beneficiary; but there is no doubt that combination has been made easier behind the tariff wall. Instance the sugar trust itself, the leather, steel, tin plate, and others.

Let us now turn to some of the effects of industrial combinations, which we may classify according as they bear upon competitors and producers of raw materials, labor, and consumers. As the number of competitors is reduced the fierceness of competition among those remaining in the field is greatly increased, for the value of the prize to the successful enterprise is correspondingly greater. It is not surprising therefore that at times this rivalry should have assumed unethical if not actually illegal forms. The practice by some trusts of fixing prices below cost at some strategic point in order to crush out a troublesome competitor, and then correspondingly raising them elsewhere so as not to sustain any loss, is serious because so subtle. Prof. John B. Clark regards this as so serious an evil that he would have the Constitution amended in order that power might be given the Federal Government to prevent it. The producers of raw materials, as cattlemen, crude oil and coal producers, sugar and tobacco growers, and others, complain that the prices at which they sell their products are dictated to them by the trusts, which are practically the sole purchasers of what they have produced. They claim that prices are depressed to the lowest point possible and that every gain from increase of demand goes into the pockets of the trust managers. It may of course be answered that the trust cannot depress prices below the point at which a living profit can be secured by the producer of the raw material or he will stop producing, but there is no doubt

but that the monopoly power possessed by the trust in such cases will sometimes be used to the disadvantage of those whose product it alone buys.

The effects upon labor of the organization of capital in combined industries and under centralized control are more complex. As trusts have superseded single corporations because this mode of industrial organization was more economical, we must expect to find that one of the economies was the displacement of labor. The discharge of traveling salesmen has already been spoken of; with the consolidation of various plants under one control other high-priced men were let go—managers, superintendents, etc. The same thing was true at the other end of the industrial scale and thousands of workmen, usually the least efficient and capable, were deprived of work. The natural consequences of these combinations and economies were not clearly apparent at the time, because they were happily coincident with a period of business expansion and prosperity which reabsorbed into the industrial organism most of the displaced workers. Another phase of the relation between trusts and labor is that of their effect upon wages. In general it may be said that there are only two sources out of which an increase of wages can be paid, and these are the profits of the business organizer and manager or the increased product of the business itself, and of these two only the latter can serve as a permanent source of higher wages. Now it is pretty evident that labor has not been in a position to force the trust magnates to forego their profits. On the other hand, wages in industries carried on by industrial combinations have risen, and it must therefore have been because there was more produced and consequently more to be divided. If the inefficient workers were discharged and only the best ones retained by the trusts, here is one explanation why they could afford to pay high wages—they paid more because they got more done. As yet labor has not admitted that it is unable to cope with these industrial combinations; it has however demanded that it be allowed to combine on a national scale and to bargain collectively for united labor with combined capital.

The discussion of the effects of trusts upon the consumer leads at once to the discussion of their effects upon prices, for it is through the agency of price that the trust touches the ordinary man. The advantages claimed by trust organizers are economies of production and lowered cost; but the vital question to the consumer is whether lowered cost increases profits or

reduces prices. On this point the Industrial Commission reaches the following conclusion: “that in most cases the combination has exerted an appreciable power over prices, and in practically all cases it has increased the margin between raw materials and finished products. Since there is reason to believe that the cost of production over a period of years has lessened, the conclusion is inevitable that the combinations have been able to increase their profits.” Moreover the power over prices was greatest during certain periods when the control of the combinations was greatest. The problem therefore resolves itself into the question, are trusts monopolies? While a categorical answer cannot be given to this, it may safely be affirmed that all trusts try to be monopolies. Nor is it necessary to control the production, sale, or purchase of a commodity absolutely in order to exercise monopoly power; the control of 50 or 60 per cent may suffice to secure virtual monopoly. The purpose of a monopoly is so to fix the price that it will obtain the maximum net profit. It is conceivable that this result may be attained by lowering the monopoly price below the point of the competitive price, but this is unusual. In general a monopoly price has meant a high price, and a high price has meant a restriction of the output. Where that has been the result of trust control, society has been injured, for not only has it not shared in the economies of production but it actually gets less and has to pay more than it would have done under competition. It may be said, however, that even in the case of the greatest monopoly there is always the specter of potential competition threatening its profits, while the possibility of substituting some other commodity for the monopolized article protects the consumer from too great extortion and keeps the price within limits. Absolute control over price is never exercised by any monopoly. Nevertheless, we may fairly conclude, in the words of Henry D. Lloyd, that “monopoly is business at the end of its journey,” control over prices is the object of combination.

There remains to be considered another charge of monopoly which has been brought against the trust, the monopoly of opportunity or the suppression of individual initiative. It is no longer possible, it is claimed, for the man of small means, even with good talents, to engage in business for himself: he must accept some subordinate position in a corporation where his individuality is checked and his power of initiative does not find free play. So far as this is true it would seem to be the result not so much of the trust

movement as of large-scale production. We have seen that the tendency of machine production is to enlarge the business unit and to call for the investment of constantly larger amounts of capital in up-to-date establishments. Some writers even point out that the average business man who engages in business on his own account fails, and that he should therefore be grateful if more efficient producers offer him a remunerative and steady salaried position. Without insisting upon this point it may still fairly be noted that there are large fields of enterprise that lie outside the area of monopolistic control. “Large-scale production is best adapted to articles that can be turned out in large quantities according to uniform patterns and standards; individual initiative is still free in those lines of production that call for artistic ability or appeal to individual tastes, or which, like agriculture, are dependent upon variable conditions.”[6]

There are, however, other evils connected with trust organization and management that are more easily remediable and that call for legislative regulation. “The evils of combination, remedied by regulative legislation,” concludes the report of the Industrial Commission,[7] “come chiefly from two sources: (1) the more or less complete exercise of the power of monopoly; (2) deception of the public through secrecy or false information.” Various remedies have been suggested to meet the first class of evils, those of monopoly, generally in the direction of strengthening the powers of the Federal Government. We have however no lack of legislation on this subject already: thirty-four states and territories have passed anti-trust laws, and the federal Anti-Trust Law of 1890 explicitly provides that “every contract, combination in the form of a trust or otherwise, or conspiracy in restraint of trade or commerce among the several states, or with foreign nations, is hereby declared illegal.” The severe restrictive measures of the states have been largely nullified by the loose legislation of three or four “charter granting” states, in which 95 per cent of all the trusts have accordingly been chartered, while the federal enactments have been found very difficult to enforce. It is not easy to define or to prove monopoly or conspiracy in restraint of trade. The second class of evils has been met by statutes requiring publicity and more definitely fixing the responsibility of corporation officials. Such measures of control must be the first step toward intelligent regulation, and are to be commended as thoroughly reasonable. The establishment of the federal Bureau of Corporations with power to

“investigate” industrial corporations engaged in interstate commerce has already led to the publication of some valuable reports. We must first proceed along the lines of publicity and intelligent information before we attempt more drastic remedies.

VI. SPECULATION AND CRISES.

An unavoidable element of risk enters into all modern business. In the old handicraft stage of industry goods were made upon order; demand preceded supply very definitely, and there was little possibility of mistakes in production. Nowadays, as we have seen, production is for a distant and often uncertain market. It is carried on by machine methods and roundabout processes; sometimes the result is a very remote one and the uncertainty of success is correspondingly great. Production is not based upon order, but upon a forecast of the possible demand, upon a future market. Chance and change are inseparable from productive enterprise—natural chances from the elements, political changes, as war or unfavorable legislation, industrial mistakes or sickness or death of oneself or others, and economic changes, as the invention of a new machine or a change in fashion. These are the unavoidable incidents in industry and are not under the control of the individual business. Some of them, however, are so regularly recurrent that they can be foretold on a large scale for any industrial society, and can be guarded against by insurance. Everyone recognizes the desirability of having such risks as those of fire, shipwreck, lightning, death, etc., assumed by certain individuals or companies who make a business of such risk-taking. A small premium is paid by the individual for protection, and he is freed from anxiety from mischance and is able to devote his whole energies and capital to his business; the insurance company has specialized in this one department and by equalizing the chances over a wide field has practically eliminated them. In doing this it performs a service of recognized and undoubted social value.

There is another kind of risk-taking the social utility of which is not at first sight so clear. Among the chances of productive enterprise are those due to the rise and fall in the prices of the raw materials, the labor, and the finished product between the time when the process of production is begun and the time when it is completed. Every farmer, every manufacturer, every student even who invests capital in his own education, is to some extent a speculator. Along certain lines he can protect himself by insurance, but that

is not possible in all. Is there no way, then, by which he can guard himself against price fluctuations and assure himself of the legitimate gains of his business? This, it may be answered, is the function of the speculator in modern business, and in performing this service he is benefiting society in much the same way that the insurance company does. We must, however, clearly distinguish between legitimate and illegitimate speculation; we are discussing only the former.

One way in which the speculative risk attaching to price fluctuations is reduced for the manufacturer and assumed by the speculator is by the establishment of a continuous open market, as the stock and produce exchanges. If a miller, for instance, engages to deliver flour a year hence and expects to begin milling in six months, he must know at what price he can buy his wheat when he needs it, or his anticipated gain may be turned into a loss by an unexpected rise in the price of wheat. He is able, however, to buy a "future" in wheat on the produce exchange from some broker who makes a specialty of this business. He buys his needed wheat now for delivery six months hence, and on the basis of this price is able to accept an order for his flour a year from now, allowing himself a fair profit as a miller but wholly eliminating the speculative risk of price fluctuations. Or a building contractor, before making an estimate of the cost of erecting a structure, will secure options at definite prices from dealers on the materials he will require. So, too, in the iron and steel business it is customary for manufacturers to contract in advance for materials at the same time that they accept orders for the delivery of the finished products. In all these cases the business of dealing in futures is assumed by a particular class, who have developed a special skill and ability in forecasting price variations, and who can do so very accurately. It is not a matter of luck or chance, but the result of wide knowledge and careful study. "To foretell the price of wheat one must know the rainfall in India, the condition of the crop in Argentina, must be in touch as nearly as possible with every unit of supply that will come into the market." Sometimes the speculators make mistakes, but they are certainly less apt to do so than men who are without their special talent and training.

The social value of this service lies in the equalization of demand and supply between the present and future that is thereby effected. Let us take as an illustration the case of the miller cited above. If at the time he accepts the

order for flour the price of wheat is high, he will be inclined to charge a high price. But the wheat broker, foreseeing that there is going to be an abundant crop six months hence, engages to sell him his wheat for future delivery at a low price, and he is thereby enabled to sell his flour at a lower price. At the same time the price of the wheat on hand at the present time, instead of being held and sold at famine prices, is consumed for present needs at moderate prices. The operations of the wheat brokers in such a case have a very steadying influence on prices, preventing the oscillation between very high prices in times of scarcity and very low prices in times of glut. It must be admitted that dealings in futures are highly speculative; "but it must be remembered that it is not merely the dealings in futures, but the future itself, that is uncertain. If such dealings can be confined to the men most competent to make accurate predictions, their tendency will clearly be to lessen the uncertainties of business."[8] But closely connected with legitimate speculation or risk-taking by a specialized and trained class, there is, as our stock and produce exchanges are actually conducted, a large amount of illegitimate speculation, and to this we may now turn for a brief consideration.

The facilities offered by the open markets on the exchanges and the practice of dealing in futures are taken advantage of by many who, without any special training or opportunities of knowing the market, simply bet on the price movements. Brokers are willing to buy and sell produce or stocks for their customers if the latter will put up with them a margin of about 10 per cent to protect them from loss. It is therefore possible for a person with little capital and no knowledge to speculate on a margin, buying what he does not want and selling what he does not own. In practice it is impossible to distinguish between those dealings in which actual delivery is intended (legitimate speculation) and those in which no such delivery is contemplated (gambling), and consequently most efforts to regulate transactions on the exchanges have failed to accomplish their purpose. The purification of their methods would seem to lie with the members of such exchanges themselves. The contention has often been made that these fictitious transactions in such commodities as wheat or corn or cotton create an artificial reduction in prices, since the professional gambler usually sells short or "bears" the market, and that this injuriously affects the farmer. This is manifestly untenable, since every fictitious sale must be balanced by a

fictitious purchase. What actually takes place is simply a bet between the two parties to such a transaction on the actual course of prices and of itself does not affect prices, except in the unusual case of a “corner.” There is, however, great possibility of evil in the presence of a crowd of uninformed speculators, for they can greatly increase the power of an unscrupulous operator who can persuade them to follow his lead. Their presence, too, increases the temptation to such a man to rig the market. Under present conditions the abuses of speculation are more in evidence than the economic advantages. How to confine speculation to the small group of risk-takers who have special training and aptitude for it, and to prevent gambling on the stock and produce exchanges is one of the economic problems of the day.

One of the most striking phenomena of modern industry is the frequent and violent convulsions of business known as crises. They are characteristic of all commercially advanced countries and are generally most marked in those countries which are most advanced. They are a product of modern methods of capitalistic production and are essentially a phenomenon of the nineteenth century. A crisis in its last analysis is the result of a lack of adjustment between production and consumption, due primarily to mistakes in production. It is significant that crises usually occur in periods of business prosperity when credit is easy, prices high, and employment general. Such a period of business prosperity and rising credit may have been begun by a series of good harvests. The demand for manufactured commodities increases, prices rise, manufacturers enlarge their factories or engage in new enterprises, wages and profits go up. Many speculators, seeing the rise, and thinking it will continue, borrow money to buy goods with the expectation of selling again at a profit. Credit operations are expanded to a dangerous extent, and when at last a shock to confidence occurs the house of cards collapses and a painful liquidation and readjustment of industry ensues. The state of trade, in the words of Lord Overstone, “revolves apparently in an established cycle. First we find it in a state of quiescence—next improvement, growing confidence, prosperity, excitement, over-trading, convulsion, pressure, stagnation, distress, ending again in quiescence.”

The immediate occasion of a crisis is always a shock to credit or confidence. Such a shock, begun perhaps by the failure of a bank or

merchant, creates a demand for ready money. No one is sure that his neighbor will remain solvent. Everyone accordingly tries to secure himself against loss by enlarging his cash reserve and thus lessens the supply for others. Now modern industry is carried on by means of credit. There is at no one time enough money in the country to meet all obligations expressed in terms of money. Considerably over three-fourths of the larger commercial transactions in the United States are carried on by means of credit. If everyone tries at the same time to get actual cash, there is simply not enough money in the country to go around. This increase of demand and diminution in the supply of money forces up the interest rate on short-time loans. Money—actual cash—is needed by many people to meet immediate engagements and they are willing to pay almost any price for it. In the last panic the rates for call money went up to over 100 per cent and in many cities in the United States clearing-house certificates and other substitutes for money were issued for use in ordinary retail trade. But even at high rates money can often not be borrowed. Many merchants and manufacturers are compelled to sell their goods at a sacrifice in order to obtain it. Vast quantities of goods and securities are thrown on the market just when investors and consumers feel least able to purchase. The result is a fall in prices. Such a fall in prices lowers profits. Enterprises have been started and engagements made on the supposition that prices would continue at the old high level. When they fall it is impossible to pay interest out of current earnings. Foreclosures and readjustments take place. There is a general liquidation and reorganization of industry. When interest contracts have been adjusted, then the effect on wages begins to be felt. As long as a manufacturer is struggling to maintain his credit he will keep his factory going, but when he has failed and perhaps been foreclosed, then the factory stops. Men are thrown out of work, and wages—the price of labor—fall. Labor troubles usually mark the end of such a period of readjustment.

This stage marks the end of the crisis and the beginning of a period of depression or “hard times,” which continues for a longer or shorter period. The panic of 1893 was followed by a long-continued depression which lasted until 1897, a period which was marked by low prices and slack work. In 1898 began a revival of business and an era of marked prosperity set in which continued for almost ten years, interrupted only slightly by a “Wall Street panic” in 1903. In October, 1907, a severe crisis occurred, recovery

from which, however, has been remarkably rapid. The periodicity which has attended crises in the past is so marked—occurring as they have at intervals of about ten years—that many writers consider them inevitable. As the easiest way to answer this question we may take up three main theories as to the causes of crises.

A much quoted, but now generally discredited, theory is that of W. S. Jevons, a noted English economist, who ascribed crises to sun-spots. Every ten years and a fraction there occur outbursts of electrical and heat energy on the sun, which we call sun-spots. These result in increased heat waves, which affect the crops on the earth, causing enlarged harvests in Europe and the United States and drought and famine in India and the tropics. The large harvests and good prices start a wave of prosperity and speculation, which culminates inevitably in a panic and depression, until a recurrence of the heat phenomenon starts the cycle again. The theory states some undoubted facts, but no causal connection between sun-spots and crises can be traced, as the latter are too irregular and the two do not always coincide. Were this theory true crises would be beyond human control.

A second theory, or group of theories, are those which attribute crises to over-production. Under modern conditions of industry a small group of men direct industry and determine what shall be produced. They try to estimate future demand and to adjust production to consumption, but they often make mistakes. They divert capital into unproductive industries, they produce the wrong things and create a comparative glut in certain lines, and when they cannot sell their goods at a profitable price they fail and precipitate a crisis. Industry must then be reorganized and frequently control be put in the hands of other men. A variation has been given this theory by the socialists, under the leadership of Rodbertus, who insist that the reason that there is over-production is because of the institution of private property. Since the capitalists own all the tools of production they pay the laborers only starvation wages. The latter cannot possibly buy all that is produced and commodities consequently heap up in the warehouses until they are thrown upon the market to be sold at any price. Then a panic occurs and a readjustment of production.

The last of these theories regards a crisis as essentially due to a failure of credit. It is seen that a large part of modern industry is carried on by

borrowed capital, by roundabout processes and for a distant market and not upon order. That is, the success of a business depends upon its ability to sell its goods when produced. Now the aggregate volume of transactions that can be carried on in a year, so runs the theory, depends upon the efficiency of the credit system; that is, in general, upon the freedom with which banks are willing to loan money to people who engage to repay it in the future out of their ventures. If for any reason the banks reduce this accommodation the amount of business that can be transacted upon borrowed capital is lessened. Either some transactions must stop or prices must fall. Either of these events causes commercial disaster. The contraction of credit makes it impossible to get the goods into the right hands, and so we have the phenomena of over-production in a great many lines. As exchange and transportation have developed and markets widened, crises have become more universal. According to this theory, they are inseparably connected with the use of credit and can be controlled only by a more careful granting of credit by the banks to industrial managers. Another phase of the credit theory is presented by those who insist that the cause of crises is the rhythmic overestimation of the profits to be secured out of certain lines of production, or their over-capitalization. The new enterprises are financed by the banks on the basis of this mistaken over-capitalization, their organizers engage to pay rates of interest which they cannot earn, and the crash inevitably follows. This is often called the over-capitalization theory, and is essentially psychological in its character.

There is no doubt as to the truth contained in this last theory. It helps to explain the rhythmic periodicity of crises. After every period of business depression confidence revives and hope is renewed; overestimation of the success of new ventures is inevitable. Then follows a mistaken investment of capital in certain lines of production, as in railroads in 1884, and a relative over-production at profitable prices of certain commodities. The true explanation seems to be found in a combination of the over-production and over-capitalization theories.

The practical problem that presents itself in this connection is the question as to whether it is possible to prevent the recurrence of crises. In view of the explanation just given it would seem that they must be regarded as unpreventable as long as industry is carried on under the competitive capitalistic system of production and the modern credit system. Moreover,

crops differ in amount from year to year and probably always will. Human production and human genius are unequal. Crises may be regarded as the price a progressive society pays for its advance, and they may be expected to recur pretty regularly at periodic intervals. Their disastrous effects may, however, be greatly lessened by wise currency legislation, by greater care in granting credit, and by greater wisdom in the direction of individual effort.

VII. THE MODERN WAGE SYSTEM.

We have already characterized the modern system of industry as capitalistic, that is, as involving the use of expensive and complex machinery in factories under the control of the capitalist managers of industry. As we have seen, such a system has caused an enormous increase in the production of wealth; it has also raised the general standard of comfort and the level of wages, and has relieved labor to a considerable extent of the deadly strain of hard manual toil that was characteristic of preceding systems. The factory system, under which capitalistic production is now carried on, may also fairly be credited with other beneficial results: as steadiness and punctuality are essential, it has on the whole led to increased sobriety and temperance; the work in general is healthier, being performed under better sanitary conditions than under the old domestic system; the intellectual status of the workingman has been raised, as vastly more intelligence is required of a skilled machine operator than of the old-time hand laborer; and finally the general well-being of the working class has been improved, as they have shared in the larger production made possible by machine methods. But, on the other hand, the new processes and methods have been accompanied by great abuses, though never so great in this country as in England. Long hours, the employment of women and children, the weakened economic position of the laborer, fluctuations in production, liability to be without employment, industrial accidents, the abolition of personal ties between employer and employe, the crowding of workmen into a small space to work by day and their concentration in city tenements by night—these are some of the problems for which the factory system must be held responsible. The condition and position of labor have been vitally affected. So far we have considered mainly the problems connected with the organization and use of capital. We must now take up the various questions connected with the relation of labor to capital and to the capitalistic system of production.

One of the most vital factors in the situation—which we must frankly admit at the start—is the existence in modern industrial society of a distinct wage-

earning class. It is perfectly obvious that under present conditions of production great capital or great ability is necessary in order to become the manager of an industrial enterprise. Most laborers do not possess either the one or the other of these, and although there are fortunate examples of industrial leaders who have risen from the ranks, the general rule is, once a wage-earner always a wage-earner. The number of those who can achieve industrial independence is moreover growing smaller as business becomes more specialized and centralized. The laborer therefore belongs to a class, which is rapidly developing what the German socialists call class-consciousness, that is, the feeling that he belongs to a distinct industrial group with interests different from and often antagonistic to those of other groups or classes. In his struggles with employers over wages this antagonism of immediate aims obscures the deeper mutuality and interdependence of their really complementary interests and not infrequently leads to a feeling of hostility, finding expression in strikes and labor agitation.

In the transition to the factory system Mr. John A. Hobson[9] points out that the position of the laborer has been one of increasing dependence in the following five important points: (1) The ownership of material—at first the worker owned this and made it into the finished product, but now he has only a passing interest in a small part of the process of working it up. (2) Ownership of tools—he retained these up to the time of the introduction of machinery, but now seldom owns them. (3) Control of productive power—with the displacement of hand labor and muscular power by steam-driven machinery, he no longer owns even this. (4) Relations between workers and employers—they were formerly on an equality; under the guild system the master and the apprentice had the same social position; now the laborer has sunk in the scale, or the employer has risen, until the only bond between them is, as Carlyle said, the “cash nexus.” A case was recently instanced where a workingman who had been working in a factory met his employer for the first time at the end of seventeen years. (5) Workplace—until the establishment of the factory system this had always been the home; now it is the factory, and there is a complete divorcement between work and the home.

Another characteristic of modern industry from the labor point of view is the existence not merely of a wage-earning class, but, more fundamental, of

the wage system. “It is characteristic of the modern industrial system,” writes President Hadley,[10] “that a laborer who owns no capital, though nominally free to do what he pleases, must actually find some property owner who will give him enough to keep him alive during the period which must elapse between the rendering of the labor and the sale of the finished product. Under such circumstances, the laborer almost inevitably submits to the direction of the property owner in deciding how his labor shall be applied. Laborers without capital must necessarily work on this basis; even those who have small amounts of capital habitually do so. Such advances of capital are known as wages.” Here we have the essence of the wage system in a nut shell. The laborer sells his labor to an employer for a stipulated wage. He has a commodity, his labor, consisting of a certain amount of strength and skill, which he is free to dispose of on the market to the best advantage, as the owner of any other commodity might do. Legally, labor is property. Owing, however, to the fact that all modern production requires capital, the only buyer of his labor is a capitalist, who directs the way in which the labor shall be applied. Such a condition, as well as some peculiarities of the commodity labor leave the laborer, indeed, only “nominally” free. In theory the labor contract is a perfectly free contract, entered into voluntarily by both employer and wage-earner, and the courts have generally insisted that this theoretical freedom must be maintained. In practice various modifications of the theory have taken place: legislation has been passed protecting laborers from bargaining away their rights, and trade unions have been formed to bargain collectively for a group of laborers. In the last analysis, however, the laborer must support himself by the sale of his labor; society guarantees him neither a living nor even the right to work. He is a bargainer in a competitive industrial world and he must assume the responsibility of providing for himself and his family by securing work. Just what is involved in such a statement is perhaps best brought out by comparing the modern wage system with previous systems of labor.

The first historical system of labor, aside from that in the family, was that of slaves. In this case the labor was forced, and being given under coercion was probably very inefficient; but the laborer was at least assured of a minimum of food, clothes and shelter. Slavery was the main source of manual labor in the ancient world, and did not disappear in England until

the eleventh century. The feudal system of the Middle Ages was characterized by serfdom, according to which the laborer was bound to the soil and was compelled to render his lord certain services. Gradually serfdom was broken down and the wage system took its place, although remnants of serfdom remained in England until the eighteenth century. Four centuries before this, however, the disintegration of the feudal society had already begun, the serfdom of the agricultural laborer was commuted into regular money payments, and the artisan bought or otherwise secured his freedom from feudal exactions. In the towns industry was regulated by the guilds, and while at first they were distinctly beneficial, in time they became monopolistic and oppressive. Power was lodged in the hands of the wealthy traders and merchants and they legislated in their own behalf against the growing class of laborers, as did the wealthy land owners against the agricultural laborers. The Statute of Laborers and other acts sought to fix wages and to prevent the freedom of the laborer in moving about or choosing his own occupation. Not indeed until the nineteenth century were the last of these old regulative laws repealed and the modern labor contract recognized in law and practice as a free contract. “The growth of labor,” says Brentano, has been “from the system of authority to the system of contract.” The system of authority, by which rates of wages, length of apprenticeship, and other details of industry were fixed by some superior authority, was found to be restrictive, uneconomic and unjust, and it gave way to the principle of economic freedom. According to the newer theory, first given effective voice by Adam Smith, in 1776, the individual should be left to himself, as he knows his own interest better than does the most enlightened government. The freest scope was given to the powers of individuals and each was to be the unlimited master of himself and his possessions.

It has since been found necessary, however, to modify both the theory and practice of this extreme individualism in order to protect the interests of various classes of society, especially the laborer. The legal theory still is that “today the labor contract is perfectly free: either side may make whatever contract he can get the other side to sign. Not only this, but either side may freely combine to demand any form of contract from the other side, as mere combinations alone are now made perfectly legal.”[11] In practice, however, this complete freedom has been greatly modified by

factory acts, acts restricting the hours and conditions of employment of women and children, anti-truck acts, laws providing for weekly payments, guarding of machinery, limiting the hours of labor, and on the other hand prohibiting intimidation and molesting. For the most part these laws have applied to women and children, who are thought less capable of guarding their own interests, and to a much less degree to labor contracts made by men, who have been considered better able to make equal contracts with employers. But concerning certain conditions of employment it has been realized that even adult males are not capable of securing equitable bargains, and along these lines the nominal freedom of the labor contract has been decidedly abridged. The attitude of the courts toward such legislation shows that they have declared many laws unconstitutional on the ground that they infringe upon the right of free contract, but in the long run seem inclined to uphold as much of this restrictive legislation as seems necessary to obviate the undoubtedly evil results that flow from this real inequality of employer and laborer.

It is a very vital and important practical economic problem that presents itself in this connection. How far shall we carry this regulative principle, or how far shall we insist upon the principle of freedom? Many labor leaders are again asking for an effectual control of the labor contract, not by the action of trade unions, but by the direct legislation of the state. What shall be our attitude to this demand? Before we can fairly answer this question we must consider somewhat more fully the character of the bargain that takes place between an employer and an individual workman, and the nature of the commodity that the laborer has to sell.

It has already been stated that the commodity which the laborer brings upon the market is his labor, that is, himself, his time, and his energies. But these wares are peculiar and differ in several important respects from ordinary marketable commodities. In the first place, labor is like a perishable commodity which must be sold at once if the owner is not to incur loss. The laborer has usually little if any capital by which to support himself in case he cannot find work, and may be compelled to make a forced sale of his labor, that is, to accept unduly low wages. In this respect then he is at a disadvantage in bargaining with his employer. A second peculiarity of the sale of labor is that the laborer and his work are inseparable. The seller of an ordinary commodity disposes of it absolutely when he makes a sale. “It

matters nothing to the seller of bricks whether they are to be used in building a palace or a sewer; but it matters a great deal to the seller of labor, who undertakes to perform a task of given difficulty, whether or not the place in which it is to be done is a wholesome and a pleasant one, or whether or not his associates will be such as he cares to have." The person who buys this labor necessarily directs the application of it to the task in hand, and thus controls very largely the place, the sanitary and social conditions, the hours, the character, and safety of the work. In the third place, the superior knowledge and intelligence of the employers gives them an advantage in bargaining with their employes, while the reluctance of employers to "spoil the labor market" often prevents that freedom of competition which is supposed to secure to the laborer his full share of the product he helps to produce.

In view of these facts we may fairly conclude that workmen are inferior to employers as bargainers and that protective legislation is necessary in order to put them on a real equality. "When laborers have to make a forced sale of their labor, their freedom of contract is more nominal than real. When women and children stand individually before the manager of hundreds of thousands of capital, it is possible that there may be little freedom and less equality in the contract by which they sell their services."[12] It is clear that between two parties of such unequal knowledge, resources and ability as a laborer and his employer the labor contract cannot be entirely free and equal. While trade unions, by combining isolated workmen into formidable and unified groups, have immeasurably increased their bargaining strength, yet legislation has also been found necessary to remedy the disadvantages already enumerated. It is realized that "there is no greater inequality than the equal treatment of unequals." In the opening section of this text attention was called to the fact that economic freedom or liberty was one of the corner stones of our modern industrial society. But freedom can best be secured by securing equality and responsibility. Factory legislation and labor laws are designed to correct the inequalities imposed by nature or involved in the very nature of capitalistic production. Direct interference by the state in the freedom of contract is justified as leading to a more real and certain equality and liberty. But while we may thoroughly approve the principle of labor legislation it is difficult to know at what point we should stop. A leading American authority on the law of labor has stated[13] that

“the industrial laborer at least is beginning to be a privileged class in the law.” On the other hand, it was possible for Disraeli to say as late as 1875, after the passage of the Employers and Workmen Act by the British Parliament, “for the first time in the history of this country employer and employed sit under equal laws”—so recently were the legal disabilities removed under which the English workmen had suffered up to this time.[14] The pendulum has swung so rapidly and so far in labor’s direction in the last generation that it is a fair question how far it will—or should—continue to go.

VIII. LABOR ORGANIZATIONS AND COLLECTIVE BARGAINING.

As modern capitalistic production caused the growth of a distinct wage-earning class and brought about a sharp separation between employers and laborers, and as the latter were thrown upon their own resources under the prevailing theories of free competition and free contract, it was inevitable that they should organize to secure their interests as a class. The growth of labor organizations has been greatest in those countries where the laborer has been forced to depend mostly upon his own efforts for protection and improvement, namely, in England and the United States. On the continent of Europe, on the other hand, where the individual has been accustomed to look to the government for the redress of industrial grievances, there has been a much less vigorous and spontaneous development of such organizations. They are a product of the nineteenth century and had their origin in modern machine production.

The growth of labor organizations in the United States has proceeded hand in hand with the industrial development of this country, and has been especially rapid since the Civil War. Two distinct types of trade unions may be noted—the local and the national (or international) unions. The former, which comprises members who live and work in the same locality, is the primary unit, and dates back to the beginning of the century. Each local union, even when subordinate to a national organization, is a self-governing unit, and is absolutely democratic. Its relation to the national body has been well compared to that of one of our states to the United States. The first national union was not formed until 1850, but now these far surpass the locals in importance. Their government is representative, as they are made up of local unions. The great majority of the national trade unions are bound together in the powerful federal organization, the American Federation of Labor. The membership of this body numbers considerably over 1,000,000, while the railroad unions, which are not connected with it, claim about 125,000 more. Probably not far from 1,500,000 persons in the United States belong to labor organizations, which is about 10 per cent of

the total working population or about 15 per cent of those engaged in trade and transportation, manufacturing and mechanical pursuits. While this does not seem a very large proportion and is not as large as the membership of British trade unions, yet it must be remembered that they constitute on the whole the elite of the labor world and exercise an authority and power out of proportion to their numbers. Many other workmen, who do not themselves belong to the unions, follow their lead and are directly affected by their actions.

Historically the two most important national organizations in this country have been the Knights of Labor and the American Federation of Labor, and they represent such different principles that it will be worth while to describe them. The Knights of Labor was organized in 1869 as a local union of seven garment cutters and had a meteoric career, counting a membership of 730,000 in 1886, the year of its greatest strength. It was a national amalgamation of mixed local assemblies composed of workers of all trades who lived in the same locality. It held the theory that the interests of all members of the laboring class are identical and must be cared for at the same time, if possible, by political action, by co-operation, and by education. In 1886, however, it entered upon a series of disastrous strikes; later it came into conflict with trade unions which had not joined its ranks and were opposed to its policies; and finally it became entangled in politics. As it lost in influence and strength its place was taken by the American Federation of Labor, which was its very opposite in organization and government. This latter body is a “confederation of trade and labor unions,” each trade being organized separately into local unions which are given great autonomy, these unions alone being represented in the national body. Only matters of general interest come before it, all local trade matters being left to the local unions. In 1903 it claimed a membership of 1,745,000.

More important than the history of labor organizations is a knowledge of their objects and methods. The primary purpose is of course to control the conditions of labor and to substitute the principle of collective bargaining for individual contract. As one of the most effective ways to secure this result they aim at a more or less complete monopoly of the labor market. This they may do by bringing all workers in a trade within the union or by preventing non-union men from working. The first of these is called the inclusive method,[15] and if successful makes the union the sole seller of the

kind of labor controlled by its members. It is a monopoly of the laborers against the employers and is sought to be enforced by inducing men to join the union either by persuasion or coercion, the latter finding expression in the strikes against the employment of non-union men and the insistence upon the “closed shop.” The other form of monopoly consists in the exclusion of new members from the trade and in a control of employment; this is a monopoly of a small group against their fellow-workmen. It is enforced by regulating the entrance to the trade, making it difficult or expensive, or by limiting the number of apprentices. Sometimes, as in the Chicago Building Trades in 1900, they have united with their employers by means of “exclusive agreements” to raise wages and prices of the finished products at the same time, and thus jointly to mulct the public. Such efforts to monopolize the labor market have their counterparts in the organization of capital, as we have seen. In practice such a labor monopoly has sometimes been used to improve and elevate conditions, just as sometimes a capitalistic monopoly has reduced prices below the competitive point. In general, however, we must condemn monopoly on principle in the competitive field and insist that freedom and opportunity be given to all on as equal terms as possible. Of the two forms of trade union monopoly, the former alone, which endeavors to make it all comprehensive and to enforce generally union conditions, can be economically justified.

“The establishment of a standard rate of wages may perhaps be said to be the primary object of trade union policy. Without the standard rate the trade union, such as it is, could have no existence.”[16] The purpose of the union is to substitute collective bargaining for individual agreements and thereby to improve the condition of its members. But if a single bargain is to determine the pay of a large number of men, there must be a common standard. In every employment on a large scale the men are necessarily grouped together and their pay is determined by a common rule. This is true even in non-union shops. It is generally assumed that the standard rate of labor organizations means a uniform wage for each member, but this is not the case; it means rather a uniform rate of pay to all for the same performance. In the case of piece work, it could manifestly not mean anything else; but a large number of labor leaders object to piece work. They insist that a standard wage means a minimum wage, and that by the establishment of such a minimum the whole standard of efficiency and the

plane of competition are raised, as the employers cannot then afford to hire any but competent workmen. The question immediately presents itself as to what is to become of the older or partially disabled men, who are no longer able to earn the standard or minimum wage? In England they are practically guaranteed a subsistence by the union; in this country the union not infrequently exempts them from the provisions as to the standard wage. When the rule is enforced there is certainly a real hardship for these men. But from the employers there comes the more serious complaint that the effect of the standard wage is to reduce to a dead level the efficient and the inefficient; that it is a maximum wage and that the efficient and industrious are prevented from earning more than a fixed amount. There is undoubtedly a great deal of truth in this charge; the man who hastens the pace is said to be taking "blood money," and sometimes a maximum wage is set which the members are forbidden to exceed. On the other hand, it may fairly be said that while the union regulation of wages does tend to produce greater uniformity, the union rate is usually higher than the competitive rate would be, that is, wages are leveled up, not down; and finally, that territorial variations make the local rate conform to local conditions.

A reduction in the hours of labor has been even more strenuously urged by progressive labor leaders in the United States than an increase in wages. "Organize and control your trade and shorten your hours," is their contention, "and wages will take care of themselves." Their arguments in favor of a general shortening of the working day are twofold. In the first place, owing to the intensity and strain of work under modern machine methods, the worker cannot work efficiently more than eight or nine hours a day. The work is too exacting and the strain on the attention too great; it is a noticeable fact that most of the accidents in industrial establishments occur in the last hour or two of the working day. Not only that, but the laborer is entitled to his share of industrial progress in the form of more leisure, giving him time for a better family and social life, affording opportunity for intellectual improvement, and permitting the development of more rational and higher wants. With the improvement in the condition of the laboring classes, will go the elevation of society as a whole.

The second argument in favor of shorter hours put forward by the trade unionist, is economic rather than social. He argues that a "reduction of hours will diminish the supply of labor in the market, and so will raise its

price. It will make room for the unemployed, and so will remove the depressing influence of their competition." There is involved in this contention the familiar lump-of-labor argument of the trade unionist: there is just so much work to be done, and if some men do each a little less there will be more for others. By shortening the hours of labor of everybody employment will be made more general, and the work will be better distributed. Now the economists in general have supported the trade unions in their demands for a shorter working day, but they have done so because they believed that the product of industry would not thereby be diminished. They have seen that when the hours of labor were reduced the laborer was less rapidly worn out physically, that he could work more rapidly for a short time, and that his increased leisure and pay, if rationally used, made him a more intelligent and efficient worker. In other words, a reduction in the hours of labor from 15 a day to 12, to 10, and even in some cases to 8, was not attended by a parallel reduction in the output, but the latter remained about the same. This is the great economic justification of the shorter working day, and as long as this can go on without materially affecting the product of industry it must be approved. If, however, the latter is decreased there will be less to divide and then the relative disadvantages of a smaller dividend must be weighed against the advantages of increased leisure. Of course the point to which the number of hours can be reduced without lessening the product can only be determined by experiment, and will differ in different trades, but it is inevitable that until this point is reached the pressure of the trade unions for shorter working days—or for more holidays or half-holidays—will not be successfully resisted.

Turning now from theory to fact, we find that there has been a great improvement in the condition of labor in this respect. At the beginning of the nineteenth century the almost universal working day was, as McMaster tells us, from sun to sun. As factories grew up the habits of agricultural labor were carried over into industrial occupations, and working days of 16 and 18 hours were not uncommon. In 1903 the average length of the working day in the United States was 9.6 hours. This great reform may fairly be credited to the efforts of organized labor itself, for without their insistence and struggles it is unlikely that it would have been voluntarily granted by employers.

The limitation of output results almost necessarily from the above-mentioned practices of the unions: reduction of hours, prohibition of piece work, and the standardization of wages all tend to restrict the output of the individual worker. But some of the unions have gone further and have directly limited the amount that could be produced during a given period by the laborer. This has been particularly true of British unions and is the subject of common complaint by English employers and writers, but illustrations may easily be found in the United States. Thus in Chicago in 1900 “the lathers limited a day’s work to twenty-five bundles of lath, for which they received $3; they had formerly done thirty-five bundles for a daily wage of $1.75. Plasterers were limited to thirty square yards a day; the steam fitters were permitted to lay only ninety feet of steam pipe per day; but the plumbers had the most objectionable rules and restricted materially the amount of work that could be done in a day.”[17] These rules were defended by the unions on the ground that they were necessary in order to secure careful work and to prevent the “rusher” for setting the pace for a fair day’s work. The practice has not been uncommon, especially in the sweated trades, for an unscrupulous employer to pay a few particularly able workmen to put extra speed into their work and so set a pace that the other workmen would be compelled to maintain. This was especially objected to by the unions in the case of team work. They claimed that when all the workmen had come up to the new standard, particularly in piece work, the wages were reduced so that even by working at the higher rate of speed, they could only make a fair wage. One of the rules of the Chicago carpenters’ union provided that “any member guilty of excessive work or rushing on any job shall be reported and shall be subject to a fine of $5.” Whatever the excuse it is clear that such limitations cannot be economically justified. Not only does such dawdling undermine the industrial efficiency of the worker, but it is unfair to the employer. If the latter bargains for the union rate of wages and the normal working day, he is entitled to a full return of the laborer’s best efforts. Otherwise there is no fairness in collective bargaining. “So far as labor leaders are concerned,” said Mr. John Burns, the English trade unionist, “we are all strongly opposed to the restriction of production; we are all in favor of better and more conscientious work.”

Laboring men have never been quite able to divest themselves of their old antipathy to labor-saving machinery. They generally regard the introduction of a new machine as a displacer of men, a creator of unemployment, a depresser of wages. Some unions have successfully resisted the introduction of machinery into their trades, as the stone cutters in Chicago,[18] but in general they have recognized the impossibility of this attitude. In general they now demand that when machinery is introduced it shall be operated by union men and their wages shall be fixed so as to give the workers a share of the increased production.

The policies and methods of the trade unions thus far discussed are those of a militant nature, but the fraternal objects of these associations, though less conspicuous, are none the less important. Labor organizations generally; have insurance and benefit features, by which sick, injured, or unemployed members are assisted. This is particularly true of the English organizations, which developed these features before the rise of the militant new unionism. They often possess large funds and have been rendered thereby more conservative and responsible. The educative effect of trade unionism among the members is marked; some of them possess libraries and all of them promote discussion and thought upon economic problems, while the administration of their affairs often gives valuable training. The older unions did much to encourage co-operation among their members, but today the tendency is to limit their activities to the essential one for which they are organized, namely, collective bargaining.

Intelligent unionists realize that they can secure the various objects for which they strive only by substituting collective bargaining for contracts between employers and individual laborers. Where this plan is accepted by employers, representatives of the two sides agree upon wage scales, usually for a year; during this period the chief task of union officials is to see that the agreement is lived up to, and if possible to add to their membership and strengthen the union. In the United States relatively few trades have adopted this method as a general practice, the employers still being able to dictate wages and conditions of employment in most of them, while the unions are still struggling for recognition, if not for existence. Employers insist, in refusing to make collective bargains with the unions, that, as they run all the risks, they must be permitted to manage their business as they see fit and without interference from the business agent of the union. In

reply the unions insist that hours, wages, and conditions of employment are as much their business as that of the employer. The latter also urges that the trade unions as at present organized are too irresponsible and before they ask for collective bargaining should be incorporated, so that they could be sued for breach of contract if guilty of such. As yet, however, the unions have preferred their present position of irresponsibility and immunity and have almost invariably refused to be incorporated.

"In the minds of a large section of the public," writes President Hadley,[19] "labor unions are chiefly associated with strikes. It is believed by many who ought to know better, that such organizations exist for the purpose of striking, and that if the organizations were suppressed, industrial peace would be secured. The first of these ideas is a distorted one; the second is wholly unfounded." Strikes are, however, a necessary concomitant of collective bargaining. If the representatives of a union cannot come to terms with an employer, they may compel their members to refuse to sell their commodity, labor; such a concerted refusal to work is a strike. The "right to quit work" has been regarded as a sacred one by trade unionists, but it involves social consequences of great importance. For the workingman, it means loss of wages and demoralizing idleness; to the employer, idle capital, loss of profits, and depreciation of plant; and to the consuming public, inconvenience and annoyance together with curtailed production. Quite aside from all acts of violence and lawlessness, by which they are too often accompanied, there is involved an enormous money waste. According to a report of the Department of Labor, losses from strikes and lockouts in the United States from 1881 to 1900 amounted to $449,342,000 or an average loss per establishment involved of about $3,500.

The public is awakening to the realization that it suffers the greatest injury as the innocent third party to every industrial dispute, and is insisting that the industrial peace be kept or more reasonable methods of settling differences be found than a strike or lockout. Such a method is found in conciliation and arbitration. In the older and more strongly organized unions strikes are infrequent and methods of joint discussion and agreement are increasingly resorted to. Boards of conciliation are often provided for, which endeavor by means of conference and concession to prevent a dispute from arising; they succeed best where both employers and employes are organized. Should the dispute come to a head, however, provision is

usually made for its reference to a board of arbitration, which may be selected by the disputants themselves or may be created by the state; in the latter case the acceptance of the award may be voluntary or compulsory. In the United States most of the successful boards have been those selected by the parties to the dispute; the state boards have usually the power only of investigating the causes of the trouble, but this in itself has proved of considerable value in more than one instance, notably in the case of the Anthracite Coal Commission. Compulsory arbitration is being given a thorough trial in Australasia and seems to be meeting with success there. In this country, however, the trade unions are strongly opposed to compulsory or enforced governmental arbitration. Writing of Great Britain, Mr. and Mrs. Webb assert that the principle of arbitration, having been found inconsistent with collective bargaining, is fast going out of favor. It would seem from the experience of both England and the United States that the chief virtue in these methods lies in the habit of joint conference and conciliation between the representatives of labor and capital.

IX. WOMEN AND CHILDREN AT WORK.

While women and children have always assisted in the work of the home, it was not until the development of the factory system that they began to work for wages outside of the family. From the earliest days the preparation of food, spinning and weaving and making up of garments, and other branches of domestic economy had been the peculiar tasks of the housewife. With the removal of the textile industries from the home to the factory and the invention of light-running machinery, many women followed them and employment was found also for young children. Thus with the inception of the modern factory system and machine production there arose the problem of woman and child labor. In England the evils of the early factory system were incredibly bad. “The beginning of the present century,” wrote President Walker,[20] “found children of five, and even of three years of age, in England, working in factories and brickyards; women working underground in mines, harnessed with mules to carts, drawing heavy loads; found the hours of labor whatever the avarice of individual mill owners might exact, were it thirteen, or fourteen, or fifteen; found no guards about machinery to protect life and limb; found the air of the factory fouler than language can describe, even could human ears bear to hear the story.” Conditions were never so bad in this country as in England owing to the later development of the system and prompter legislation against its evils, and especially to the scarcity of labor which compelled employers to make the conditions of labor more attractive.

The field of employment for women has been a constantly expanding one. When Miss Harriet Martineau visited the United States in 1840 she found only seven occupations open to women, namely, teaching, needle-work, keeping boarders, work in the cotton mills, type-setting, book-binding, and domestic service. Since that time the area has widened until there is scarcely an occupation in which women are not found except those closed to her by law or by physical inability. The number of females 10 years of age and over engaged in gainful occupations was 2,647,000 in 1880 or 14.7 per cent of the total female population; this number more than doubled in

the next twenty years, being 5,319,000 in 1900 or 18.8 per cent of all. The largest number employed was in domestic and personal service, and next to that in manufacturing and mechanical pursuits, though even in that branch they were most numerous in the traditional branches of woman's work, as dressmakers, seamstresses, etc. It is nevertheless in the manufacturing industries that the most serious evils connected with woman and child labor are found. The problems differ greatly in different sections of the United States: in the Atlantic states the greatest proportion of women as compared with men find employment and give rise to special problems of women's work; in the South child labor is more conspicuous; while in the West both woman and child labor are of relatively small importance.

An interesting question suggests itself at this point: Is the increase in the employment of women at the expense of men? Are the women crowding the men out of their occupations and taking their places? At first inspection the statistics of occupations would seem to lead to an affirmative answer, for the percentage of women breadwinners increased from 13.5 per cent of all such in 1880 to 16.6 per cent in 1900, while that of the men fell from 80 to 77.3 per cent, and that of the children remained about the same. The cause of the change in the proportion of the sexes was not due, however, to any falling off in the number of men, but to the great influx of women into the ranks of wage-workers. In some lines of employment, like those of bookkeepers, stenographers, typewriters, clerks, etc., there has undoubtedly been an encroachment and men have been displaced. But on the other hand, many occupations have been opened to men during the last fifty years that were unknown before. Such have been the expanding fields of railroad construction and operation, the steel industry, the utilization of electricity, and other similar lines. In most of these the muscular effort involved or the character of the work have kept women out, but in other lines where special rapidity or lightness of touch are required the women outnumber the men, as in the manufacture of cotton goods, hosiery, hats and caps, etc. The development and improvement of machinery has of course favored the employment of women. Mr. John A. Hobson[21] asserts that "in modern machinery a larger and larger amount of inventive skill is engaged in adjusting machine-tending to the physical and mental capacity of women and children." He concludes that if the exploitation of these forms of cheap labor had not been prevented by factory legislation and by public

disapproval, “the great mass of the textile factories of this country [England] would have been almost entirely worked by women and children.” As a matter of fact one of the reasons for the great expansion of woman labor in the United States as well as England is because it has been found cheaper than man’s labor. We are thus brought face to face with a fundamental question in the discussion of the problem—why are women paid lower wages than men?

As to the fact there is no doubt; one comparison taken from the Census of 1900 will be sufficient to illustrate it: the annual average earnings of men in mechanical and manufacturing industries were $490, and of women $272 per annum. The more important question is why this difference exists. A number of reasons suggest themselves at once. In the first place women are less efficient than men and produce less; hence they are paid less. In some industries, particularly those requiring physical strength, women cannot compete successfully, and those are usually the highest paid employments. Other well-paid industries are regarded by men as essentially their own and social pressure is applied to keep women out. Then, too, woman’s ambition to attain industrial efficiency is not so great, owing to her expectation of marriage and release from industrial life. Women are more often absent from work owing to sickness and domestic claims upon their time; this irregularity of employment tends to reduce their efficiency. But even in employments where the efficiency of men and women are admittedly equal the women receive lower wages in the majority of cases. According to a report of the Bureau of Labor, out of 100 cases where the women did the same work as the men and did it as well, they received lower wages than the men in 80. This leads to the consideration of a second group of causes, which have to do with woman’s standard of living. One reason why she receives less is because she is able and willing to live on less. Physiologically, Dr. Atwater has said, man needs one-fifth more nutriment than woman. Women’s wages are less because of their somewhat lower cost of subsistence. But even aside from this fact, the frequent partial dependence of women upon other members of their family for support makes them willing to accept less and consequently reduces their wages. The average American workingwoman is young, only about twenty-two and a half years old, and after the age of twenty-five is reached the number declines rapidly. That is to say, working girls regard their employment as a

temporary affair, remaining only about five years on the average in the store or factory; during this time they often live at home with their parents and are content to receive a wage much smaller than a man would require as head of a household.

The third reason is, however, the most important, because it explains at the same time the low economic position which woman occupies in the industrial world. The narrowing of the field within which women can readily find employment has the effect of greatly intensifying the competition within that field. There is also a great reserve army of potential women wage-earners, whom a slight increase of wages or force of circumstances—loss of employment by the male members of the family—will bring into the field as competitors. There is, in other words, a constant over-supply of labor in most women's industries, which does not exist in any men's industries except the most unskilled. Women exhibit, furthermore, a comparative lack of mobility from one industry to another, as well as from one locality to another. According to Professor Smart, women are so unready to leave home that their pay on one side of narrow Scotland is 50 per cent lower than on the other side. In the same way, the flow of labor from one occupation to another, which tends to equalize the advantages and rates of pay of different employments, is far feebler among women than among men. Finally, there is little organization among women. Their individualistic, almost jealous, attitude to one another prevents their combination and united action, while their submissive acceptance of what is offered leads to apathy. They have only infrequently formed unions and endeavored to substitute collective bargaining for individual action. Women are therefore industrially in much the same situation as unskilled, unorganized male laborers, and the remedy in both cases would seem to be the same—education and organization.

The presence of a large supply of cheap woman labor undoubtedly has a depressing effect upon men's wages, and consequently upon the standard of life of the whole laboring class. George Gunton[22] is authority for the statement that "in proportion as the wife and children contribute to the support of the family the wages of the father are reduced." The family wage tends to remain the same whether it is earned by the father alone, or by the father with the assistance of his wife and children. It is, however, not quite clear in most cases whether the men's wages are low because the women

and children work, or whether the women and children work because the men's wages are low. It may fairly be concluded, however, that the evil effects of low wages for women are not confined to themselves but are felt by all with whom they come in competition.

What conclusion shall we draw then, in view of all these facts, as to the desirability of employment of women? The fact of their low wages and industrial dependence is not sufficient to lead one to condemn it. These are transitional phenomena and can be remedied. Women have always worked —on the farm, in the home, in making household supplies. When this work was taken over by the factory woman became a wage-worker in the modern sense. "The census records in respect to the labor of women, therefore, read in the light of collateral facts, are a history of industrial readjustment rather than a record of the relative extent of the employment of women, and it is impossible to say, so far as the census figures are concerned, whether a larger proportion of women are actively engaged in labor today than formerly or not. The one fact which is clear is that factory or shop work is displacing home work, and that this readjustment of industrial conditions is leading to the employment of women outside the home in constantly increasing numbers."[23] The effect of this readjustment has been to increase greatly the production of wealth. The production of household supplies was removed from the family to the factory when it was handed over to machinery and done better and more cheaply. If the work of women thus released were expended for no useful purpose society would gain only in the increased leisure of the women. But if these then took up other new lines or set men free from old employments so that they could turn to still different ones, then the production of goods could be greatly increased. "Without women's help," says Mr. George L. Bolen,[24] "their work in stores and offices would be done by men taken from other employment. The latter's present work would have to be stopped to that extent, lessening the quantity of goods produced by men. The effect would be the same as if a farmer had to stop plowing two hours before noon to go to the house and cook his dinner.... Women behind the counter, and at the typewriter, release men for work that women cannot do." From the standpoint of woman herself, industrial independence must be regarded as a great gain. Set free from the necessity of contracting marriage for the sake of a home, and of depending upon mere sex attraction to attain that end, she will develop her

capacities more fully and when she does enter upon marriage will do so as a result of mutual attraction. The entrance of women into gainful occupations must be regarded as an essential step in their own progress and the improvement of society.

Quite different must be our attitude towards child labor, which can only be condemned as a waste of labor power and as stunting the development of the children. The Census of 1870 stated for the first time the number of children at work in the United States; there were 739,164 between the ages of 10 and 15 years, of whom 114,628 were employed in manufactures. During the next decade the number increased over 58 per cent to 1,118,356 children at work in all occupations. The disclosure of such an undesirable tendency called forth restrictive legislation in most of the states and the number declined materially by 1890. Since 1890 however there has been a reversal of this tendency back to the conditions of 1880, owing chiefly to the industrial development of the South, where almost no factory legislation exists as yet. In 1904 there were 1,752,187 children at work between the ages of 10 and 15 years, or almost one-fifth of all the children of those ages. The evils connected with child labor are the long hours—usually 11 or 12 hours a day where no restrictive legislation exists—and the exhausting and often dangerous work. The effect on the health of the children of monotonous and exhausting toil before their muscles are set and their frames knit up is thoroughly bad; they are stunted and deformed and prematurely aged. Many of the occupations, too, in which child laborers are most numerous, are dangerous or injurious, as tin can factories, saw mills, paper box factories, type foundries, and tobacco establishments. Second only to the physical effects of child labor is the mental and moral injury suffered not merely by the child but also by society in depriving these youthful laborers of a thorough education. While it is well that children should be kept busy, there is no compensating reward either in money wage or preparation for adult life in such monotonous, profitless drudgery. The influence of the competition of children upon wages is leveling, and their employment indicates either a willingness on the part of employers and parents to exploit this cheap and defenseless form of labor, or a backward state of civilization. Such an evil can be cured only by determined public opposition, by the passage of laws forbidding all labor by children under a certain age, say 15 (except possibly in agricultural or housework),

compelling school attendance, and providing for careful inspection. Most of all is needed an aroused public conscience.

Labor legislation is the most effective method of improving the conditions of employment, and to a consideration of this subject we must devote the remainder of this section. We have already seen that the fundamental principle of our modern wage system is freedom of contract. This is guaranteed in our federal and state constitutions as both a personal and a property right. As a result of this fact the courts have generally declared unconstitutional any legislation, designed to protect the interests of labor, that seemed to abrogate this freedom of contract or that savored of class legislation. Efforts to improve the condition of labor by legislation have therefore met with especial obstacles in this country. On the whole, however, means have been discovered of evading these constitutional restrictions when it has seemed clearly demanded by the welfare of society, and the history of labor legislation in this country is one of fairly steady progress. The early laws were practically confined to imprisonment for debt, mechanics' liens, the hours of education of children employed in factories, and similar matters. Nothing noteworthy was accomplished until 1866 when Massachusetts passed an eight-hour child labor law for children under fourteen; in 1874 she passed a ten-hour law for women and children under eighteen, engaged in manufacturing establishments, and in 1877 enacted the first factory inspection act, which has since been copied in about twenty-four states, and without which mere legislation is of little avail.

The factory acts may be divided into two classes, those that endeavor to secure the safe or healthful manner of conducting a business, and those that attempt to limit the occupations, the hours, and the methods of payment of the workers. Under the first head come such matters as fire protection, ventilation, guarding of machinery, inspection of boilers and mines, etc. Such legislation and inspection have in many states been extended to churches, schoolhouses, hotels, theaters and public buildings. The second group includes those laws which are usually meant when factory acts are referred to. In England there has been a very steady development and extension of such legislation, beginning in 1802, when Peel's Act tried to protect the health and morals of the pauper apprentices in the cotton mills; this was extended to all young people in textile industries in 1833, to

women in 1844, then to all large industries in 1864, and to smaller ones in 1867, and finally in 1878 these various provisions were codified into a complete factory act, regulating the health and safety of the laboring people generally. In the United States the movement was considerably later and has not been so uninterrupted. But today laws limiting the number of hours of labor to eight have been passed by the Federal Government and fifteen of the states for all those engaged on public works. Attempts to fix the hours of labor of adult male workers have usually been declared unconstitutional, for the reasons stated above, except in especially dangerous or unhealthful occupations, as bakeries, mines, smelters and similar lines. Consequently the men have been forced to rely largely upon their own efforts for the redress of industrial grievances; in this fact lies one explanation of the growth and strength of labor organizations in this country. On the other hand, legislation in behalf of women and especially children—wards of the state—has usually been held constitutional by the courts, and has had a more extended application. About twenty of the states have regulated the length of the working day for women and children. Special child labor laws limit the age below which employment is illegal, usually between ten and fourteen years of age; and provide for a minimum of education before a child can be employed. About half the states provide for factory inspection to see that the provisions of the various acts are lived up to. In general we may conclude that by the passage of such legislation society has definitely decided that there are some conditions of employment that cannot be safely left to free contract or to collective bargaining between employer and employe, but that they must be regulated by society itself on the broad grounds of social welfare.

X. UNEMPLOYMENT AND INSURANCE.

The greatest problem in modern industry as well as the greatest curse to the laboring classes, is unemployment. While unemployment has always existed under all systems of labor, it assumed added significance when the introduction of the wage system threw every worker upon his own resources and made him responsible for the care of himself and his family. Modern industry is sensitive and unstable and its delicate mechanism, very likely to get out of order; credit and fashion, to mention no others, are factors that make for instability, and these are essentially modern. Professor Marshall is of the opinion that the factory system has not increased inconstancy of employment, but has simply rendered it plainer by localizing it. But whether more or fewer than in earlier times, the number of the unemployed in modern industry is appallingly great. It is not easy to estimate correctly the extent and amount of this evil and we accordingly find considerable variations in the statistical presentations of fact. In 1885 two investigations of the amount of employment were made, one by Carroll D. Wright, in his report as United States Commissioner of Labor for 1886, and the other by the Massachusetts Bureau of Labor in its report for 1887. Mr. Wright defines the unemployed very narrowly as “those who under prosperous times would be fully employed, and who, during the time mentioned, were seeking employment”; using the term in this restricted sense he concluded that 7½ per cent of the working population engaged in manufacturing and mechanical pursuits, and trade and transportation were idle during the year, which moreover he considered one of extreme depression. The Massachusetts statistics, on the other hand, were presented as indicative of general conditions in normal years and may safely be regarded as such. According to this report, 30 per cent of the total number of breadwinners in the state had been unemployed at their principal occupations on an average of 4.11 months in the year covered; some of these found work at other or secondary occupations. But the net result of the investigation was well put in the terse statement of the report, that “about one-third of the total persons engaged in remunerative labor were

unemployed at their principal occupation for about one-third of the working time." At the lowest estimate the whole working population lost on the average almost one-tenth of their working time. The loss of such a proportion of the community's productive force, with all the demoralization attendant upon irregular or no labor, is evidence of a problem of grave import.

Unemployment is such a broad term and covers so many different ideas that it will be well to classify the unemployed before proceeding further. They may be logically divided into the following classes: I. The temporarily unemployed, who comprise (a) those certain of work again, as efficient workmen who are temporarily out of work owing to seasonal variations, shut downs, etc.; (b) those without such prospect, a group which again divides into two groups, namely, (1) efficient and industrious workmen who have been thrown out of work by a change in fashion, the introduction of new machinery, foreign competition, a prolonged depression, etc., and (2) those whose work is essentially fluctuating and casual in its nature, as casual day laborers, charwomen, etc. II. The permanently unemployed, consisting in turn of (a) the "won't-works," as tramps, and (b) the "can't-works," or the defective and dependent classes generally. Such a classification renders much easier the analysis both of the causes and of the cure of unemployment.

The first question that presents itself in any discussion of the causes of unemployment is whether it is due primarily to personal causes, as inefficiency or intemperance, or to industrial causes over which the individual has no control. "Personal causes are those mental, moral, and physical defects which show themselves either in the inability and inefficiency of the workman or in his unwillingness to work. Here are included all the varieties of personal inaptitude, ranging from idiocy, intemperance, and vice to old age, sickness, and accident."[25] Such a comprehensive definition includes many cases, of course, where no blame can be attached to the individual, and yet each one of these causes is personal, that is, it does not affect at the same time a whole group, as an industrial depression would do. Persons included in this group are always on the margin of employment; in bad times the first to be discharged, in good times they are the last to be employed. Nor is the cause of their lack of employment always easy to give; it may be itself the result of industrial

accident or unhealthful occupation, or the result of heredity, evil habits and associations, and defective education. We may present two tables giving briefly the causes of poverty and unemployment. The first gives the causes of poverty ascribed by the charity organization societies of New York, Boston, and Baltimore to applicants for relief:

Causes of poverty: charity organization society records.[A]

Cause.	Per cent.	
Drink	13.7	
Shiftlessness and inefficiency	7.5	
Other moral defects	2.1	
Total, Character		23.3
No male support	5.0	
Lack of other normal support	3.6	
Total, Support		8.6
Lack of employment	23.5	
Insufficient employment	8.1	
Poorly paid, etc.	3.3	
Total, Employment		34.9
Sickness and death in family	21.1	
Insanity and physical defects	4.1	
Old Age	3.9	
Other incapacity	3.2	
Total, Incapacity		32.3
	100.	100.

[A] Warner, American Charities, Rev. Ed., 53.

The first group of causes indicates misconduct, as the last group indicates misfortune; the other two shade off into industrial causes, though lack of employment—the largest single cause—may in turn be ascribed to any one of several remoter causes according to the bias of the investigator. This table is a record of the causes of failure on the part of those who have fallen behind or dropped out altogether in the race of life. At the other end of the scale stand the members of labor organization, on the whole, the elite of the labor world. The following table gives the causes of unemployment of

31,339 cases at the end of September, 1900, as reported to the New York Bureau of Labor Statistics:

Causes of idleness, members of trade unions, 1900.

Cause	Per Cent
No work	75.5
Bad weather	.5
Strike or lockout	13.0
Sickness	4.7
Superannuation	1.6
Other causes	4.7
Total	100.0

This table emphasizes very strongly the industrial causes of unemployment, three-fourths of which is ascribed to lack of work. In some cases, as the iron and steel workers, where there is a regular two months' shut-down to make repairs, and the building trades where the inclemency of the weather usually prevents work during the winter, the lack of employment may be regarded as a vacation rather than a hardship, for the rates of pay are high enough during the remaining months to offset those of idleness. In other cases, however, as in coal-mining, there is a large reserve army of workers on hand and employment is secured for only one-half to two-thirds the time. In 1900, when the average number of days of employment was larger than it had been in ten years, the bituminous miners were employed only 234 days and the anthracite miners only 166 days in the year. This indicates a very bad organization of the industry. The same thing was formerly true of the London dockyards, where there was a reserve army of some 4,000 surplus workers. Of course the effect of this is to depress wages. The clothing trade is subject to seasonal fluctuations and the caprice of fashion, and offers very irregular employment. Machinery and improved processes were frequently spoken of by witnesses before the Industrial Commission as the leading cause of unemployment. If the general conditions of business are good at the time of the first introduction of machinery the displaced laborer is reabsorbed again and the hardship is not so noticeable. But if it coincides with a period of business depression the introduction of machinery appears to be the cause of a large displacement of labor, which might more truly be

ascribed to industrial depression. This last cause is responsible for enormous suffering among the laboring classes, for the method oftenest resorted to by industrial enterprises to reduce expenses is the wholesale discharge of laborers, who are thus made to bear the burden of industrial disorganization. This was well illustrated by the economies effected by the railroads in the year 1908, in their general reduction of the labor force and of wages. But even in good years the inconstancy of employment is startling. In the four years 1897-1900 the men in trade unions in New York State lost 16.2 per cent of their time from unemployment, which is almost exactly one day in every week. And these, it must be remembered, were skilled and efficient workers in organized trades. Finally, strikes are given as a cause of unemployment in the table; these are a peculiar feature of modern industry, and do not call for further discussion, except to point out that they are not as important as often represented.

The foregoing analysis of the causes of unemployment shows that they are deep-seated in the nature of modern industry, and that it would be unjust to the workingman to attribute them in any large measure to his incapacity or indisposition to labor. The care of the unemployable must of course be undertaken by society, and such persons prevented as far as possible from depressing the wages of competent labor by their competition. Exceptional periods of distress may and should be met by temporary relief measures. But what we may call the normal unemployment in modern industry, which amounts to 2-2½ per cent of the labor force, cannot be overcome by direct methods. The remedy for this lies “in a better organization of employers and employes, more steady expansion of trade, and greater stability of industry and of legislation affecting industry. These are not problems directly of unemployment, but rather of taxation, currency, monopoly, immigration, over-production, and technical advances in industry. Their treatment must be undertaken, not primarily as measures of providing for the unemployed, but as measures for improving the conditions of business.”[26] The problem of unemployment would thus seem to be a permanent one, bound up in the very nature of a dynamic society; it may be regarded as the price of progress. But the question may fairly be raised as to whether the laboring classes should foot the bill, or whether the cost might not fairly be borne by society as a whole. This has suggested, as a solution of the problem, insurance of workingmen against unemployment, a

discussion of which, however, must be deferred to the end of the section. Some methods of alleviation, if not of abolition, of the evils of unemployment may be suggested. Free public employment bureaus and agencies, national in scope and well integrated, would do much to secure a better adjustment of demand and supply in the labor market, and secure a better distribution of the labor force and greater mobility of labor. Better organization and mutual understanding on the part of both employers and employes is needed, to prevent the loss through strikes and lockouts. And finally, improved industrial and technical education is essential, whereby the loss in skill through the introduction of new inventions and machinery may be minimized, and the productivity of the laboring class be increased.

Among the measures of relief for unemployment due to accident, sickness, and old age, none is more important or more deserving of a hearing in the United States than that of insurance against these evils. The earnings of the average male wage-earner are so small—half of the number earn annually less than $436, and half of the adult male factory workers earn less than $400 a year—that the unemployment, sickness, disablement, or old age of the breadwinner must throw a large proportion of families so afflicted into a condition of periodic poverty. Any remedies that will alleviate the miseries caused by fluctuations in employment, industrial accidents, diseases incident to industry, etc., deserve a respectful hearing.

No adequate statistics of industrial accidents exist in the United States, but a recent estimate by F. L. Hoffman[27] gave the number of fatal accidents among occupied males in 1908 as between 30,000 and 35,000. An analysis of the reports of the New York Bureau of Labor Statistics from 1901 to 1906, shows that of the total number (39,244) of industrial accidents reported in that state a little over 2 per cent were fatal, almost 17 per cent resulted in permanent disablement, and 81 per cent resulted in temporary disablement. More than half of the accidents in industry are the result of machinery in motion. Mr. Hoffman calculates that “it should not be impossible to save at least one-third or perhaps one-half by intelligent and rational methods of factory inspection, legislation, and control.” Prevention of accidents rather than compensation to the workingman after they occur should be the aim of society, in order to avoid the wasteful loss of productive power, not to mention the suffering and misery entailed by such accidents. “Immunity, not compensation,” has been the demand of the

British trade unions. Of first importance then is careful factory legislation, safeguarding of machinery, and factory inspection. But here we are interested primarily in the question of responsibility and compensation. In the United States, legislatures and the courts have taken the position that the workingman was responsible unless he could prove the employer responsible for his injury. How impossible such proof is and consequently how intenable such a position, is clear from the following table, compiled by the German Government for purposes of accident insurance:

Accidents in German industries traceable to different causes.

Causes.	Agriculture (1891)	Industry (1887)	Mining (1887)
Fault of employer	18.2	19.8	1.3
Fault of injured workman	24.4	25.0	29.8
Fault of both	20.1	4.4	…
Fault of third person	2.8	3.3	4.3
Unavoidable or indeterminable	34.5	46.9	64.6
Total	100.0	100.0	100.0

Statistics from both Germany and Austria show that a full half or more of all industrial accidents are due to causes for which neither employers, injured workmen, nor fellow employes are responsible, but which are incidental to the nature of the industry itself. But besides the danger of injury from machinery, there are numerous specially dangerous or injurious trades, in which injury by poisoning, disease, etc., is almost unavoidable as trade processes are at present conducted. These have been classified as follows: trades in which lead is a poisonous element, trades which produce other chemical poisons, trades in which lockjaw is an incident, trades in which the danger arises from injurious particles in the air, or from dust, processes that require a sudden change from heat to cold and vice versa, and those that require artificial humidity, and trades in which accidents are so frequent as to demand special legislation. Before we try to decide who in justice should bear the cost of sickness or injury arising from these causes, let us inquire as to the practice in the United States and in other countries, so as to have the data necessary for a fair conclusion.

The original legal doctrine regarding liability for accident in England and America, which is still practically unmodified in the latter country, was based on the principle of individual responsibility for acts of negligence. Briefly stated the common law doctrine is that an employer must provide reasonably safe conditions of employment, and that then the employe assumes the risks incident to the occupation, or arising from the carelessness of fellow-servants; moreover, even if the employer has been remiss, the employe cannot collect damages if he has been guilty of contributory negligence. These three doctrines—assumption of risk, doctrine of the fellow-servant, and contributory negligence—have been used practically to free the employer from all responsibility in cases where injured employes have sought to secure damages. Moreover, as has been shown above, many cases exist where it is impossible to fix the blame on either employer, employe, or a third party, and in such cases no compensation could be secured for injury under the law. The full rigor of the common law, which has worked out so unfairly for the workingman in modern machine production, has been modified in about twenty-seven states by statutes defining more exactly the duties of the employer, and repealing the fellow-servant doctrine in regard to railway employes and in a few states in regard to all mechanical industries. With these exceptions, however, the law of employers' liability has not been changed, and compensation for industrial accidents must be sought by injured employes through a suit for damages against the employer. In 1906 and again in 1908 Congress passed a federal employers' liability act, limited to common carriers, which, however, represents only development along the lines of negligence law. That is, we are still proceeding upon the assumption that in every accident which occurs somebody is to blame. We shall have to look to foreign countries for a practical application of the principle that the cost of accidents in modern industry should be made a charge upon the industry itself, and ultimately be incorporated in the higher price of the article produced.

Germany was the first country to introduce the principle of compulsory accident insurance in 1884. Employers are there organized into associations and sections and are compelled to bear the expense of granting to injured workingmen compensation, which amounts to about two-thirds their average wages. England in 1897, by the passage of the Workmen's

Compensation Act, adopted the principle “that a workman is entitled for all accidents of occupation to a moderate and reasonable compensation.” Twenty-three countries, or practically all the advanced industrial nations of the world except the United States, have passed laws to compensate sufferers for all accidents of industry, thus placing the burden of industrial accidents upon the industry as such and not upon the laborer.

As we have seen, sickness and old age are still more usual causes of poverty and unemployment than accident. All the arguments for compulsory insurance therefore apply with redoubled force to these evils. Germany was again the pioneer in the establishment of these forms of insurance. In 1883 sickness insurance was organized, being made compulsory for all persons with incomes under $500; the expense is borne one-third by the workers and two-thirds by employers, the main purpose being to secure a sufficient relief—amounting to one-half the wage—for a period of thirteen weeks. In 1889 invalidity and old-age insurance was introduced for the same class; contributions are made in equal proportion by employe and employer, the state contributing about $12 a year to each annuity. Pensions are granted after thirty years of payment or to those over seventy. In 1908 Great Britain passed a still more comprehensive measure, providing for pensioning all citizens of seventy years or over, who have been residents for twenty years, in accordance with a sliding scale based upon private income, the pensions ranging from five shillings weekly down to one shilling. The pensions were expected to cost $35,000,000 the first year, but will probably entail double that amount. Finally, insurance against unemployment was tried in Switzerland in 1893 to 1897, but was finally abolished, owing to abuses and difficulty of administration.

There are probably no more important practical economic problems than those connected with unemployment and workingmen’s insurance. Slowly the conviction has spread that under present conditions of industry workingmen cannot fairly be held responsible for industrial accidents, and that with prevailing wages they cannot be expected to save enough to maintain themselves in sickness and old age. It therefore becomes the duty of society so to organize industry and legislation that the terrors of accidents, sickness, and old age, shall be reduced to a minimum.

XI. MACHINERY AND INDUSTRIAL EFFICIENCY.

So far in the discussion of modern capitalistic production and of the various labor problems to which it has given rise we have not treated in detail the question of machinery and its effects on labor. We cannot, however, leave this subject without taking up this phase of it with considerable care. The advantages of machinery have been more often emphasized than the evils, so that we may profitably begin with the darker side of the picture. President Hadley[28] enumerates three evils which are charged against machinery, as now managed and operated: "1. That it displaces a large amount of human labor, thus taking income away from employes and giving it to employers. 2. That when it does not actually drive human labor out of use, it employs it in circumstances unfavorable to efficiency, health, and morals. 3. That under the best conditions it deprives the workman of independence, making him a specialized machine instead of a broad-minded man." We cannot do better than take up these points one by one.

In answer to the first charge President Hadley flatly denies that machinery has displaced labor, but insists that "there has been a most conspicuous increase of employment in those lines where improvements in machinery have been greatest," giving the expansion of railroads as an illustration. But it is not possible to generalize from this case without further analysis. The immediate effect of improved machinery, especially if suddenly introduced, is practically always to throw men out of employment. The extent to which this will occur depends on the suddenness and extensiveness of the change, but fortunately, as Professor Nicholson points out, new inventions seldom come suddenly or are introduced all at once on an extensive scale. It took almost a generation, for example, for American machine methods to displace Swiss hand labor in the making of watches. But when such a change does occur it hits hardest the least efficient and older men, those just on the margin of employment, for a man past middle life can rarely learn a new trade. The effect of displacement in causing suffering will also depend somewhat upon the mobility of labor, both the knowledge of new opportunities and the capital to make possible a change of location or

industry, and improvements in the means of transportation. It can easily be shown that as a general principle the lump-of-labor theory is erroneous, namely, that there is just so much work to be done and that if machinery is introduced there will be less work for men to do. But there is this element of truth in it, that the question whether men will be reabsorbed in the same industry depends upon the fact as to whether the market for the goods produced by the new machine can be expanded. If the demand is elastic, that is, can be largely extended because of the fall in price brought about by the cheaper production, as in the case of cotton goods, then the displaced laborers will probably be re-employed to produce an enlarged supply. If, however, the demand is inelastic, that is, will not be expanded by reason of a fall in price, as in the case of salt or coffins, then the displaced labor will not be reabsorbed in the same industry but must look elsewhere for employment.

The elaborate investigation of the Department of Labor in 1898 regarding the relative merits of hand and machine labor shows clearly the effect on the displacement of labor by the introduction of machinery. A few cases will serve as illustrations (see table on next page).

Hand and Machine Methods Compared.

Year of production	Article produced	Different operations performed	Different workmen employed
1829-30	Wheat (hand)	8	4
1895-96	Wheat (machine)	5	6
1859	Boots (hand)	83	2
1895	Boots (machine)	122	113
1850	Carpet (hand)	15	18
1895	Carpet (machine)	41	81
1891	Loading ore (hand)	1	1
1896	Loading ore (machine)	3	10

Year of production	Article produced	Time worked.		Labor Cost
		Hours	Minutes	
1829-30	Wheat (hand)	61	5	$ 3.55
1895-96	Wheat (machine)	3	19	.66

1859	Boots (hand)	1436	40	408.50
1895	Boots (machine)	154	5	35.40
1850	Carpet (hand)	4047	30	20.24
1895	Carpet (machine)	509	1	.29
1891	Loading ore (hand)	200	0	40.00
1896	Loading ore (machine)	2	51	.55

These cases, chosen at random, all show an increase in the number of different men employed, and an immense saving in time and in labor cost. Nothing is indicated however as to the total amount of employment. Optimistic writers like Carroll D. Wright claim that if machinery has displaced labor in one direction it has created more employment for them in others. He shows for instance[29] that the per capita consumption of cotton in this country in 1830 was 5.9 lbs., while in 1890 it was 19 lbs., and gives similar figures for iron and steel, and railroad traffic. It will be noticed that all of his examples are chosen from industries in which the demand is elastic. Mr. J. A. Hobson, a more careful and conservative writer, draws less optimistic conclusions from a study of Great Britain. He says: “First, so far as the aggregate of manufactures is concerned, the net result of the increased use of machinery has not been to offer an increased demand for labor in those industries commensurate with the growth of the working population. Second, an increased proportion of the manufacturing population is employed either in those branches of the large industries where machinery is least used, or in the smaller manufactures which are either subsidiary to the large industries, or are engaged in providing miscellaneous comforts and luxuries.”[30] It must be said, however, in modification of Mr. Hobson’s inferences, that it may be accounted as a social gain if the demand for manufactured commodities can be met by the labor of a smaller proportion of the population, since the energies of the rest are then set free for professional or artistic or similar pursuits. A study of the census reports of Great Britain seems to show that this is what has happened in that country.

The amount of labor is not the only factor to be considered; the regularity of employment, as we saw in the last section, is of hardly less importance. “Another danger of an entirely opposite kind,” says Professor Nicholson[31] , “lurks in this immense power of machinery, which is continually showing

its reality and remedies for which will, it is to be feared, be the fruit of long years of tentative adaptation to the new environment. What all sensible workingmen desire, what the advocates of the trade unions say is their chief object, is to get a “steady sufficient wage,” but it has been proved inductively that great fluctuations in price occur in those commodities which require for their production a large proportion of fixed capital. These fluctuations in price are accompanied by corresponding fluctuations in wages and irregularity of employment. But fluctuations in wages and discontinuities in employment are two of the greatest evils which can befall the laboring classes.” We have already seen how modern capitalistic methods of production may lead to over-production and to a crisis. We now see how machine methods may cause unemployment or irregular employment. The men displaced directly by new machinery, those thrown out of work by industrial depression resulting from over-production in machine industries, and finally those irregularly employed in the new occupations supplying luxuries—all of these may fairly attribute their suffering in large measure to machine methods.

“The second great charge made against the factory system is that it displaces a higher grade of labor by a lower grade; sometimes substituting the work of women and children for that of men; sometimes substituting work under conditions physically or morally unhealthful, for work under healthful conditions; sometimes substituting specialized and mechanical work for diversified occupation which contributes to general intelligence.” The point as to the labor of women and children has already been discussed. The charge that factory labor is physically unhealthful may in general be denied. Mr. Wright, in an elaborate defense of the factory system in the Tenth Census, concluded that the conditions of work in the modern factory are much more conducive to good health than those under the preceding domestic system, while morally they are far superior. The qualities demanded by the machine production of the modern factory are punctuality, steadiness, reliability, and sobriety, and it therefore makes against intemperance and immorality. So far as these exist in factory towns, they are the result of town life rather than of manufacturing. It must, however, be said that while the factory system is not inherently unhealthful, the high pressure at which operatives of steam-driven machinery are compelled to work, particularly in this country, may and often does wear him out

prematurely. This again is partially offset by a shortening of the hours of labor.

The final charge against the factory system is monotony of work. Many writers, from Adam Smith down, take the view that it is more stupefying to make a small part of an article, say the sixty-fourth part of a shoe, than to make the whole article. Professor Marshall, who has considered the subject carefully[32] , concludes that while it takes away manual skill, it substitutes higher or more intellectual forms of skill. “The more delicate the machine’s power the greater is the judgment and carefulness which is called for from those who see after it.” But after all there is less danger from monotony of work than from monotony of life, and the cure for this would seem to be in an increase of machinery rather than in its abolition.

Let us now try to summarize our conclusions on this intricate question. The first effects of the introduction of labor-saving machinery is to displace particular laborers; these suffer real injury, though they are often reabsorbed in the industrial organism. The social gain is undoubted, for the improved methods lead to lower prices and thus to an increase in the real wages of labor. To the improvement and wider use of machinery we must indeed look for the ultimate relief of the human race from exhausting toil. Says a socialist writer: “On mechanical slavery, on the slavery of the machine, the future of the world depends.... All unintellectual labor, all monotonous, dull labor, all labor that deals with dreadful things, and involves unpleasant conditions, must be done by machinery. Machinery must work for us in coal mines, and do all sanitary services, and be the stoker of steamers, and clean the streets, and run messages on wet days, and do anything that is tedious or distressing.” If labor today has a complaint to make against the use of machinery, it is that labor has not shared sufficiently in the improvements thus far effected. But the evil here is connected with the inequitable distribution of wealth, not with the methods of its production. In justice labor should share in the technical improvements which characterized the nineteenth century and will revolutionize to a still greater extent the industries of the twentieth. The practical question in this connection is as to the best method for labor to secure its claim to a share in the increased production. One answer, to which we will turn next, is by increasing its efficiency through better industrial education and training.

The subject of industrial education has recently been receiving considerable attention in the United States and the needs and shortcomings of our country in this regard have been described. Under modern methods of production, with their extreme specialization of labor and extended use of machinery, it is practically impossible for a worker to secure an adequate knowledge of a trade in the actual practice of it. In former days boys acquired training in their trades by the system of apprenticeship under the immediate charge of a master of the craft. The system of apprenticeship has today almost disappeared; boys are taken into shops as helpers, not as apprentices, and receive practically no systematic instruction in their trade, especially in a modern large establishment. In consequence of these facts it is insisted that school instruction should be given to make good the absence of shop practice; that a general system of industrial education should be developed to give our workingmen systematic training in the various trades. The superiority of the opportunities for industrial education on the continent of Europe, especially in Germany, have been frequently emphasized, and their industrial advance has been credited in large measure to this fact. We can probably not approach the subject better than by explaining the systems in these other countries and then comparing them with that of the United States.

Beginning with Germany as the country in which industrial education has received the greatest attention, we find there three different kinds of schools, which we may call the lower, middle, and higher. The lower group includes artisan and specialized trade schools, and is intended to be a substitute for the apprenticeship system. While they have an important influence on the general industrial efficiency of the nation, they concern chiefly the small handicrafts. The middle group comprises the trade schools (gewerbeschulen), of which the most famous are the weaving and dyeing schools at Chemnitz; other branches taught are soap-boiling, milling, building, pottery, etc. These are the schools that provide technical instruction for the large manufacturing industries, and are consequently of great importance; they train the foremen, superintendents, managers, and heads of establishments rather than the workingmen. The higher group is formed of the technical high schools or technological institutes, where are trained the scientific experts. The importance of the German system lies in the development of the last two groups rather than in provision for the

training of the workmen. Germany's recent industrial advance must be credited to the training of the officers, not the rank and file, in the industrial army, to the development of managerial ability rather than of manual skill.

In England the last twenty years have seen a marvelous development in industrial education, brought about in part by the "made in Germany" agitation. The English system differs from the German in educating working-class boys, while at work in the mill or at the forge, into foremen, managers, etc., mainly by means of evening classes in trade or technical schools. The German system, on the other hand, trained men who already had a superior general education. These schools are regarded as stepping stones for the more ambitious and intelligent young workingmen. They give a practical grasp of the subjects, but do not teach actual processes of manufacture, owing to trade union objections. They thus come between the lower and middle schools in Germany. The higher technical schools also exist and have recently been greatly expanded.

The system of industrial education in the United States may be said to resemble that of Germany more than England in that it supplies industries from above rather than from below, but it is in a very chaotic state as yet. The most important schools are institutes of technology and the technical departments of the universities, but these train men only for the highest positions. Provision for the industrial training of the workingman is almost lacking except in a few manufacturing centers. Thus there are a few trade schools resembling somewhat those in the Middle German group, as the textile schools at Philadelphia, Lowell, and a few other cities. Lower trade schools are found in New York City, but hardly anywhere else. That there is a distinct need of and demand for instruction of this character is shown by the enormous expansion of correspondence schools, a peculiarly American institution, which endeavor to give the training afforded by the English schools to the more ambitious young artisans.

So far in their industrial development the people of the United States have been immensely aided by two factors: the rich natural resources of the country, and the high quality of the labor. But as we have already seen, the natural resources are being either rapidly exhausted or monopolized. As to the character of the second factor, we may quote from the testimony of a recent careful observer, Dr. A. Shadwell[33] : "The American method of

work in the industrial sphere is distinguished by the following features: enterprise, audacity, push, restlessness, eagerness for novelty, inventiveness, emulation, and cupidity. Employers and employed have exhibited the same qualities in their degree."... But they suffer "from the national defect of want of thoroughness, which arises from the craving for short cuts." Now that American industries are entering the markets of the world in international competition, it becomes important to correct any faults that will cause us to fall behind. So far the movement for better industrial education through the establishment of trade schools has met two obstacles in this country. The first is the hostility of the trade unions, which fear to see their control of the labor market disturbed by the annual turning out of hundreds or thousands of workers from the trade schools without any especial sympathy with trade union methods or policies. The other difficulty lies in the satisfaction with prevailing methods, the belief that the American workman without training possesses skill superior to that of his European competitors, and a naïve national self-conceit in all things American. Now that we are for almost the first time in a hundred years measuring our industrial efficiency in foreign markets against our European competitors, we shall be compelled to take stock of all the items that make for industrial supremacy. There seems to be little doubt that when once this is fairly done, the need of a better system of industrial education will be recognized and met.

XII. PROFIT-SHARING AND CO-OPERATION.

Among the reforms suggested for remedying some of the evils incident to the modern wage system those of profit-sharing and co-operation occupy a prominent place. The separation of the community into capitalists and laborers, classes different in conditions and ideals, constitutes a menace to the peace and progress of industrial society. The wage system moreover is thought by many to have broken down the former intimate relation of employer and worker, and some scheme is needed to correlate their interests again and to bind them together. To secure this result profit-sharing is advocated. As defined by the International Co-operative Congress in 1897 this is "the agreement, freely entered into, by which the employe receives a share, fixed in advance, of the profits." It is not a change from the present wage system, but simply a modification of that system according to which the laborer receives a share in the profits in addition to his wages. The purpose is to identify the interests of the employes with those of their employer and thus to give him some of the same motives for energy, care, and thrift in the conduct of the business. Three principal methods of profit-sharing may be mentioned, though the variations are manifold. The favorite method in England and the United States is the payment of a cash bonus at the end of a fixed period, as a year. A second plan, which is the rule in France, is a deferred participation by means of a savings bank deposit, provident fund, or annuity, for the purpose of providing for old age and disability. The third plan, which has recently grown in favor in this country, is the payment in shares of stock of the company.

The economic theory of profit-sharing is that by inducing greater care and diligence on the part of the employe he will himself create the fund from which he is paid. It is claimed by its advocates that it increases both the quantity and the quality of the product and that it promotes greater care of implements and materials, thus reducing the cost at the same time that it increases the output. The classic example of this is the case of the original profit-sharing scheme, the Maison Leclaire, in Paris; the result of the first six years' experiment was a dividend on wages of $3,753 a year, derived

entirely from the increased economy and care of the workers. In some cases, however, the object of the employers is to secure immunity from strikes and other labor disturbances and a greater permanence of the labor force; and participation in profits is conditioned on the men abstaining from joining a trade union, or on uninterrupted service. In these cases the deferred participation plan is used. The advantages claimed for the system are not merely the increase in product already spoken of and the greatest efficiency of the worker, but also the improvement in his material and moral standards, and the promotion of industrial peace by lessening discontent and friction. The main basis for the system, since it is economic and not philanthropic in its nature, must of course be the increase in production brought about by its adoption.

More weighty, however, appear the objections against profit-sharing, which seem to have had sufficient force to cause the failure of a number of ventures in this direction. In the first place, the relation between the increased effort of a single workman and the success of a general business is so remote, especially in our complicated modern industry, that it is unlikely to act as a very powerful stimulus. But even if it should, the savings thus effected might be swept away by the poor business management of the employer. “It is quite possible that the workman who, in the hope of earning ‘bonus to labor,’ has done work 10 per cent in excess of the normal standard, may, even under a liberal scheme, find that, instead of receiving an addition to his normal wages of, say, 7 per cent, the bad management of his employer has reduced his bonus to so low a level that he has to be content with a supplement equivalent to only 2 per cent on his wages, or that, as has been the case in a large proportion of the schemes ... no bonus whatever is forthcoming.”[34] It is undesirable to make the earnings of the laborer dependent in any way upon the fluctuations of business or the ability of the employer. The ordinary wage system has at least the merit that the reward of the laborer is made dependent only on his own efforts. The lot of the modern worker is too unstable and employment too unsteady to add a new element of uncertainty in wages. If the laborer has really earned the premium, say labor leaders, why not add it to his wages instead of adopting this roundabout method. The sliding scale, or a system of premiums or bonus payments for increased output, would be better than profit-sharing, and is rapidly spreading.

This leads to the second objection, which is that profit-sharing paralyzes the efforts of the laborers to better their own conditions through trade unions, strikes or other methods. The trade union attitude was vigorously stated by President Gompers of the American Federation of Labor in his testimony before the Industrial Commission[35]: “There have been few, if any, of these concerns which have been even comparatively fair to their employes.... They made the work harder, longer hours, and when the employes of other concerns in the same line of trade were enjoying increased wages, shorter hours of labor, and other improvements, tending to the material progress of the worker, the employes of the concern where so-called profit-sharing was the system at the end of the year found themselves receiving lower wages for harder work than were those who were not under that beneficent system.” As long as the system is viewed with suspicion by the laborer or used as a weapon in industrial bargaining by employers, the plan is foredoomed to failure. But even were it managed in the proper spirit, it is after all applicable to only a comparatively few industries, those, namely, in which labor makes up the largest part of the cost of production. In most modern industries capital plays such an important role as compared with labor that the field for this plan is comparatively limited.

In the actual practice of profit-sharing there have been many interesting experiments, and not a few failures. It may be said to date from 1842, when M. Leclaire, a Parisian painter and house decorator, introduced it into his business, and has since spread over France and England; it has met with little success in the rest of Europe. In the United States the movement has also been more recent and of smaller proportions. The reason for this is suggested by President Hadley as follows[36]: “Where the laborers under the old wage system are not working up to a high standard of efficiency, there is more chance for the success of profit-sharing. This seems to be the reason why it works better on the Continent than in England, and better in England than in America.” It was estimated in 1900 that there had been in the entire world some 500 experiments in profit-sharing, of which about 400 were still in existence: a more conservative estimate would place the latter number at about 300.

More radical than profit-sharing, which involves only a change in the method of payment of wages, is co-operation, which involves a change of management as well. Its final goal, in the minds of its advocates, is the

radical modification if not ultimate abolition of the present wage system. While profit-sharing is paternalistic and is directed to an increase of production, co-operation may be said to be democratic, and to aim at a more equitable distribution. Under this plan the laborers hope to divert to themselves the large amount of profits which they now see going into the possession of their employers. By eliminating the manager or enterpriser they hope to save his profits for themselves. Two different kinds of co-operation are usually distinguished—distributive or consumers' co-operation, and producers' co-operation—which we may profitably take up in turn.

Successful consumers' co-operation may be said to have originated in Great Britain when twenty-eight Rochdale workingmen founded their famous society of Equitable Pioneers. The success and growth of this remarkable experiment, starting with a capital of £28, to a great system of 8,000 members with a capital of £200,000 in 1874, is a most romantic story. It was largely imitated and retail co-operative stores sprang up all over England. In 1864 the English Co-operative Wholesale Society was started, for the purpose of the joint purchase of supplies for the retail co-operative stores on better terms than these could secure singly from ordinary wholesalers. It effected large economies and was successful from the beginning; by 1901 it had a capital of £2,500,000 and acted as purchaser for over 1,000 retail societies. From buying, the society soon passed to making its own goods and now manufactures directly a long list of commodities. In 1868 the Scottish Wholesale Society was inaugurated upon practically the same plan. Consumers' co-operation has met with considerable success in Europe also. In the United States, however, experiments of this kind have in general had only a brief existence. It is impossible to say how many such societies exist today as no adequate statistics on the subject exist. Trade union stores in New England, the grange stores of the Patrons of Husbandry and later similar ones of the Sovereigns of Industry, and a few sporadic movements since in different parts of the country, show what has been attempted. The reasons for the lack of success in this country are not hard to find. Co-operation requires a willingness to take considerable trouble for small economies, which American workingmen, with their generally high wages, have not yet been willing to take. It also requires a considerable degree of homogeneity in thought and interests on the part of a people,

which is naturally less present in the United States with its large admixture of foreign population than in England or the countries of Europe.

The methods of the Rochdale Society will serve as an illustration of the way in which the savings effected by co-operation are distributed among the members. Any one might become a member upon payment of one shilling and was then entitled to trade at the store. The prices charged were those current in the town, but purity of goods was assured; cash payments were an essential feature. At the end of the year the profits were divided among the members in proportion to the amount of their purchases. On the other hand, it may be noted that no attempt was made to, introduce profit-sharing with the employes, who are paid ordinary but good wages only. Other forms of consumers' co-operation are those which undertake to supply insurance, or credit, like the co-operative insurance companies, banks, and building and loan associations. The latter especially have had considerable success in the United States and have helped many a laborer or man of small means to the ownership of a home.

Producers' co-operation differs from that just described in that it is a union on the part of laborers to do away with the employer and to secure for themselves the profits. The object of the first is to lower prices for the co-operators as consumers; the object of the second is rather to secure higher prices for themselves as producers by eliminating the profits of the industrial manager. They hope to perform his function by their collective effort, and to manage as well as labor; indeed, by diminishing friction and strikes they even hope to increase the profits. Examples of successful co-operation of this sort are not numerous, as it has great difficulties to contend with. Most of the experiments have failed, though recently it would seem that the movement is making substantial though slow progress, especially in France and England. Most of those in the latter country, however, seem to be of simple industries, as agriculture and dairy-farming. The most notable example of successful productive co-operation in the United States has been furnished by the coopers of Minneapolis, who organized a shop of their own in 1868 and have steadily increased their business since that time. Other instances often cited are the wood-workers in St. Louis and boot and shoe companies in Massachusetts. More recently there has been a considerable extension of co-operative creameries, cheese factories and similar businesses of a simple kind.

The advantages of co-operation are summed up as follows by President Walker.[37] From the laborer's point of view: "First, to secure for the laboring class that large amount of wealth, which ... goes annually in profits to the employer. Second, to secure for the laborer the opportunity to produce independently of the will of an employer.... In addition to these, the political economist beholds in cooperation three sources of advantage. First, co-operation would, by the very terms of the case, do away with strikes.... Second, the workman would be incited to greater industry and to greater carefulness in dealing with materials and with machinery. Third, in no small degree frugality would be encouraged." To these may be added other advantages, mostly realizable, however, in consumers' co-operation. Saving in store-room, clerk hire, advertising, book-keeping, etc., is effected, while above all, the practice of cash payments saves all loss from bad debts. The initial success of the Rochdale pioneers was in large part due to the economy in this line, as a system of long credits burdened the retail trade of England at the time they began. In this country the large department stores have introduced this system and have thus been able to give their customers lower prices, and by so much have lessened the motive for consumers' co-operation. The educative effects of successful co-operation upon the participators in developing habits of thrift, careful management and a knowledge of business principles, is one of the chief advantages of the system. The ultimate ideal of enthusiastic co-operators does not, however, stop short of a mere saving in price. The goal is stated as follows by the Right Relationship League of America, which has several co-operative stores in the Northwest: Consumers' co-operation is merely the first step which "will lead next to co-operative production, next to public ownership of natural resources and finally to complete industrial and economic equality, social and political right relationship—the Kingdom of God on Earth."

The defects of co-operation have already been suggested in the account of their failure. In the first place, the importance and need of intelligent and efficient management are usually underrated by workingmen. They are unwilling to pay high salaries and as a consequence lose the best men and secure inefficient service. Co-operation has therefore succeeded best in retail trade where the processes are comparatively simple, or in those branches of production where industry counts for most and management for

least. But even if it were possible to secure an efficient and progressive manager for a co-operative shop, it is found very difficult for a man chosen by the workmen to enforce discipline among them. A second disadvantage is the difficulty of securing capital. Where, as in many branches of large-scale manufacturing today, the average investment of capital amounts to more than $1,000 per employe, the impossibility of obtaining this by the contributions of the workers is obvious. Nor are capitalists usually willing to lend to such organizations, as the risks are too great. To meet this difficulty Ferdinand Lassalle, a German socialist, proposed that the state should advance the necessary capital to associations of workmen. But the experience so far with productive co-operation would seem to suggest that the social benefits would not equal the waste of public capital. There is danger also that if successful the co-operative associations would tend to become monopolies; they are profit-seeking societies and would probably not differ materially in their methods from ordinary joint stock enterprises.

It seems impossible, therefore, to expect from co-operation a final solution of the labor problem, such as John Stuart Mill, for instance, hoped for. Where successful, it has succeeded in distributing profits among a larger number of persons than would otherwise have received them. Its educative and moral effects, moreover, in the appeals which it makes to higher motives and to character, are of the highest value. But as an industrial system of enterprise it cannot supplant the present system as long as the manager of industry is needed. Today he performs a useful social service and profits are his pay therefor. If he is to be eliminated, society must first be raised to a higher plane of efficiency, intelligence, and morality. But just because it makes these high demands upon the members of the laboring class, attempts at co-operation should receive all reasonable encouragement.

XIII. PROBLEMS OF DISTRIBUTION.

So far we have discussed for the most part those economic problems that center round the production of wealth, such as the use of natural resources, large-scale production, trusts and monopolies, labor organizations, unemployment, industrial education and co-operation. Now we shall consider briefly a few of the problems that are connected with the distribution of wealth. Professor Blockmar[38] says that the three great problems of economic society are: "First, how to create the largest amount of utilities or wealth; second, how justly to divide this amount; and third, how to make the product minister to the permanent rather than to the transient well-being of society." The first problem we have already discussed; the second forms the subject of the present section; while the third will be taken up in the next section. Within the last century the center of interest in the practical application of economic principles has decidedly shifted from production to distribution. The earlier writers in economics, as shown in the mercantile lists of the seventeenth and eighteenth centuries, even Adam Smith, were chiefly interested in methods of increasing a nation's wealth. With the introduction of the factory system and the opening up of vast natural resources by improvements in mining and transportation, the production of wealth has enormously increased, and now the question of the method of its distribution or division is felt to be more pressing.

Under the term distribution two different processes are included, which should be distinguished before going further. The first is called functional distribution, and concerns the distribution of the product of industry or the income of society, among the different factors of production. That is to say, land, labor, capital and managerial ability have contributed in varying degrees to the production of a certain amount of current wealth, and the problem of functional distribution is to ascertain how the net product resulting from these joint efforts is divided. How much goes to rent, how much to wages, how much to interest and how much to profits? The second kind of distribution is the division of the wealth of society among individuals or families; this is personal distribution, and raises the question

of poverty and great wealth. In discussing these problems, however, we must remember that wealth production and distribution takes place in modern society under conditions imposed by the social order in which we live; these were defined as competition, private property and personal liberty. If any modifications of the processes of distribution were desired, it would undoubtedly be necessary to alter these fundamental institutions.

John Stuart Mill held that production was governed by natural laws, which could be ascertained and stated, but that distribution was artificial and hence that it was not possible to discover constant and certain laws governing it. Beginning mainly with Mill, the ethical question has been more and more asked as to what share each factor in production ought to get, not merely what he does receive. “Hence the question is rising more and more as to what should be the basis of division, and many proposals have been made. It is proposed that laborers combine to get a larger share. Hence we have trade unions, Knights of Labor, etc. It is proposed that capitalists and landlords give a larger proportion of the produce to the laborers than they are able to secure by mere private struggle. Hence we have proposals for profit-sharing and various charities. It is proposed that laborers combine to be their own capitalists and landlords; hence we have all sorts of co-operative and communistic experiments. It is asserted that the wealthy classes have so much power in their hands that private co-operation cannot succeed in competing against them, and hence it is proposed that all the people, through government (municipal, state, and national), secure all the means of production (capital and land, so far at least as land is used for production), and operate them collectively for the equitable good of all, the people thus being their own employers, capitalists, and landlords. Hence we have municipalism, nationalism, socialism. It is claimed that capitalists and landlords have been able to secure, and are today able to maintain, their large share in distribution, only through the favoritism of the Government. Hence we have proposals for free trade, the single tax,... the extreme proposals of the very great minimizing of the state in individualism, or the abolition of the Government in anarchism.”[39] In view of this very imperfect list it is not too much to say that most of the economic problems that are stirring society today are connected with the distribution of wealth.

The first question that suggests itself in the discussion of functional distribution is as to whether it is actually governed by natural law, so-called.

It is observable that the amounts which go to rent, to wages, to interest, and to profits are regularly quite constant. What determines this? The socialists contend that natural distribution is the only just method and insist that the state should regulate this just distribution; they are not clear, however, as to what this natural method is. Henry George uses the same phrase when he says, “the just distribution of wealth is manifestly a natural distribution of wealth, and this is that which gives to him who makes it and secures to him who saves it.” All such statements beg the question for they all turn on the use of the word natural. Many modern economists are inclined to assert that the question of distribution is not an ethical one, not a question of what ought to be but of what is. Thus Professor Tetter says[40] : “Distribution in economics is the seasoned explanation of the way in which the total product of a society is divided among its members. It is a logical question and not an ethical one.” And Professor Clark writes, “There is, in short, a deep-acting natural law at work amid the confusing struggles of the labor market.” It will not be possible, in the brief limits of this section, to take up all the theories as to the way in which this distribution is effected among the claimants to a share of the product, but a few of the more important practical results may be stated. We shall take up the four different factors in turn.

Rent is usually defined as the return for the use of natural objects and agencies. Rent has usually been low in the United States because of the large amount of land and other natural agents available. In general it may be said that when any factor of production is relatively abundant in comparison with the other factors, its share of the product will be small.[41] Henry George, however, argues that as the amount of land is limited and is now practically all taken up, the future will see a constantly increasing demand for land, and hence the landlords will absorb most of the future income of society. This is true of most of land and other natural agents especially in demand, as choice sites in our cities, anthracite coal mines, etc. The practical problem that suggests itself is, do we wish private property in land? The socialists answer no, but the individualists insist that the best use has been and can be made of land only by reducing it to private ownership. In practice, however, even in modern individualistic societies, the absolute and unregulated use of land by the owner is restricted in various ways.

Interest is the amount paid for the use of capital. From the time of the church fathers in the Middle Ages down to the present-day socialists, interest and the private ownership of productive capital have formed favorite objects of attack. The justification of interest lies in the fact that men prefer present goods to future goods—a bird in the hand is worth two in the bush—and interest is the difference in value between the two at the present moment; it is time value. The justification of private property, on the other hand, lies rather in its expediency than in any inherent and unalterable law of nature. It has developed with civilization and has been, without question, a fundamental cause of material progress. But moderate individualists even, as John Stuart Mill, have attacked the institution of inheritance while leaving the main edifice of private property untouched. They would limit absolutely the amount of bequest or, as President Roosevelt advocated, would use inheritance taxes as a means of breaking up large fortunes.

Profits are the reward which the manager of a business receives for his services in organizing and superintending the business. This share of the social income was the last to be recognized by economists, and its rightfulness is even yet denied by the socialists. They insist that profits are really the earnings of labor which have been withheld from the laborer by the superior skill and economic strength of the capitalist manager; they are institutional robbery, the exploitation of labor. It is not possible to take up the arguments on this point, but it may be said in a word that the manager of business contributes a needed service to the work of society just as truly as the laborer does, and receives his earned reward in the form of profits.

Wages are the reward of labor. It is often assumed that wages are lower than they should be, that the laborer in some way is deprived of a portion of what he has rightfully earned. It is worth while inquiring briefly how the share of labor in the distribution of the social income is determined. Various theories have been developed to explain the distributive process, of which we may notice three. The oldest in point of time and the most pessimistic theory held that wages were fixed by competition and the growth of population at the bare subsistence minimum, a bare starvation level. If by some happy chance wages were raised above this point, then the population would speedily multiply and the increased competition thus brought about among the laborers would depress wages again to the lowest amount

sufficient to support a family. Under the name of the “iron law of wages,” this theory is still put forth by the socialists as the explanation—together with the institution of private property—of wages. Historically, however, this theory has happily been proven untrue, as the advance in the standard of living among the working class during the past century testifies. It has now been almost wholly superseded by the so-called productivity theory,[42] which asserts that wages depend upon the productivity of labor; that the laborer gets what he produces, and that this share is assured him by the working out of the competitive process under free competition. If this theory is true, there can be no ethical question raised; if labor is dissatisfied with its share, then it must increase its productive efficiency. As a matter of fact wages have always been high in the United States because labor has been relatively scarce compared with land and capital, and consequently its marginal productivity has been high. The third theory says that wages are a result of bargaining, of competition in the labor market, a question of supply and demand. Under these circumstances it is largely a question of economic strength between labor and capital, and if labor is well-organized, alert, and able to drive a good bargain, then wages will be high; otherwise they will be low. While there is an element of truth in the last theory, the second one seems the truest explanation of general wages; certain it is that no monopoly power of labor, however great, could permanently maintain wages at a level higher than the actual produce of labor. The element of truth in the first theory is that wages can never, for any length of time, fall below the cost of subsistence.

Of more practical interest are questions connected with the personal distribution of wealth. In this connection arise such problems as the increase of large fortunes, the causes of poverty, and similar questions. The boast of our Republic has long been that here opportunity was open to all, that wealth was widely diffused, and that such inequalities of fortune as characterized the nations of the Old World were happily lacking. In the fifty-five years, 1850-1904, the per capita value of all property in the United States exactly quadrupled; how has this increase been distributed? Unfortunately we have no complete statistics on this point, yet reliable estimates by authoritative writers all tell the same story—of great concentration of wealth in the possession of a comparatively few rich families. In 1893 Mr. George K. Holmes concluded from a study of the

statistics of farm and home ownership in the United States that “91 per cent of the families of the country own no more than about 29 per cent of the wealth, and 9 per cent of the families own about 71 per cent of the wealth.” A more accurate and satisfactory statement can be drawn from the income-tax returns for Prussia, which tells almost the same story with regard to income. The table on the following page is condensed from an article by Professor A. Wagner:

Distribution of Income in Prussia, 1902

Income	Per cent of persons	Per cent of income
Below $214	70.7	33.0
$214 to $714	25.8	34.9
Over $714	3.5	32.1

According to these figures over two-thirds of the persons—heads of families or single adults—had only one-third of the income, while 3½ per cent had another third. Another striking fact shown by the table is the large proportion of persons receiving incomes of less than $214 a year, the minimum taxable income. It shows the poverty of the mass of the people as well as the concentration of wealth among the few rich. In the United States, where the natural resources have been so much richer than in Germany, a similar table would probably show a much smaller proportion under the Prussian minimum, but on the other hand it would probably show a greater concentration of income in the hands of a few. Europe has as yet no billionaire. The great fortunes of the United States have been made possible by the unrivaled opportunities for the exploitation of rich natural resources, the appropriation of natural monopolies, and to special privileges and opportunities in manufactures and transportation. The importance of monopoly privileges in the distribution of wealth is well shown by the results of an investigation made in 1892 by the New York Tribune into the sources of the fortunes of millionaires. It was undertaken to show that protection was not the main cause; but while it proved this, it showed clearly that most of them were built up on monopoly. “Of the 4,047 millionaires reported, only 1,125, or 28 per cent, obtained their fortunes in protected industries.... About 78 per cent of the fortunes were derived from permanent monopoly privileges, and only 22 per cent from competitive

industries unaided by natural and artificial monopolies.... Furthermore, if the size of fortunes is taken into account it will be found that perhaps 95 per cent of the total values represented by these millionaire fortunes is due to those investments classed as land values and natural monopolies, and to competitive industries aided by such monopolies."[43] It is essential to the stability of our democratic institutions that all special privileges be absolutely prohibited, and that monopoly be brought under strict government control and regulation. Improper methods of wealth accumulation should certainly be prevented.

The opposite question of poverty has already been discussed and some of the causes of poverty pointed out. It will be sufficient here to try to answer the question which has often been asked: Are the rich growing richer and the poor poorer? Though the first part of the question has just been affirmed, the second part may be denied. The nineteenth century has witnessed a vast improvement in the condition of the laboring man, who has shared in the increasing wealth which he has helped to produce. Wages have steadily increased, the hours of labor have been reduced, and the material well-being of the wage-earner is greater today than it has ever been before. It has more than once been pointed out by writers on this subject that with an equal distribution of wealth no one would be well-to-do, while many others insist that inequality in itself is a desirable thing. Greater diffusion of wealth can come about only by very slow processes, and permanent plenty can be secured only by a great increase in the accumulations of capital and the efficiency of each worker. Any suggested reform, therefore, that would weaken the motives to thrift and industry must be rejected.

XIV. SAVING AND SPENDING.

The goal and purpose of all economic activities is the satisfaction of human wants. The object of production is consumption. We work because we desire and need various things which we can get only if we produce them or earn the money to buy them. In this section we take up some of the problems connected with the rational use or consumption of the wealth which is continually being produced. We have seen something of the conditions under which it is produced, and the manner in which it is distributed; we must now study the not less important subject of its application to human needs and desires. The great question is, how can we get the largest and most rational return for a given expenditure? Before trying to answer this question, it will be helpful to present a summary statement of actual expenditures in different places:

Expenditures for Different Purposes.

Items	United States 1903	New York City	Great Britain
Food	43.1	43.4	51.4
Clothing	13.0	10.6	18.1
Rent	18.1	19.4	13.5
Fuel and light	5.7	5.1	3.5
Miscellaneous	20.1	21.5	13.5
Total	100.0	100.0	100.0

Items	Prussia	Average
Food	55.0	48.2
Clothing	18.0	14.9
Rent	12.0	15.8
Fuel and light	5.0	4.8
Miscellaneous	10.0	16.3
Total	100.0	100.0

From this table it is seen that practically half of the income of average working-class families is expended for food, and five-sixths of it goes for the bare necessaries. It is therefore of the utmost importance that this be spent wisely. The remaining one-sixth, included here under the head “miscellaneous,” comprises such items as education, care of health, comfort, mental and bodily recreation, etc. It is manifest that this group can be expanded in only one of two ways: either by enlarging the total income, or by economizing on the other items by a wiser and better-ordered expenditure. The former question has already been discussed; here we are concerned only with the latter. Dr. Frederick Engel, a Prussian statistician, laid down certain laws with regard to consumption: as the income of a family increases a smaller percentage is spent for food and a larger percentage for education, health, recreation, etc.; while the percentage spent for clothing, rent, fuel and light remains approximately the same. A higher civilization and culture for the mass of the people can only be secured by expanding the group of culture expenditures. As long as these remain unsatisfied for the ordinary family we cannot claim to have attained our economic goal. The author of a recent study of conditions in New York City, where the cost of living is high, concludes that a “fair living wage for a workingman’s family in New York City should be at least $728 a year, or a steady income of $14 a week.”[44] The actual earnings are certainly below this figure.

One of the problems which has often proved very puzzling is the relation between saving and spending. At what point should one stop spending in order to save? If the satisfaction of our wants is the object of production, why should we save at all? This is the point urged by the author of a specious little book called “The Fallacy of Saving.” The problem can be most easily solved by a more careful analysis of terms. In the popular view, saving involves the withdrawal of goods or money from use, while spending means putting them to immediate use. The spendthrift is proverbially popular. “If the rich do not spend, the poor die of hunger,” said Montesquieu. Saving may take the form of hoarding or withdrawing things from use, but nowadays this is practised only by misers; saving ordinarily takes the form of investment in some productive enterprise, either directly or through a bank. In this way a demand is created for goods just as truly as though the money had been spent for a dinner or a suit of clothes. Saving is

spending, but it is spending for the future rather than the present; it usually causes the production of permanent material goods rather than transient or immaterial pleasures. Another cause of the confusion of ideas on this subject is that we always speak of money and thus lose sight of the acts of production and consumption that lie back of the money transfer. We see that money is transferred by spending and think that it increases trade. Consequently, when a prodigal spends his money foolishly, it is excused on the ground that it makes employment and puts money in circulation. We forget that it would have been "put in circulation" just as effectively if he had not spent it, but had placed it in a bank. If we look back of the money transfer, we see that usually there has been a foolish or wasteful expenditure, sometimes an absolute destruction of wealth. A fire which burns down valuable buildings is an absolute social loss, even though employment be given to masons and carpenters in putting them up again.

A third confusion of ideas that exists in the popular mind is due to an over-emphasis of the desirability of work for its own sake. The man who "makes work" is thought to be doing a desirable thing, even though this results from the unnecessary destruction of useful things. Now the real goal of all rational economic endeavor is not production for its own sake, but consumption; not work, but the gratification of wants. Every destruction of durable commodities which lessens the power to gratify wants is a loss to a community and no juggling with words can make it anything else. If it gives employment to labor, that means that the labor has been diverted from the production of other things to which it would have been devoted. Edward Atkinson several years ago calculated that every year fires destroyed property in the United States to the amount $150,000,000.[45] That workmen are employed to reproduce the buildings, etc., can surely not be reckoned as a social gain. There is great danger in a commercial age like ours of forgetting that work is not an end in itself, but simply a means to an end. But it may be argued that unless these men had been given employment of this sort, they would have starved. It is conceivable that during or after a revolution industry would be so interrupted that ordinary employments would not be open. But in ordinary times such a statement is simply an assertion of the fallacious lump-of-labor theory, that there is just so much work to be done and no more. New wants are continually pressing for satisfaction, waiting only for the prior ones to be satisfied before they urge

their claims. So soon as the old ones are satisfied, additional employment is provided in meeting the newer desires. The aim of society is to expand continually the circle of gratified desires. As durable goods and agents are accumulated by the process of saving, this becomes increasingly possible in every progressive society. Useless destruction involves sheer waste and cannot be justified on any grounds.

On the other hand, saving is socially necessary in every industrially developed community in order to furnish the requisite capital for the continued production of wealth. Professor Marshall has estimated that every year one-fifth of the wealth of a nation is used up in the processes of manufacture and production; just to keep machines, factories, railroads, and other instruments of production up to the point of efficiency and restore loss and depreciation would therefore require considerable saving. If the nation is to grow wealthier and is to accumulate additional capital, manifestly still more must be saved. This is done in all progressive countries. Saving is carried on by individuals, however, and not by nations, and the motives that lead to it are personal. The most important is probably the desire to provide for wife and children or other relatives; next to that is the wish to lay by sufficient for one's old age. In our individualistic society, where each family forms an independent unit and is assumed to be self-supporting, it is very desirable that habits of thrift and saving be developed. Both from a social and a personal point of view therefore saving must be approved, though it is undesirable that it should proceed so far as to prevent spending for the gratification of essential present needs.

But what shall we say about expenditures for luxuries? Here the spending is for the gratification of a want, though it may be out of proportion to the results. What shall be our attitude to it? This question is not so easy to answer as the other. Three different schools have given as many answers to the problem of luxury: the first condemns it utterly; the second approves it wholly; and the third takes an intermediate position between the two extremes. Luxury is condemned by the first school from three points of view: as a question of individual morals, it is regarded as debasing and enervating, thus preventing the highest development of the human faculties; as a question of economics it is condemned as wasteful; and as a question of right and justice it is incompatible with an equitable distribution of wealth. It is upon this last point that the opponents of luxury lay the greatest

emphasis. As the quantity of existing wealth is insufficient to satisfy even the primal wants of the large majority of our fellow-creatures, we should endeavor to increase this available store as much as we can, and should refrain from drawing upon it in a reckless manner in order to gratify superfluous wants. Furthermore, the productive powers that we can use are, as a matter of fact, limited; and therefore, if the wealthy classes divert a portion of these forces towards the production of articles of luxury, there will be so much the less available for the production of those staple articles that the masses require for their consumption. In the case of a Robinson Crusoe this would be perfectly clear: if he devoted several months to the polishing of a diamond for ornament, he would have to go without a house or other improvements he might have made in that time. Or, if he forced his man Friday to spend half his time polishing diamonds for him, Friday might be compelled to go without sufficient clothing or food or housing. The same thing is true of organized society, only the truth is hidden by the phenomena of exchange. It has been estimated[46] that the annual consumption of wealth in the United States is divided somewhat as follows: necessaries, six billion dollars; luxuries, three and one-half billion (of which $900,000,000 go for liquor and $500,000,000 for tobacco); capitalistic uses, three and three-quarter billion. It is manifest that if the expenditure for luxuries was curtailed or abandoned, there would be more to devote to the other categories.

The opposite school replies to these arguments that luxury is an indispensable stimulus to progress; that really all economic progress is first manifested in the form of a need of luxury, and that luxury therefore is a necessary phase of its development. Since luxury is wholly relative, every want or need is, on its first appearance in the world, regarded as superfluous; first, because no one has hitherto wanted it, and secondly, because its production probably requires a considerable amount of labor, on account of man’s inexperience and the inevitable gropings in the dark that attend all beginnings. The decencies of life today and even the necessities were once regarded as luxuries—chimneys in houses, shoes, forks and knives, linen for the body, bath tubs, etc. If all luxury had always been sternly suppressed when it made its appearance, all the needs that constitute civilization would have been nipped in the bud, and we should still be in the condition of our ancestors of the Stone Age. Civilization depends on the

multiplication of wants. Economic progress is a process of converting superfluities into conveniences, and conveniences into necessities.

The attitude taken by practically all economists today is intermediate between these two extremes. Moderate luxury is justified, but lavish and indiscriminate luxury is disapproved of. This justification of luxury rests upon purely economic grounds. In so far as personal consumption is the objective point of production, the prohibition of luxury would act as an impediment to enterprise. If the desire to enjoy luxuries stimulates the productive powers of economically important members of society, it is justifiable as a necessary motive force. The introduction of luxuries and the consequent raising of the standard of living seems often the only way to secure progress. If the mass of the people live on the minimum of cheap food, multiply as long as cheap food is to be had, and spend little for comforts and luxuries, then most of the labor of such a community must be spent in obtaining food for the masses. Such is the condition in India and China. But if a large part of the community has a higher standard of living, it will exercise self-restraint in the increase of its numbers, and the whole level of intelligence and comfort will be raised, as in France or Switzerland or New England. On the other hand, it is urged that “failure on the part of any family to secure the necessaries of life is injurious, not only to it, but to the whole community. Under-consumption means under-nutrition and loss in industrial efficiency. If permitted to continue it must inevitably undermine the standards which make a family self-supporting and self-sufficient and reduce its members to dependency. The general interest requires, therefore, acceptance of the maxim: the consumption of luxuries should be deferred until all are provided with necessaries.... This suggests that no one is justified in spending income for a luxury for himself or his family that will afford less happiness than would the same income spent for someone else.”[47]

But the difficult question at once suggests itself: How can the surplus incomes of the rich be used so as to provide for the needs of the poor, without undermining their independence or permanently lowering their earning power? It has been suggested that there should be a socialization of luxury; that the rich should use their wealth for the construction of public art galleries, libraries, parks, baths, etc., which would thus gratify as great a number as possible. The feeling is growing in the United States and in the

world that wealth is a social trust, and that the ownership of wealth imposes upon a person certain moral obligations. While every man has a legal right to spend his surplus income as he pleases, he is morally bound to spend it in such a way as to increase the welfare of the whole community.

Let us now finally take up the problem of economy in consumption. It is said that an American family will waste enough food for a French family to live on. The farmer who leaves his implements out in the rain or his cattle without proper shelter, is guilty of waste. We all waste clothing by frequent changes in fashion. Such waste is as much due to a lack of knowledge and training as to carelessness. The single example of the consumption of food will illustrate this point. “If we place the average income of an American family at $500—and it will not greatly exceed that figure—then nearly $250 of this amount is expended each year for food. Waste occurs in any or all of the following ways: (1) needlessly expensive foods containing little real nutriment are used; (2) there is a failure to select the foods best suited to the needs of the family; (3) a great deal is thrown away which ought to be utilized; (4) bad preparation of the food causes it to lose much of the nutriment which it does contain; (5) badly constructed ovens diffuse heat, instead of confining it, and cause enormous loss of fuel. We shall state less than the truth if we estimate that fully one-fifth of the money expended for food is absolutely wasted, while the excessive expenditure often fails to provide adequate nutrition.”[48] The remedy for such a waste as this clearly lies in the teaching of domestic science in our public schools to the daughters and future wives of the workingmen. As the ordinary household expenses, as shown above, absorb from 80 to 90 per cent of the ordinary income, the training of the housewife, under whose control they fall, is almost as imperative as that of the wage-earner.

The economic evils of intemperance have already been partially stated in the objections to luxury. There is, however, one additional objection to the excessive use of intoxicating liquor which is not true of most indulgences: it diminishes a man’s productive powers. It is harmful in its effects upon both consumption and production. Other items of consumption appear, however, not so clearly under the immediate control of the consumer. The housing accommodations in many of our large cities have often been unsanitary and unworthy of being called homes. Legislation has been necessary to compel the erection of better tenements and prevent the exploitation of helpless

people. So too it has been found necessary to legislate against loan-sharks, in order to protect people against their own improvidence and ignorance. In addition to legislation against positive evils, we must of course look to education as the great remedy of waste in consumption.

There is one other phase of the subject of consumption that may well be mentioned before leaving this subject. Owing to the constant pressure of the consuming public for cheap goods, many articles are produced under conditions dangerous to the health, morality and well-being of the operatives, as in the case of the “sweated trades.” To remedy these evils consumers’ leagues have been started in many places, the members of which pledge themselves not to buy goods or to trade in stores where the conditions of work are not up to certain prescribed standards. They realize that as consumers they owe a duty to other members of society not to exploit them. While this method has proven a fairly effective method of protest in some cases, it cannot be looked to as a solution of this evil. But it emphasizes the fact that the interests of all members of society as producers and consumers are closely interdependent, and that the progress of society requires the improvement of the condition of all.

XV. MONEY AND BANKING.

Probably on no subject has there been such confused thinking or have such widely varying views been held as on that of money. There is, however, substantial unanimity of opinion on the important points among economists today, though in practice there still remain many unsolved problems. The modern industrial system has already been characterized as one of capitalistic production, of large-scale enterprises with extended use of machinery. Not less fundamental are the processes of valuation and exchange made possible by the use of money and credit; and also by the machinery for the geographical distribution of goods, our railroads and steamship lines. The modern stage of economic development has been described by Hildebrand as one of "credit economy," as opposed to those of barter and money economy, which preceded. It is inconceivable that the modern complex system of exchange could be maintained without the extended use of money and credit. Without attempting to define these terms or to trace their historical development, we may proceed at once to state some of the problems to which they have given rise.

The first question that suggests itself is, what determines the value of money? The generally accepted answer may be briefly stated: it is, that the value of money depends, other things remaining the same, upon its quantity. According to the quantity theory an increase in the supply of money will cause a fall in the value of each unit, just as an increase in the supply of wheat or cotton will cause a fall in the value of each bushel or bale. Conversely, a decrease in the quantity of money will cause a rise in the value of money. It is simply an application of the general law of value to money. The phrase "other things remaining the same" is however an important one, for it assumes that the amount of business and the methods by which it is conducted will remain substantially unchanged. Of course if an increase in the amount of money is accompanied by an equivalent expansion of trade, the one may offset the other and the value of money remain unchanged. Now, inasmuch as the prices of all goods and services are measured and expressed in terms of money, it is clear that a fall in the

value of money means a rise of general prices; the value of each commodity is now expressed in terms of a larger number of less valuable units or dollars. Prices will be high if the quantity of money in circulation in a country is large; they will be low if the quantity is small. To the question, which is better for a country, high prices or low prices, it may be answered that it is a matter of indifference, provided only that there is enough money to do the work of exchange efficiently and that fluctuations are prevented. Just how much constitutes enough is, however, a matter of contention. In the undeveloped sections of our country, where capital is scarce and banking facilities undeveloped and where most of the people are debtors, there has always been a demand for cheap and abundant money. Capital and money have been confused and the need of one has led to a demand for the other.

It is not a matter of indifference, however, whether prices be rising or falling, that is, whether inflation or contraction of the currency is taking place. A period of falling prices means hardship and injustice to debtors and producers of goods, as farmers, manufacturers, etc. Having contracted obligations and engaged in the production of commodities with the expectation of a given price, they find their goods worth less when ready for the market and themselves confronted with a loss instead of the anticipated profit. Under such circumstances a contraction of the currency and falling prices means lessened production of wealth. Consequently many writers, and even so good an economist as President Walker, have urged that a slow steady inflation of the currency would promote trade and “give a fillip to industry.” The monetary history of the United States is filled with attempts to realize this in practice: colonial and revolutionary bills of credit were first issued; when these were forbidden by the new Constitution resort was had to issues by state banks. When the Federal Government began the issue of greenbacks and restricted the use of state bank notes, the inflationists looked to this source for assistance. After the defeat of the Greenback party, they turned finally to the coinage of silver, which was now falling in price, and the question of bimetallism in the United States was made a practical political issue.

Down to 1870 practically all the nations of Europe and America had the system of bimetallism at ratios of 15½ or 16 to 1. About that date the great increase in the supply of gold and the fall in the value of silver led one

country after another to abandon the latter and to adopt the system of gold monometallism. This was vigorously resisted by many persons and several fruitless efforts made to secure a system of international bimetallism. Failing that, the friends of silver in this country endeavored to secure independent action by the United States alone, and were ultimately successful in obtaining the purchase by the Federal Government of practically the entire silver output of the country during the years 1878-1893.

Development of the Manufacturing Industries in the United States, 1800-1905.

Fiscal Year, ending June 30—	Population June 1.	Wealth.	
		Total.	Per capita.
		Dollars.	Dollars.
1800	5,308,483	…	…
1810	7,239,881	…	…
1820	9,638,453	…	…
1830	12,866,020	…	…
1840	17,069,453	…	…
1850	23,191,876	7,135,780,000	307.69
1851	23,995,000	…	…
1852	24,802,000	…	…
1853	25,615,000	…	…
1854	26,433,000	…	…
1855	27,256,000	…	…
1856	28,083,000	…	…
1857	28,916,000	…	…
1858	29,758,000	…	…
1859	30,596,000	…	…
1860	31,443,321	16,159,616,000	513.93
1861	32,064,000	…	…
1862	32,704,000	…	…
1863	33,365,000	…	…
1864	34,046,000	…	…
1865	34,748,000	…	…
1866	35,469,000	…	…
1867	36,211,000	…	…
1868	36,973,000	…	…
1869	37,756,000	…	…
1870	38,558,371	30,068,518,000	779.83
1871	39,555,000	…	…
1872	40,596,000	…	…
1873	41,677,000	…	…
1874	42,796,000	…	…
1875	43,951,000	…	…
1876	45,137,000	…	…

1877	46,353,000	…	…
1878	47,598,000	…	…
1879	48,866,000	…	…
1880	50,155,783	43,642,000,000	850.20
1881	51,316,000	…	…
1882	52,495,000	…	…
1883	53,693,000	…	…
1884	54,911,000	…	…
1885	56,148,000	…	…
1886	57,404,000	…	…
1887	58,680,000	…	…
1888	59,974,000	…	…
1889	61,289,000	…	…
1890	62,622,250	65,037,091,000	1,038.57
1891	63,844,000	…	…
1892	65,086,000	…	…
1893	66,349,000	…	…
1894	67,632,000	…	…
1895	68,934,000	77,000,000,000	1,117.01
1896	70,254,000	…	…
1897	71,592,000	…	…
1898	72,947,000	…	…
1899	74,318,000	…	…
1900	76,303,387	88,517,306,775	1,164.79
1901	79,003,000	…	…
1903	80,372,000	…	…
1904	81,752,000	107,104,211,917	1,310.11
1905	83,143,000	…	…
1906	84,216,433	…	…
1907	85,817,239	…	…
1908	87,189,392	…	…

Fiscal Year, ending June 30—	Production of wool.[B]	Raw wool imported.
	Pounds.	Pounds.
1800	…	…
1810	…	…
1820	…	…
1830	35,802,114	669,883
1840	52,516,959	9,898,740
1850	…	18,695,294
1851	…	32,607,315
1852	…	18,343,218
1853	…	21,616,035
1854	…	20,228,035
1855	…	18,599,784
1856	…	14,778,496
1857	…	16,505,216
1858	…	…
1859	60,264,913	…
1860	75,000,000	…
1861	90,000,000	…
1862	106,000,000	42,131,061
1863	123,000,000	73,931,944
1864	142,000,000	90,464,002
1865	155,000,000	43,877,408
1866	160,000,000	67,918,253
1867	168,000,000	16,558,046
1868	180,000,000	24,124,803
1869	162,000,000	39,275,926
1870	160,000,000	49,230,199
1871	150,000,000	68,058,028
1872	158,000,000	122,256,499
1873	170,000,000	85,496,049
1874	181,000,000	42,939,541
1875	192,000,000	54,901,760
1876	200,000,000	44,642,836

1877	208,250,000	42,171,192
1878	211,000,000	48,449,079
1879	232,500,000	39,005,155
1880	240,000,000	128,131,747
1881	272,000,000	55,964,236
1882	290,000,000	67,861,744
1883	300,000,000	70,575,478
1884	308,000,000	78,350,651
1885	302,000,000	70,596,170
1886	285,000,000	129,084,958
1887	269,000,000	114,038,030
1888	265,000,000	113,558,753
1889	276,000,000	126,487,729
1890	285,000,000	105,431,285
1891	294,000,000	129,303,648
1892	303,153,000	148,670,652
1893	298,057,384	172,433,838
1894	309,748,000	55,152,585
1895	272,474,708	206,033,906
1896	259,153,251	230,911,473
1897	266,720,684	350,852,026
1898	272,191,330	132,795,202
1899	288,636,621	76,736,209
1900	302,502,328	155,928,455
1901	287,450,000	166,576,966
1903	291,783,032	177,137,796
1904	295,488,438	173,742,834
1905	298,915,130	249,135,746
1906	298,294,750	201,688,668
1907	311,138,321	203,847,545
1908	…	125,980,524

Fiscal Year, ending June 30—	Production of cotton.[B] (500-lb. bales, gross weight.)	Manufactures of cotton. Thousands of spindles in operation on Sept. 1st.		
		In Southern States.	In Northern States.	Total United States.
	Number.	Thou-sands.	Thou-sands.	Thou-sands.
1800	73,222	…	…	…
1810	177,824	…	…	…
1820	334,728	…	…	…
1830	732,218	…	…	…
1840	1,347,640	181	2,104	2,285
1850	2,136,083	265	3,733	3,998
1851	2,799,290	…	…	…
1852	3,130,338	…	…	…
1853	2,766,194	…	…	…
1854	2,708,082	…	…	…
1855	3,220,782	…	…	…
1856	3,873,680	…	…	…
1857	3,012,016	…	…	…
1858	3,758,273	…	…	…
1859	4,309,642	…	…	…
1860	3,841,416	324	4,912	5,236
1861	4,490,586	…	…	…
1862	1,596,653	…	…	…
1863	449,059	…	…	…
1864	299,372	…	…	…
1865	2,093,658	…	…	…
1866	1,948,077	…	…	…
1867	2,345,610	…	…	…
1868	2,198,141	…	…	…
1869	2,409,597	…	…	…
1870	4,024,527	328	6,804	7,132
1871	2,756,564	…	…	…
1872	3,650,932	…	…	…
1873	3,873,750	…	…	…

1874	3,528,276	…	…	…
1875	4,302,818	…	…	…
1876	4,118,390	…	…	…
1877	4,494,224	…	…	…
1878	4,745,078	…	…	…
1879	5,466,387	…	…	…
1880	6,356,998	561	10,092	10,653
1881	5,136,447	…	…	…
1882	6,833,442	…	…	…
1883	5,521,963	860	11,800	12,660
1884	5,477,448	1,050	12,250	13,300
1885	6,369,341	1,125	12,250	13,375
1886	6,314,561	1,150	12,250	13,400
1887	6,884,667	1,200	12,300	13,500
1888	6,923,775	1,250	12,300	13,550
1889	7,742,511	1,360	12,700	14,060
1890	8,562,089	1,570	12,814	14,384
1891	8,940,867	1,740	12,900	14,640
1892	6,658,313	1,950	13,250	15,200
1893	7,433,056	2,100	13,450	15,550
1894	10,025,534	2,200	13,500	15,700
1895	7,146,772	2,400	13,700	16,100
1896	8,515,640	2,850	13,800	16,650
1897	10,985,040	3,250	13,900	17,150
1898	11,435,368	3,550	13,900	17,450
1899	9,459,935	3,950	14,150	18,100
1900	10,266,527	4,368	15,104	19,472
1901	9,675,771	5,500	11,700	20,200
1902	10,827,168	6,400	15,000	21,400
1903	10,045,615	6,900	15,100	22,000
1904	13,679,954	7,650	15,200	22,850
1905	10,804,556	7,631	16,056	23,687
1906	13,595,498	8,995	16,255	25,250
1907	11,375,461	9,528	16,847	26,275
1908	13,587,306	10,201	17,304	27,505

Fiscal Year, ending June 30—	Manufactures of cotton.		
	Thousands of bales of domestic cotton taken by mills.		
	In Southern States.	In Northern States.	Total United States
	Thou-sands.	Thou-sands.	Thou-sands.
1800	…	…	…
1810	…	…	…
1820	…	…	…
1830	…	…	…
1840	71	166	237
1850	78	497	575
1851	60	404	464
1852	111	588	699
1853	153	650	803
1854	145	592	737
1855	135	571	706
1856	138	633	771
1857	154	666	820
1858	143	452	595
1859	167	760	927
1860	94	751	845
1861	153	650	803
1862	…	…	…
1863	…	…	…
1864	…	…	…
1865	…	…	…
1866	127	541	668
1867	150	573	723
1868	168	800	968
1869	173	822	995
1870	69	728	797
1871	91	1,072	1,163
1872	120	977	1,097
1873	138	1,063	1,201
1874	128	1,192	1,320
1875	130	1,071	1,201

1876	134	1,220	1,354
1877	127	1,302	1,429
1878	151	1,345	1,496
1879	186	1,375	1,561
1880	189	1,382	1,570
1881	225	1,713	1,938
1882	287	1,677	1,964
1883	313	1,759	2,072
1884	340	1,537	1,877
1885	316	1,437	1,753
1886	381	1,781	2,162
1887	401	1,687	2,088
1888	456	1,805	2,261
1889	480	1,790	2,270
1890	539	1,979	2,518
1891	613	2,027	2,640
1892	684	2,172	2,856
1893	723	1,652	2,375
1894	711	1,580	2,291
1895	852	2,019	2,871
1896	900	1,605	2,505
1897	999	1,793	2,792
1898	1,254	2,211	3,465
1899	1,415	2,217	3,632
1900	1,523	2,350	3,873
1901	1,583	1,964	3,547
1902	2,017	2,066	4,083
1903	1,958	1,966	3,924
1904	1,889	2,046	3,935
1905	2,140	2,139	4,279
1906	2,373	2,536	4,909
1907	2,411	2,574	4,985
1908	2,187	2,352	4,539

Fiscal Year, ending June 30—	Exports. (domestic)	Imports.
	Dollars.	Dollars.
1800	…	…
1810	…	…
1820	…	7,812,326
1830	1,318,183	5,774,013
1840	3,549,607	6,504,104
1850	4,734,424	20,781,346
1851	7,241,205	22,164,442
1852	7,672,151	19,689,496
1853	8,768,894	27,731,363
1854	5,535,516	33,949,503
1855	5,857,181	17,757,112
1856	6,967,309	25,917,999
1857	6,115,177	28,685,726
1858	5,651,504	18,584,810
1859	8,316,222	26,976,381
1860	10,934,796	33,215,541
1861	7,957,038	25,271,382
1862	2,946,464	8,890,119
1863	2,906,411	14,121,589
1864	1,456,901	14,341,501
1865	3,451,561	9,223,686
1866	1,780,175	27,502,194
1867	4,608,235	19,302,005
1868	4,871,054	17,335,406
1869	5,874,222	20,481,312
1870	3,787,282	23,380,053
1871	3,558,236	29,876,640
1872	2,304,330	35,307,447
1873	2,947,528	35,201,324
1874	3,095,840	28,193,869
1875	4,071,882	27,738,401
1876	7,722,978	22,725,598
1877	10,235,843	18,923,614

1878	11,438,660	19,081,037
1879	10,853,950	19,928,310
1880	9,981,418	29,929,366
1881	13,571,387	31,219,329
1882	13,222,979	35,719,791
1883	12,951,145	38,036,044
1884	11,885,211	29,074,626
1885	11,836,591	27,197,241
1886	13,959,934	29,709,266
1887	14,929,342	28,940,353
1888	13,013,189	28,917,799
1889	10,212,644	26,805,942
1890	9,999,277	29,918,055
1891	13,604,857	29,712,624
1892	13,226,277	28,323,841
1893	11,809,355	33,560,293
1894	14,340,886	22,346,547
1895	13,789,810	33,196,625
1896	16,837,396	32,437,504
1897	21,037,678	34,429,363
1898	17,024,092	27,267,300
1899	23,566,914	32,054,434
1900	24,003,087	41,296,239
1901	20,272,418	40,246,935
1902	32,108,362	44,460,126
1903	32,216,304	52,462,755
1904	22,403,713	49,524,246
1905	49,666,080	48,919,936
1906	52,944,033	63,043,322
1907	32,305,412	73,704,636
1908	25,177,758	68,379,781

Fiscal Year, ending June 30—	Unmanu-factured silk imported.	Imports of crude rubber.
	Pounds.	Pounds.
1800	…	…
1810	…	…
1820	…	…
1830	…	…
1840	…	…
1850	…	…
1851	…	…
1852	…	…
1853	…	…
1854	…	…
1855	…	…
1856	…	…
1857	…	…
1858	…	…
1859	…	…
1860	…	…
1861	…	…
1862	…	2,125,561
1863	…	5,104,650
1864	407,935	…
1865	288,286	…
1866	567,904	…
1867	491,983	…
1868	512,449	8,438,019
1869	720,045	7,813,134
1870	583,589	9,624,098
1871	1,100,281	11,031,939
1872	1,063,809	11,803,437
1873	1,159,420	14,536,978
1874	794,837	14,191,320
1875	1,101,681	12,035,909
1876	1,354,991	10,589,297
1877	1,186,170	13,821,109

1878	1,182,750	12,512,203
1879	1,889,776	14,878,584
1880	2,562,236	16,826,099
1881	2,790,413	20,015,176
1882	3,549,404	22,712,862
1883	4,731,106	21,646,320
1884	4,284,888	24,574,025
1885	4,308,908	24,208,148
1886	6,818,060	29,263,632
1887	6,028,091	28,649,446
1888	6,370,322	36,628,351
1889	6,645,124	32,339,503
1890	7,510,440	33,842,374
1891	6,266,629	33,712,089
1892	8,834,049	39,976,205
1893	8,497,477	41,547,680
1894	5,902,485	33,757,783
1895	9,316,460	39,741,607
1896	9,363,987	36,774,460
1897	7,993,444	35,574,449
1898	12,087,951	46,055,497
1899	11,250,383	51,063,066
1900	13,073,718	49,377,138
1901	10,405,555	55,275,529
1902	14,234,826	50,413,481
1903	15,270,859	55,010,571
1904	16,722,709	59,015,551
1905	22,357,307	67,234,256
1906	17,352,021	57,844,345
1907	18,743,904	76,963,838
1908	16,662,132	62,233,160

[B] Calendar years.

Development of the Manufacturing Industries in the United States, 1800-1905—Continued.

Year.	Production of		Exports of domestic copper & manufactures of.
	Coal.[C]	Copper.[C]	
	Long tons.	Long tons.	Dollars.
1800	…	…	…
1810	20	…	17,426
1820	3,080	…	18,547
1830	285,779	…	36,601
1840	1,848,249	100	86,954
1850	6,266,233	650	105,060
1851	7,798,683	900	91,871
1852	8,764,879	1,100	103,039
1853	9,437,757	2,000	108,205
1854	10,698,841	2,250	91,984
1855	11,541,672	3,000	690,766
1856	12,095,469	4,000	534,846
1857	11,910,883	4,800	607,054
1858	12,477,213	5,500	1,985,223
1859	13,958,192	6,300	1,048,246
1860	13,044,680	7,200	1,664,122
1861	14,721,439	7,500	2,375,029
1862	15,612,353	9,000	1,098,546
1863	19,034,877	8,500	1,026,038
1864	21,076,003	8,000	251,272
1865	21,243,012	8,500	991,746
1866	25,896,056	8,900	143,761
1867	27,432,520	10,000	474,110
1868	29,341,036	11,600	479,488
1869	29,378,893	12,500	355,274
1870	29,496,054	12,600	504,741
1871	41,861,679	13,000	188,218
1872	45,940,535	12,500	185,983
1873	51,430,786	15,500	88,711
1874	46,969,571	17,500	356,758
1875	46,739,571	18,000	1,085,688

1876	47,571,429	19,000	3,441,939
1877	54,019,429	21,000	2,913,943
1878	51,728,214	21,500	2,319,901
1879	60,808,749	23,000	2,831,053
1880	63,822,830	27,000	793,455
1881	76,679,491	32,000	824,896
1882	92,456,419	40,467	658,941
1883	103,310,290	51,574	1,404,243
1884	107,281,742	64,708	2,664,964
1885	99,250,263	74,052	5,447,423
1886	101,500,381	70,430	2,602,869
1887	116,652,242	81,017	2,033,523
1888	132,731,837	101,054	3,812,798
1889	126,097,779	101,239	2,348,954
1890	140,866,931	115,966	2,349,392
1891	150,505,954	126,839	4,614,597
1892	160,115,242	154,018	7,226,392
1893	162,814,977	147,033	4,525,573
1894	152,447,791	158,120	19,697,140
1895	172,426,366	169,917	14,468,703
1896	171,416,390	205,384	19,720,104
1897	178,776,070	220,571	31,621,125
1898	196,407,381	235,050	32,180,872
1899	226,554,636	253,870	35,983,529
1900	240,789,310	270,588	57,852,960
1901	261,874,836	268,782	43,267,021
1902	269,277,178	294,423	41,218,373
1903	319,068,229	311,627	39,667,196
1904	314,121,784	362,739	57,142,081
1905	350,820,840	402,637	86,225,291
1906	369,783,284	409,735	81,282,664
1907	428,895,914	387,945	94,762,110
1908	…	…	104,064,580

Year.	Production of	
	Natural gas.[C]	Iron ore.[C]
	Dollars.	Long tons.
1800	…	…
1810	…	…
1820	…	…
1830	…	…
1840	…	…
1850	…	…
1851	…	…
1852	…	…
1853	…	…
1855	…	…
1856	…	…
1857	…	…
1858	…	…
1859	…	…
1860	…	…
1861	…	…
1862	…	…
1863	…	…
1864	…	…
1865	…	…
1866	…	…
1867	…	…
1868	…	…
1869	…	…
1870	…	3,031,891
1871	…	…
1872	…	…
1873	…	…
1874	…	…
1876	…	…
1877	…	…
1878	…	…
1879	…	…

1880	…	7,120,362
1881	…	…
1882	215,000	…
1883	475,000	…
1884	1,460,000	…
1885	4,857,200	…
1886	10,012,000	…
1887	15,817,500	…
1888	22,629,875	…
1889	21,097,099	14,518,041
1890	18,792,725	16,036,043
1891	15,500,084	14,591,178
1892	14,870,714	16,296,666
1893	14,346,250	11,587,629
1894	13,954,400	11,879,679
1895	13,006,650	15,957,614
1896	13,002,512	16,005,449
1897	13,826,422	17,518,046
1898	15,296,813	19,433,716
1899	20,074,873	24,683,173
1900	23,698,674	27,553,161
1901	27,066,077	28,887,479
1902	30,867,863	35,554,135
1903	35,807,860	35,019,308
1904	38,496,760	27,644,330
1905	41,562,855	42,526,133
1906	46,873,932	47,749,728
1907	52,866,835	51,720,619
1908	…	…

Year.	Production of	
	Pig iron.[C]	Steel.[C]
	Long tons.	Long tons.
1800	…	…
1810	53,908	…
1820	20,000	…
1830	165,000	…

1840	286,903	…
1850	563,755	…
1851	…	…
1852	…	…
1853	…	…
1855	700,159	…
1856	788,515	…
1857	712,640	…
1858	629,548	…
1859	750,560	…
1860	821,223	…
1861	653,164	…
1862	703,270	…
1863	846,075	…
1864	1,014,282	…
1865	831,770	…
1866	1,205,663	…
1867	1,305,023	19,643
1868	1,431,250	26,786
1869	1,711,287	31,250
1870	1,665,179	68,750
1871	1,706,793	73,214
1872	2,548,713	142,954
1873	2,560,963	198,796
1874	2,023,733	389,799
1876	1,868,961	533,191
1877	2,066,594	569,618
1878	2,301,215	731,977
1879	2,741,853	935,273
1880	3,835,191	1,247,335
1881	4,144,254	1,588,314
1882	4,623,323	1,736,692
1883	4,595,510	1,673,535
1884	4,097,868	1,550,879
1885	4,044,526	1,711,920
1886	5,683,329	2,562,503
1887	6,417,148	3,339,071

1888	6,489,738	2,899,440
1889	7,603,642	3,385,732
1890	9,202,703	4,277,071
1891	8,279,876	3,904,240
1892	9,157,000	4,927,581
1893	7,124,502	4,019,995
1894	6,657,888	4,412,032
1895	9,446,308	6,114,834
1896	8,623,127	5,281,689
1897	9,652,680	7,156,957
1898	11,773,934	8,932,857
1899	13,620,703	10,639,857
1900	13,789,242	10,188,329
1901	15,878,354	13,473,595
1902	17,821,307	14,947,250
1903	18,009,252	14,534,978
1904	16,497,033	13,859,887
1905	22,992,380	20,023,947
1906	25,307,191	23,398,136
1907	25,781,361	23,362,594
1908	15,936,018	…

Year.	Iron and steel Manufactures.	
	Imports.	Exports (domestic)
	Dollars.	Dollars.
1800	…	52,144
1810	…	91,914
1820	…	46,552
1830	6,346,287	322,747
1840	8,157,923	1,127,877
1850	20,145,067	1,953,702
1851	22,439,297	2,336,587
1852	23,568,649	2,368,384
1853	34,944,002	2,541,554
1855	28,693,979	3,803,706
1856	29,050,101	4,256,613

1857	30,743,649	4,959,238
1858	20,171,007	4,843,592
1859	22,379,743	5,577,748
1860	26,158,235	5,870,114
1861	21,160,235	6,039,149
1862	11,451,707	4,732,348
1863	16,152,843	6,681,417
1864	23,822,876	7,541,967
1865	16,660,991	11,227,294
1866	25,598,147	4,006,180
1867	31,630,519	9,351,062
1868	30,346,768	10,950,275
1869	38,213,717	10,938,492
1870	40,273,682	13,483,163
1871	53,024,075	21,189,692
1872	67,852,616	11,463,880
1873	74,302,102	13,655,087
1874	31,432,380	19,534,215
1876	23,197,417	15,449,846
1877	19,320,927	16,501,638
1878	18,987,130	16,053,571
1879	19,594,608	15,133,493
1880	71,266,699	14,716,524
1881	60,604,477	16,608,767
1882	67,976,897	20,748,206
1883	40,147,053	21,909,881
1885	33,610,093	16,592,155
1886	37,534,078	15,745,569
1887	49,203,164	15,958,502
1888	48,992,757	17,763,034
1889	42,377,793	21,156,077
1890	41,679,591	25,542,208
1891	53,544,372	28,909,614
1892	28,928,103	28,800,930
1893	34,937,974	30,106,482
1894	20,925,769	29,220,264
1895	23,048,515	32,000,989

1896	25,338,103	41,160,877
1897	16,094,557	57,497,872
1898	12,626,431	70,406,885
1899	12,100,440	93,716,031
1900	20,478,728	121,913,548
1901	17,874,789	117,319,320
1902	27,180,247	98,552,562
1903	51,617,312	96,642,467
1904	27,028,312	111,948,586
1905	23,510,164	134,728,363
1906	29,053,987	160,984,985
1907	40,587,865	181,530,871
1908	27,607,909	183,982,182

Year.	Prices of staple commodities.	
	Per ton.[C]	
	Pig iron No. 1, foundry.	Steel rails, standard sections
	Dollars.	Dollars.
1800	…	…
1810	…	…
1820	…	…
1830	…	…
1840	27.88	…
1850	20.88	…
1851	21.38	…
1852	22.63	…
1853	36.13	…
1854	36.88	…
1855	27.75	…
1856	27.18	…
1857	26.34	…
1858	22.19	…
1859	23.33	…
1860	22.70	…
1861	20.26	…

1862	23.92	…
1863	35.24	…
1864	59.22	…
1865	46.08	…
1866	46.84	…
1867	44.08	166.00
1868	39.25	158.46
1869	40.61	132.19
1870	33.23	106.79
1871	35.08	102.52
1872	48.94	111.94
1873	42.79	120.58
1874	30.19	94.28
1875	25.53	68.75
1876	22.19	59.25
1877	18.92	45.58
1878	17.67	42.21
1879	21.72	48.21
1880	28.48	67.52
1881	25.17	61.08
1882	25.77	48.50
1883	22.42	37.75
1884	19.81	30.75
1885	17.99	28.52
1886	18.71	34.52
1887	20.93	37.08
1888	18.88	29.83
1889	17.76	29.25
1890	18.41	31.78
1891	17.52	29.92
1892	15.75	30.00
1893	14.52	28.12
1894	12.66	24.00
1895	13.10	24.33
1896	12.95	28.00
1897	12.10	18.75
1898	11.66	17.62

1899	19.36	28.12
1900	19.98	32.29
1901	15.87	27.33
1902	22.19	28.00
1903	19.92	28.00
1904	15.57	28.00
1905	17.88	28.00
1906	20.98	28.00
1907	23.89	28.00
1908	17.70	28.00

Year.	Prices of staple commodities.		
	Middling cotton per pound.[C]	Standard sheetings per yard.[C]	Washed Ohio fleece wool, per lb., in eastern m'k'ts, July 1. Medium.
	Cents.	Cents.	Cents.
1800	…	…	…
1810	…	…	…
1820	…	…	…
1830	…	…	50.
1840	…	…	39.
1850	12.34	7.87	37.
1851	12.14	7.08	42.
1852	.50	6.96	38.
1853	11.02	7.92	53.
1854	10.97	7.96	37.
1855	10.39	7.64	40.
1856	10.30	7.50	42.
1857	13.51	8.90	50.
1858	12.23	8.25	37.
1859	12.08	8.50	40.
1860	11.00	8.73	50.
1861	13.01	10.00	30.
1862	31.29	18.55	47.
1863	67.21	36.04	70.
1864	101.50	52.07	100.
1865	83.38	38.04	73.
1866	43.20	24.31	67.
1867	31.59	18.28	49.
1868	24.85	16.79	45.
1869	29.01	16.19	48.
1870	23.98	14.58	45.
1871	16.95	13.00	60.
1872	22.19	14.27	70.
1873	20.14	13.31	48.

1874	17.95	11.42	53.
1875	15.46	10.41	49.
1876	12.98	8.85	35.
1877	11.82	8.46	44.
1878	11.22	7.80	36.
1879	10.84	7.97	38.
1880	11.51	8.51	48.
1881	12.03	8.51	44.
1882	11.56	8.45	45.
1883	11.88	8.32	41.
1884	10.88	7.28	34.
1885	10.45	6.75	31.
1886	9.28	6.75	33.
1887	10.21	7.15	37.
1888	10.03	7.00	39.
1889	10.65	7.00	39.
1890	11.07	7.00	37.
1891	8.60	6.83	35.
1892	7.71	6.50	34.
1893	8.56	5.90	26.
1894	6.94	5.11	21.
1895	7.44	5.74	21.
1896	7.93	5.45	18.
1897	7.00	4.73	23½
1898	5.94	4.20	29.
1899	6.88	5.28	31½
1900	9.25	6.05	31½
1901	8.75	5.54	26.
1902	9.00	5.48	26¾
1903	11.18	6.25	31½
1904	11.75	7.13	32½
1905	9.80	7.00	39.
1906	11.50	7.25	37.
1907	12.10	7.62	36.
1908	10.62	6.75	38.

[C] Calendar year.

The arguments in favor of bimetallism are as various as the motives of its advocates, but two or three of the more important ones may be briefly stated. It is urged because it would give a more stable measure of value than either silver or gold alone could do; and the evil effects of fluctuations in the value of gold since 1873 are pointed out to illustrate this contention. Monometallists answer this by asserting that most of the price changes can be accounted for by improvements in production; that even if they were caused by a contraction of the currency, this was simply one of the risks of business; and finally, that the evil effects of falling prices are offset by a corresponding reduction in interest rates. A second argument of the bimetallists was the alleged insufficiency of gold on which to do the world's business. As this has been practically met by the phenomenal increase in gold production in the last decade, especially since the gold discoveries in Alaska, it is not necessary to dwell upon this argument. On February 1, 1909, the per capita circulation of money in the United States reached $35.00, the highest point in our history. A final argument of the bimetallists concerns foreign trade: it would facilitate this by establishing a fixed par-of-exchange between all countries. While the weight of this may be admitted, it has been practically deprived of all force by the adoption of the gold standard by virtually all the industrially developed nations of the world. This last fact shows that the question has now been actually settled by the logic of events and today the issue of bimetallism has only an academic interest.

Another problem connected with money which has been removed from the arena of oratory to that of calm discussion is that of government paper money. It is urged, with much truth, that if a nation issued paper money instead of gold or silver, it would save all the expense of mining these metals. It would resemble, as Adam Smith said, the discovery of wagon roads through the air in the realm of transportation. Another argument advanced in favor of government paper money is that it would be possible by a scientific adjustment of the issues to regulate the amount of money in circulation and so to prevent all fluctuations in prices. Both contraction and inflation would be prevented and a cheap and yet ideal system of money would exist. Still others see in this form of money an instrument for the creation of wealth; this last argument simply results from a confusion of ideas and need not be dealt with. A sufficient answer to the other two is an

appeal to the lesson of history: no government which has embarked upon the issue of paper money has ever been able to restrict the issues within reasonable limits; often it has led to national bankruptcy and the repudiation of the entire issues. The experience of the United States with the greenbacks has been more fortunate than that of many countries, but does not tempt to further experiment.

The monetary situation in the United States today may be regarded as fairly well settled. Although we have a very heterogeneous assortment of different kinds of money, a fairly distinct sphere is allotted to each, and as the basis for all, the gold standard has been definitely established by law. Money of large denominations consists of gold and gold certificates (lowest denomination, $20), of greenbacks and national bank notes (lowest denomination, $10, though one-third of bank notes may be $5); the needs of retail trade are met by the issue of silver certificates and silver dollars, and of fractional currency. The system would be much simplified by the retirement and destruction of the $346,000,000 in greenbacks, but as there is now a fifty-per cent reserve in gold back of them, little danger need be apprehended from their presence. Many people have regarded the existence of some $500,000,000 worth of silver dollars as a menace to the goodness of our money supply, but as the amount of gold in circulation increases the silver will form a constantly smaller percentage of the whole. It is a cumbersome and not very valuable asset of the Government, but is now almost powerless for good or ill.

Important as is the subject of money and essential as is the need of a standard of undoubted goodness, it is overshadowed in practical significance by the problems of banking and credit. An investigation by the Comptroller of the Currency some years ago showed that over 90 per cent of the receipts of the national banks consisted of credit instruments, while probably 60 per cent of the trade of the country was carried on by credit rather than by cash transactions. A credit transaction is a transfer of goods or money for a future equivalent; the element of time is introduced. This makes possible an enormous increase in the number of exchanges and obviates the necessity, to a large extent, of using money. Most of us enjoy personal credit, which is limited only by our ability to persuade other people to trust in us. But this power of purchasing things without immediate payment must be made readily available if the ordinary business man is to

make use of it. This is done through the medium of a bank, whose business it is to discount the notes of its customers, which in turn is based upon confidence in their prospective earnings. The bank credit thus obtained may be transferred by means of checks to other persons and to other banks. It is the most fluid and volatile means of payment yet devised, and is subject to dangers and abuses. In the last analysis business based upon such a system of credit rests upon confidence in the honesty of individuals and in the enforcement of the law governing contracts, and also in the ability of those who have pledged themselves to future payment to make good their obligations. In times of panic credit fails and resort is had to money.

The fundamental institution in our credit economy is the bank, and it is therefore essential that it be thoroughly safe and responsive to the needs of the business world. A bank may furnish its customers with the ready means of payment they need in exchange for their future promises either in the form of bank notes or bank credit. The former are more largely used on the continent of Europe and in rural districts in this country, the latter by England and the United States, especially in the cities. The preference for one or the other seems to be a matter of geography. The issue of bank notes has been very carefully safeguarded since the establishment of the national banking system in 1863. They are based upon the purchase of government bonds and are absolutely safe. They lack, however, one essential quality of good bank money in that they are quite inelastic. That is to say, the amount of bank notes in circulation does not vary according to the needs of business, increasing to meet an increased demand, and then declining again when the demand has passed. Being based upon government bonds and not upon the value of business assets, they vary in amount only with the price of the former and not at all with the volume of the latter.

The main practical problem connected with our banking system is, therefore, to find some other basis for the issue of bank notes, especially as it is not desirable to maintain a permanent bonded indebtedness solely for this purpose. Various suggestions have been made, as the establishment of a central bank with sole power of issue, like the government banks in European countries. This is a favorite proposal with the big bankers, but is unlikely to be adopted as it is directly contrary to the spirit of the existing system. The Canadian system is held up as a model, with its system of branch banking and 5 per cent safety fund for the redemption of the notes of

failed banks. Curiously enough this was copied after the system in operation in New York State, which was nipped in the bud by some early mistakes and by the development of the national banking system. It works admirably in Canada and is well worth careful study. The plan of asset currency is another suggestion, according to which bank notes should be issued up to a certain percentage of the resources of the bank, but without pledging any specific property for their redemption as is done in the case of the national banks at present. It has finally been urged that our present bond deposit system should be modified by substituting state, municipal, railroad, or industrial bonds for those of the Federal Government, but that in other respects the system should be left intact. We may look for legislation along one or another of these lines in the next few years, as the subject is an urgent one whose solution cannot long be postponed.

Another problem is connected with the money reserves that the banks are required by law to keep on hand in order to meet demand liabilities. Under the national system in the United States the country banks may deposit three-fifths of their lawful reserves with banks in reserve cities, and these banks in turn may deposit one-half of their reserves in banks in central reserve cities (New York, Chicago, and St. Louis). Thus there is a massing, under this system, of the bank reserves of the country in the city of New York, and within that city in some twenty banks. While there is great economy in such a system the concentration of reserves is certainly attended by great dangers, not the least of which is its use by speculative influences in the New York money market, as a great part of it is loaned out to speculators on call.

Still another practical problem connected with the monetary and banking system of the United States is that of the independent treasury system. The Federal Government is to a large extent its own banker; it collects, disburses its revenue and keeps its money in its own vaults; it even, as we have seen, issues paper money and keeps a reserve therefor. By its action in withdrawing large amounts of money from use, or on the other hand making large disbursements, it can and does affect the money market vitally and sometimes disastrously. While it is permitted to deposit funds in selected national banks and has recently made increasing use of this privilege, thus correlating in a measure the reserves of the Government and the needs of the business community, it is held by most students that the

independent treasury system should be abolished, and that the banks should act as the intermediaries between the Government and the people in the collection and expenditure of its funds.

So far we have been discussing commercial banks, but there is another kind of institution which goes by the same name but serves quite a different purpose, namely, the savings bank. The essential and almost the only requirement of such an institution is safety. As we have seen, it is not only desirable for personal reasons to inculcate habits of saving and thrift in individuals, but it is also necessary to secure the accumulation of capital needed in modern industry. It is therefore important that such institutions should be widespread, accessible, and thoroughly trusted. These requirements seem to be best fulfilled by the postal savings banks in England and elsewhere, which have led to a great increase in savings on the part of the people. The introduction of such a system in the United States is greatly to be desired.

XVI. TRANSPORTATION AND COMMUNICATION.

Almost as important for the conduct of modern industry as machine methods and credit are the rapid means of transportation and communication furnished by our railroad, steamship, express, post office, telegraph and telephone systems. Indeed the development of industry on a national scale and its integration under centralized control has been made possible only by these improvements. But not only have these businesses rendered the centralization of industry possible; they themselves exhibit on a national scale concentration of control. They are all industries of increasing returns and lend themselves naturally to monopolistic control. At the very beginning of railroad construction one of the most far-sighted managers enunciated the doctrine that "where combination is possible competition is impossible." For years competition was regarded as the regulator of rates, pooling between railroads was forbidden, canals were advocated as competitors, and by every possible device it was sought to stimulate it. We are at last beginning to recognize the monopoly character of the railroad industry and to regulate it accordingly.

Consolidation in the railroad world is not a new phenomenon nor is it confined to that industry, but it has proceeded further there than in any other line of business. The first form which combination took was that of pooling, according to which the traffic was "pooled" and the earnings then divided among the companies entering into the pool according to some previous agreement. This was forbidden by the Interstate Commerce Act in 1887 and even more stringently by the Anti-Trust Act of 1890, and accordingly railroad managers next resorted to actual consolidation of competing lines. Where this has not been possible or desirable, virtual combination has been secured by the so-called "community of interests" arrangements, based on the acquisition by one road of enough stock in competing lines to secure representation on their boards of directors. Today some eight or nine groups of capitalists control over two-thirds of the railway mileage of the United States, and according to a recent widely-published statement the late Mr. E. H. Harriman was credited with controlling, directly or indirectly, a system

aggregating over 67,000 miles. These great consolidations have followed mainly the territorial groupings of railroads; the United States has now been districted out by a few large transportation companies, much as France, Italy, England and other European countries had previously been divided up. Consolidation has in many instances resulted in increased convenience to the public and in economies in management and operation, but it places a dangerous amount of power in the hands of a few men, which has not infrequently been abused, and should clearly be under strict government control.

The primary economic problem connected with railways is always the question of rates. This has been called in a recent book “the heart of the railroad problem.” The first fact that strikes the student of the subject is the great reduction in rates and fares in the past twenty-five years, especially in freight rates. From 1.24 cents in 1882 the average revenue per ton mile received by railroads in the United States has decreased to .748 cents in 1906. Freight rates, especially through rates for bulky traffic, are considerably lower in this country, and passenger fares somewhat higher, than in Europe. But the vital problem connected with rates is not as to their relative cheapness or extortionateness; it concerns rather the granting of discriminating rates. Discriminations may be of three kinds: those between different classes of goods, those between localities, and those between persons. The first group is based upon the classification of freight and rests upon differences in cost of shipment, in bulk, in risk, etc. If reasonably employed, this kind of discrimination is justifiable. Local discriminations, that is, charging different rates to different localities for substantially the same service, is not only unwarranted in most cases, but is short-sighted as well. Where superior facilities or especially keen competition exists, lower rates may be permitted for favored localities, but the arbitrary exercise of such powers by railway officials is thoroughly unjustifiable. Even less defensible is the practice, now happily less frequent, of granting discriminatory rates to favored individuals or corporations. They have been given by means of secret rates and rebates, by under-billing and under-classification, by free passes, etc. Both of these latter evils have been forbidden or greatly restricted by the passage of the Interstate Commerce Act in 1887 and subsequent legislation.

The public nature of railroads is now fairly well recognized in our law and is beginning to be understood by the people at large. Railroads enjoy peculiar privileges in the grant of corporate franchises and charters, in the right of eminent domain, and in enormous grants of land and money which have been made to them in this country. Moreover in the functions they perform the social character of their duties is emphasized, and they are under the necessity of maintaining a constant service open to all. Though they are owned by private investors and managed as private enterprises, they are essentially public enterprises as to their privileges, functions, and duties. Consequently most of the states have now undertaken, through commissions, to regulate the railroads in the public interest. Some thirty-one have appointed commissions, which probably control four-fifths of the traffic originating and ending in a single state. These state commissions differ in power, those of the Mississippi Valley and the South usually having mandatory powers, that is, power to prescribe and enforce maximum rates. In the eastern and central states commissions with supervisory powers merely, of investigation and report, have been created. The only exceptions are found in the Far West where the need of improved transportation facilities is more pressing than regulation, and in five eastern states whose legislatures are controlled by the railroad interests. While the state commissions have done and are doing valuable service, it is clear that the growth of giant railroad combinations which traverse several states necessitates federal control. The appointment of the Interstate Commerce Commission in 1887 established the principle of federal regulation, but the application of the principle in active practice has been slow and has been impeded by the courts. The final control of rates has not yet been given to the Commission.

Owing to the individualistic character of our institutions and law, public ownership of railroads does not exist in the United States, which thus forms, together with England, almost the sole important exception to the world’s practice in this regard. On the continent of Europe government ownership is the rule. Public control through either ownership or regulation by commission is essential to secure an equitable adjustment of public and private rights and to prevent the abuse of monopoly power inherent in the very nature of railroads. Public ownership has many advantages and has given satisfactory results in Europe. But for the United States the principle

of private ownership with stricter governmental regulation has been definitely laid down; the problem of the future is simply how far that control shall go.

The discussion of our steam railroads does not exhaust the subject of transportation. A recent and important development is the growth of electric interurban railways, which are opening up districts untouched by the more expensive steam roads and exercising a marked influence in rural districts upon business and social life. A more significant problem, both because of its close relations to the railroads and its monopoly character, is offered by the express companies. Organized at a time when railroads were new and undeveloped they took over the safe and expeditious delivery of small and valuable articles. They have since grown in importance and power; six large companies now control over 90 per cent of the business. Since they are generally in the form of partnerships and not of corporations it has not been possible to bring them under legal control, and their rates are extremely high—three or four times as much as freight rates. In some cases the railroads, in order to gain the profits from these high rates, have themselves organized express companies to operate over their lines, immune from interference by the Interstate Commerce Commission. Even where that is not done, the express companies are performing a service which could as well be performed by the railroads themselves and at lower rates. These facts have lent great strength to the demand for the establishment by the Federal Government in connection with the post office of a parcels post, such as exists in England and in most European countries. By the extension of the maximum limit of mail packages to ten or fifteen pounds the usefulness of the post office could be immensely increased without any loss in rates. So far, however, the express companies have been strong enough to resist the introduction of this reform, though it is warmly advocated by the present Postmaster-General. A recent important improvement in our postal service has been the extension of rural free delivery to the farming districts, thereby breaking down to a great extent the isolation of country districts. This and the rural telephone have been of great social value.

The importance of the telephone and telegraph in our modern industrial life cannot be overestimated. As means of transmitting intelligence they have served to bring the most distant parts of the world into almost instant touch, and have made possible the modern centralization of business. Both offer

the same problems of monopoly that we have seen exist in other parts of this field, the telegraph business being completely monopolized by two large companies, the telephone business by one, all strongly entrenched behind patents. The desirability of public ownership of these utilities rests upon stronger grounds than in the case of railroads and is strongly urged by many conservative writers.

Although attention has usually been centered upon the railroads in any discussion of the transportation question in the United States, there are important practical problems connected with both the inland and the ocean water transportation. The questions of constructing artificial inland waterways and of subsidizing our foreign merchant marine are vital political and industrial issues. The United States is probably better provided with internal navigable natural waterways than any other country. Her navigable rivers comprise some 18,000 miles. Affording access to the very heart of the continent both from the Atlantic coast and from the Gulf. They form a cheap and convenient means of transportation, especially for bulky and cheap articles; 30,000,000 tons a year are carried on the streams of the Mississippi Valley alone, though much of the former traffic has been diverted to the railroads. On the northern border of the country the Great Lakes form an unrivaled series of inland seas. The traffic on these shows a great increase every year, amounting now to over 60,000,000 tons annually. The Federal Government has performed useful service in improving the conditions of navigation along these natural waterways, and is now considering a comprehensive scheme for their further improvement.

A very different problem is offered by our canal system. During the period 1820-1840 many canals were constructed by the states to connect existing waterways and provide an outlet for produce from the interior. The best examples of these were the Erie and the Ohio canals. After the development of the railway, however, traffic began to be steadily and then rapidly diverted from the canals to these quicker avenues of transportation. Many of the canals were bought up by their rivals and permitted to fall into disuse, while those retained by the state governments remained mere shallow ditches, unimproved and ill-adapted to modern needs. The recent appropriation by the people of New York State of over $100,000,000 for the improvement of the Erie Canal, and the construction of the Panama Canal by the Federal Government have brought the question of the rehabilitation

of our neglected canal system to the front again. It seems wasteful not to connect the separate links in the magnificent system of natural waterways already provided by nature, and this will probably be the first step taken. And indeed a beginning has already been made by the construction of the Hennepin Canal, the Des Plaines Canal, and others, and a company has been formed to connect Pittsburg with Lake Erie and to cut through Cape Cod. It must, however, be borne in mind that there are two distinct types of canal: those which are simply short connecting links between navigable waterways and which permit the passage of vessels used on those waters; and those canals which are shallow, have extensive lockage, and permit the use of only small boats, thus necessitating the transshipment of freight. One might well advocate the construction and enlargement of the first type, and yet hesitate to approve of the second. As yet, however, owing in part to the opposition and clamor of railroad interests, the question of canals has not received the attention it deserves in the United States.

The ocean merchant marine comprises two widely different branches, the coastwise and the foreign trade. The former is open only to vessels flying the American flag, and has shown a very steady growth; five-sixths of our ocean merchant marine today is engaged in this branch of commerce. Coal, lumber, cotton, and similar bulky commodities constitute the chief items entering into the coastwise trade. The tonnage of American vessels engaged in the foreign trade, on the other hand, has shown a steady decline ever since the outbreak of the Civil War. Foreign vessels today carry fully 90 per cent of the foreign commerce of the United States. The causes of this decline are economic rather than political, for American legislation has on the whole been very liberal to the shipping interests. At the time the western part of our country began to be opened up and its great resources exploited, our merchant marine was one of the best in the world. But now the other opportunities for the investment of capital were so profitable and alluring, and the need of it so great, that all the available labor and capital of the American people began to be devoted to the development of their internal resources. A nation cannot do everything with equal advantage at the same time any more than an individual can. Accordingly we began to withdraw our capital from shipping and devote it to agriculture, mining, manufacturing, transportation, and similar more profitable enterprises. Foreigners could build vessels and run them more cheaply than we could

and it paid us to hire them to do it. Recently, however, and especially since the recent awakening of a national consciousness after the Spanish-American War, the patriotism of many individuals has been hurt by the thought that we had to depend upon foreign vessels for the carriage of our foreign commerce, while in the minds of others a comprehensive naval program demanded the building up of a native merchant marine. Two questions suggest themselves here: Do we wish to stimulate this growth artificially? And, if we do, what means shall we adopt? On the second point the Merchant Marine Commission of 1904 recommended for the United States a general bounty on all shipping, such as France has, and the subvention of certain lines of steamers over ten specified routes, following the example of Great Britain, Germany, and Japan. Without committing ourselves on this point, it may be suggested that on political, geographical, and economic grounds we may expect in the near future to see the natural development of an American merchant marine. With the growth of our foreign trade, the accumulation of capital at home, and the building up of a strong navy, the conditions for American shipbuilding and shipping will become steadily more favorable, and we may expect to see American enterprise engage in this as in other lines of industry. Eventually we are destined to become a maritime nation.

XVII. TAXATION AND TARIFF.

In no way does the State affect the interests of its citizens more vitally than in the sphere of taxation. The State in modern society is the people organized for certain collective purposes, as for the public defense, the preservation of domestic peace, and the furtherance of the social and industrial welfare. To carry out these objects money is needed and the State has therefore to collect from its citizens sufficient revenue to defray its expenditures. John Fiske has tersely defined taxes as “portions of private property taken for public purposes.” Taxation thus implies a certain degree of compulsion; by it the Government interferes with the free choice of the individual and expends a part at least of his income for him in ways that he himself might not have chosen. The social and industrial consequences of a system of taxation may also be far-reaching and important. As Professor R. T. Ely says: “Taxation may create monopolies, or it may prevent them; it may diffuse wealth, or it may control it; it may promote labor or equality of rights, or it may tend to the establishment of tyranny and despotism; it may be used to bring about reform, or it may be used to aggravate existing grievances and foster dissensions between classes.” It is evident therefore that the utmost care should be exercised in framing a system of taxation.

Certain canons or rules of taxation were laid down by Adam Smith over a hundred years ago and have been generally endorsed by economists ever since. One was that taxes ought to be certain and not arbitrary, as to amount, time and manner of payment; another was that taxes ought to be levied in the manner most convenient to the tax-payer; and a third, that taxes ought to take as little as possible out of the pockets of the tax-payer over and above what is paid into the public treasury. These three maxims—certainty, convenience, and economy—have been generally accepted, but less general agreement exists in regard to the fourth, which states that the subjects of every state ought to contribute to the support of the Government as nearly as possible in proportion to their respective abilities. This rule has given rise to two problems: first, is ability the most just basis of taxation; and secondly, if so, how is ability to be measured? The theory of justice

generally accepted by legal writers and by the American courts is expressed in the maxim that taxes should be proportioned to benefits received. The benefit theory affords a good rule in the assessment of local property taxes, but fails utterly in the domain of national and state affairs. Who can measure the benefits to each individual of an appropriation for a new war ship or for a state penitentiary or for the public school system? Probably the benefits are in inverse proportion to the income or wealth of the individual, and the heaviest taxes would then have to be apportioned to those least able to pay. Most economists today agree that taxes should be apportioned according to “faculty” or ability to pay. It satisfies better our sense of fairness and is more readily applicable than the benefit theory. In the last analysis, of course, it may be said that taxation in general must confer real benefits upon society or it will not be tolerated. Here, however, we are concerned with a rule of apportionment.

The second practical problem encountered is when we attempt to apply the faculty principle in practice; how is ability to be measured? Three measures have been suggested: expenditure, income, and property. Expenditure is open to the objection that it would place an unduly large proportion of the tax burdens on the poor, whose expenditures are larger in proportion to their means than those of other classes of society. Property is objected to because large classes of society, including professional men with large incomes, would then escape taxation largely or altogether. Income on the surface seems the fairest measure of ability, but is objected to because the incomes of different individuals, both on account of source and size, really indicate unequal and not similar abilities. In practice, however, all three methods are employed in all advanced states, so it is not necessary to decide which is theoretically the fairest.

Still another practical question confronts us after we adopt the ability theory: Shall the rate of taxation be the same no matter what the amount of the property or income, or shall it increase as the amount grows larger? In other words, shall taxation be proportional or progressive? In general the advocates of the ability theory also support progression, though there are many exceptions to this statement. Three main arguments have been urged in support of this method. First, progression is advocated in order to secure equality of sacrifice; it is argued that each dollar of a $10,000 income affords less gratification to the owner than each dollar of a $1,000 income,

and that consequently in order to equalize the sacrifices of the two individuals a larger proportion of the first income should be taken than of the second. Objection is made to this, that wants expand even more rapidly than incomes and therefore the initial assumption is untrue. Progression is urged, in the second place, by those who desire to use taxation as a method of introducing social reforms or of bringing about a more equitable distribution of wealth, as by the breaking up of large fortunes. It seems inadvisable, however, to use the machinery of taxation for such purposes. Other writers urge that the ability to earn or produce wealth increases at an accelerating rate, and that taxation should therefore keep pace with it. “It is the first thousand that counts.” The objection is made here that it would penalize ability and energy. In general, while the arguments are not conclusive, progression certainly secures a nearer approach to the ideal of the ability theory than does proportional taxation. The practical application, after we accept it, is still a difficult matter. It should be applied to the revenue system as a whole by the careful selection of special taxes. As a matter of fact we have just the opposite system in the United States, for the poor man undoubtedly pays out a larger proportion of his income in taxes—principally on articles of consumption—than do his wealthy neighbors.

In the main there has been a clear division in the United States between the sources of income of the Federal Government on the one hand and those of the state and local governments on the other. The Federal Treasury has derived its revenue almost entirely from indirect taxes—excise and customs—while the other governments have depended chiefly upon direct taxes upon persons, property, business, corporations, and inheritances. The division rests upon the constitutional allotment of powers, but it also corresponds very closely to the industrial and political functions of each in their relations to the individual citizens. The chief duty of the Federal Government is that of national defense and foreign intercourse, relations which are national in extent but which affect the individual only remotely; so, too, its taxing area is national and its exactions are felt only distantly. Few persons, it has been said, taste the tax in their tea or their whisky, yet over one-third of all the taxes collected in the United States are derived from either customs or excise duties. Whisky and tobacco contribute most of the internal revenue, while import duties are levied on practically everything brought into the country which could compete with any home

product. These two sources yield over $500,000,000 a year to the Federal Treasury. During the Civil War these sources of revenue were supplemented by a federal income tax, but as such a tax was later declared unconstitutional by the Supreme Court, further recourse to this in the near future seems improbable. From a purely economic and financial point of view this is very regrettable, for the Federal Government should unquestionably have at its command the means of quickly raising large additional revenue with as little disturbance to industry as possible. Such a means would be afforded by the income tax, which moreover can be administered only by the Federal Government, as it must be national in its operations to be fair.

The main reliance of the state and local governments in this country is the general property tax, which amounted in 1902 to over $700,000,000 or almost half of all the taxes collected. This really consists of two very distinct parts, which present quite different problems, namely, the tax on real property and that on personal property. Under our peculiar system, by which property is assessed locally, and upon the basis of that assessment its share of the state taxes distributed to each locality, there is every incentive offered to the local assessor to under-value the land in his jurisdiction, thereby escaping part of the state burdens. This evil of inequality between localities could be obviated by the simple expedient of relieving real estate of all state taxes and leaving it solely to the counties and cities for purposes of taxation. In the case of personal property the great evil is evasion. Much of our modern wealth exists in the form of securities, stocks, bonds, mortgages, etc., and this is practically undiscoverable by assessors except by the voluntary declaration of the tax-payer, which is only truthfully made by trustees and a few conscientious persons. Most of our laws have been directed to the discovery of this intangible property, as it is called, but without avail. In a few of the most progressive states the effort has at last been recognized as futile, and the attempt is now being made to reach these sources of income indirectly, by taxes on corporations, on business, franchises and other tangible evidences of wealth.

Not only are corporation, business, license and similar taxes being developed, but increasing resort is had to inheritance taxes, over thirty states now making use of this form of taxation. They are more frequently imposed on collateral than direct inheritances, and in many states are

progressive, both as to amount and as to nearness of relationship. Thus in Wisconsin the rates advance from one per cent for bequests under $25,000 to husband, wife, or lineal relation, to 15 per cent for sums over $500,000 to very distant relatives or strangers. These various forms of taxation are necessary to secure the needed revenues for the state governments, especially if these forego further resort to taxation of realty. The tendency is now sufficiently marked to make it possible to indicate with some certainty the future of taxation in this country. To a certain extent, however, this must be regarded as the expression of an ideal rather than the description of an existing system. The Federal Government should have customs and excise duties, supplemented by an income tax. The state governments should have corporation and inheritance taxes. The cities and minor civil divisions should have taxes on realty, and license and franchise taxes. Such a division is logical and avoids duplication of taxation of the same source by two or more grades of government. In view of the pre-emption of the field of corporation taxation by the states, it is therefore doubly regrettable that the Federal Government should now (August, 1909) have adopted a tax on income of corporations for federal purposes.

Other problems connected with finance are suggested in connection with the universal tendency to increase in governmental expenditures and in public debts. The former is an expression of the growth and expansion of state functions, which will be discussed in the next section. The latter is due in part to this same fact, in part also to the development of credit and the creation of a market for the sale of public and other securities, and finally to the growth of constitutional government, which has made the people willing to entrust their capital to a government which they themselves as citizens really control.

The question of the tariff involves such important economic as well as financial consideration that it seems best to discuss this form of taxation somewhat more fully. For it has been used not merely as a means of raising revenue but also as an instrument to develop particular industries and prevent foreign competition. Any detailed discussion of this subject therefore involves a statement of the pros and cons of protection and free trade. It should be said, however, in advance that the real issue is not free trade, for that is demanded by only a few doctrinaires, but freer trade through an intelligent revision of the tariff downward. The system of

protection has prevailed in the United States for virtually one hundred years, and could not be suddenly changed and abolished if one would. From the financial standpoint, too, import duties are absolutely essential to the support of our Federal Government; the question here is not absolutely free trade, but the choice of articles for revenue purposes. Shall they be those which are not produced in this country or those which enter into competition with domestic products? If financial considerations alone prevailed, the former would undoubtedly be selected as the more convenient, certain, and economical. But in the determination of the tariff policies of the United States economic considerations have been paramount and to an examination of these we must now turn.

Historically the following arguments have played the main role in support of protection at different times in the United States. The infant industries argument was advanced by Hamilton in his celebrated Report on Manufactures in 1791 and has always been important until recently when the infants had grown to be so lusty that it was evident that other reasons for protecting them must be discovered. This was found in the plea for diversified production, which was necessary for a well-rounded economic development; the need of creating a strong national government and national spirit also played their part. In order to win over the farmers the home market argument was early urged; this has taken various forms. In the first place it was urged that the building up of manufacturing centers and the consequent increase in population would give the farmers a better market than the fluctuating foreign one. As set forth by Carey, it would keep within the country the elements taken from the soil. It would also save the freights on the transportation of goods back and forth across the ocean. Each of these arguments has lost force with the development of the country and the decrease in the cost of transportation. More important today is the wages argument; at first protection was urged because wages were high in the United States and the manufacturer needed to be protected against his foreign competitor who employed cheap labor. Today it is argued that protection has raised wages and must be continued in order to protect the laborer against the pauper labor of Europe. Curiously enough, in France protection is urged for French workmen against the highly paid and efficient American. The effect of the tariff on wages has been greatly exaggerated; wages are high in the United States because the productivity

of labor is high. Indeed so far as the tariff raises prices it may be argued that the real wages of labor are lowered. More generally accepted as defensible grounds for protection are the political arguments that a nation should be able to produce its own military armaments and supplies, and that it should be able to use the tariff as a retaliatory measure. Recently this latter has received considerable force from the practice of “dumping,” by which is meant the occasional sale of products abroad at prices lower than those charged at home. Domestic manufacturers in the country thus treated are of course seriously injured and have insisted upon protection against this procedure which has been authorized in Canada.

In answer to these various arguments the free traders, or those desiring a modification of present high rates, make their main appeal to the doctrine of comparative costs. Briefly stated this asserts that nations, like individuals, can do some things better than others. Like the individual lawyer therefore who pays to have his boots blacked while he devotes himself to the law, the nation should produce the things it is best fitted for and pay others to produce other things which it can do less well. In this way each will obtain the largest possible return. Protection, which interferes with this natural international division of labor, simply diverts labor and capital from more into less profitable industries. Practically, this purely abstract economic argument has had little influence on the commercial policy of nations, which have been moved more by political and industrial considerations. Today, however, there is no question but that the freer movement of capital and industry throughout the world would be advantageous. In answer to the home market argument it is pointed out that with the growth of large-scale production the profitable area of manufacture has greatly widened and now in many cases transcends national boundaries. As home producers seek foreign markets, as they are beginning to do, they themselves will demand a reduction of the tariff, especially in the matter of raw materials. Free traders also deny the need of artificially diversifying industry in a country as large and varied as the United States, or of building up infant industries. Indeed, on the latter point, they urge that many of our trusts are the result of the tariff, and that the attempt to grant legislative favors has resulted only in wholesale demoralization and a debauching of our national politics.

In conclusion it may be said that under certain conditions the policy of protection is relatively defensible; that it has undoubtedly hastened the

industrial development of the United States, though it has not caused it; and that, on the other hand, it is responsible for not a few evils in our political and industrial life. The struggle of particular interests during the framing of the Payne bill shows the impossibility of deciding this issue upon academic grounds. It may be prophesied, however, that as our manufacturers reach out more seriously after the foreign markets the tariff will be modified so as to make this possible; but he would be a rash prophet who should predict a sudden or great change in our tariff policy within the present generation.

XVIII. THE FUNCTIONS OF GOVERNMENT.

In the course of the preceding pages we have repeatedly referred to the necessity or desirability of governmental action, and have emphasized the important part which it plays in our economic life today. Every practical economic problem that confronts us calls in some degree for the exercise of state activity. It is necessary for us then, if we are to render sound judgment on these questions, to have a clear opinion as to the proper sphere of government action, as to how far the State should interfere in the economic activities of private individuals. We cannot do better than to state first the main functions of a modern state. The modern industrial system, as we saw in the first section, is based upon certain fundamental institutions—personal liberty, competition, and private property. The first function of government is to guarantee to every individual the rights of freedom, property, and contract; this involves the maintenance of peace and order. These are often spoken of as "natural rights"; rather they are rational rights, based upon expediency and human welfare, and are created and maintained by society. Without the constant support and intervention of government they would possess little reality or significance. But in addition to guaranteeing these fundamental institutions, modern governments grant individuals certain privileges, as patents, copyrights, trade-marks, franchises, etc., designed to stimulate the economic activity of individuals.

A second group of functions undertaken by the modern state is regulative. As we have seen, laws are made regulating the freedom of contract, the conditions of labor, the conduct of business, methods of banking and transportation, etc. The terms under which competitive business may be conducted are laid down, and while freedom of industry prevails for every individual it is only on condition that he conforms to the rules of the game thus prescribed. But the conditions are not merely restrictive; sometimes they are designed to promote enterprise, as in the case of gifts, subsidies, protective duties, etc. In all these ways the State interferes with the action of perfectly free competition for the purpose of securing better or more equitable conditions. A third group of functions embraces the direct

participation in industry by the Government itself, as the post-office, gas, electric, and water works, canals, roads, sewers, parks, etc. In other countries, when the functions of government are more extended than in the United States, it conducts railroads, telegraph and telephone systems, tenements, pawn shops, theaters, industrial insurance, or various other activities. The line which divides public from private enterprise varies greatly in different countries.

This raises the general question, how far is it desirable that the economic functions of government should extend? As to the necessity of state activity in some form there can be no doubt. Production, exchange, distribution, and to a smaller extent consumption, are all social processes; they concern the whole of society, and must be brought under social control. Montesquieu laid down the proposition in the middle of the eighteenth century that taxes invariably increase with the growth of liberty. Historically this has been verified: the development of freedom in government and industry has meant the realization of self-restraint by the imposition of regulative law. But the modern State has gone further than this: it has realized the necessity of taking an active part in modern industrial life, for the equalization of the terms of competition, the redress of grievances, and the furnishing of utilities, either because it could do it better or because it was the only agency capable of acting. The standpoint of this treatise has been one of moderate individualism, believing in free competition and individual initiative, but not frightened off by the bogey of socialism, if at any point the interference of government seemed desirable or necessary. To present the matter clearly it will be well to state briefly the main theories that have been held as to the proper function of government, arranging them in their logical, though not in their historical, order.

At one extreme stands anarchism, which must be thought of not as anarchy and riot, but as a philosophical theory of society. Scientific anarchism contemplates an ideal state of perfect freedom, in which the State, the coercive exercise of authority by man over man, would not exist. According to this theory only the individual has rights; there is no more divinity of right in a majority than there is in kings. Government is an invasion of the right of the individual to do as he will, and should be abolished; with its abolition would vanish the various moral, social, and industrial evils to which it has given rise, and human society would develop on a higher

plane. Stated in its extreme form anarchism is evidently too ideal for frail human nature as at present constituted. Of more practical importance has been the theory of extreme individualism as set forth by Herbert Spencer—a view designated by Huxley as the night-watchman theory of the State. According to this the functions of government should be limited to the protection of life and property and the enforcement of contracts, but should not include such things as education, regulation of industry, local improvements, charities, coinage, etc. Private initiative and competition are trusted to supply these things, while the economic harmony of the interests of each individual with those of society will prevent any wrong from being done. The keynote of the whole theory lies in the view that government is an evil, though a necessary one, and should consequently be restricted. Adam Smith's system of "national liberty" went somewhat further, as it added to the three functions named above, the construction of public works and buildings, etc.; but it excluded such activities as education and the civil courts, which we regard as most suited to government management. This theory had its origin in the reaction against the undue interference with industry by the Government under mercantilism and had thus a historic justification and value.

The theory most generally held by economists and writers in the United States is probably the modified individualism set forth by John Stuart Mill. According to him, freedom of industry or "laissez faire should be the general practice; every departure from it, unless required by some great good, is a certain evil." Industry, he said, should be left to individuals and the Government should never interfere unless there is an antagonism between social and private interests. Individuals following their own interests will always conduct business better than the Government, which is inefficient, corrupt, and can fall back on taxation to cover its mistakes. Individualism should therefore be the rule and governmental action the exception. But Mill himself admitted that there was no theoretical limit to the extension of governmental functions, and in so doing is said to have opened the door to socialism. Nevertheless, the basic idea is still that government is an evil and an extension of its activities is on the whole undesirable.

Opposed to this view is the culture state theory, enunciated by Roscher and very generally held in Germany, which regards the State as a beneficent,

positive and constructive force in our industrial life. The advocates of this theory point out that the functions of the Government change with progress, and that in our complex modern industrial life it should seek to improve conditions positively, and not leave the people to the mercies of a blind competitive struggle; practically, it should regulate industry, conditions of work, housing, etc., and should manage all public utilities which affect the life or well-being of the citizens, as railroads, telegraphs, industrial insurance, etc. Still further in the same direction goes the view known as state socialism, of whom the best-known advocate is Professor Wagner. This advocates individualism, but insists that it is responsible for many injustices and evils, which it is consequently the duty of the State to redress. For instance, the State should correct the inequalities of wealth brought about by the distribution of the social income under the present competitive system; this should be done by the progressive taxation of inheritances and incomes, the limitation of inheritance and bequest, the government ownership of public utilities, as railroads, telegraph, telephone, coal mines, etc. This theory stops just short of socialism, but enlarges the functions of the State to the largest degree compatible with individualism. Beyond this, and at the farthest extreme from anarchism, stands socialism, which, however, demands a more careful examination than the other views have received because of its present prominence.

Socialism may be briefly defined in the words of Professor Ely[49] as “that contemplated system of industrial society which proposes the abolition of private property in the great material instruments of production, and the substitution therefor of collective property; and advocates the collective management of production, together with the distribution of social income by society, and private property in the larger proportion of this social income.” Four features are involved in this definition, namely, common ownership, production, distribution, and private incomes. The cardinal and distinctive element in socialism is the collective or social ownership of the means of production, that is, of the land and capital. Instead of having these owned privately as today, they would be owned by the people as a whole, by the State, and used by them for production. Socialists do not oppose capital, as is often said, but only the private ownership of capital. But under such a system private business as we know it today, individual enterprise for the sake of profit, could not exist. It is often urged that socialism means

a “grand divide,” and that in such an event the shrewder and more thrifty would shortly have the wealth of the idle or stupid members of society. But just that is guarded against under socialism, for there would be no private ownership of capital, and hence no one could get his neighbor’s share; it would all be held under collective ownership. With the abolition of private capital, there would disappear of course all the economic institutions that have grown up around it, as credit, banking, lease, hire, the stock and produce exchanges, etc.

Socialism also means the collective or social organization and management of industry. Socialists criticise severely our present methods of production, which they call planless and wasteful. They point to the constant recurrence of crises as an evidence of mistakes of the competitive system, which they say could be obviated under a well-organized comprehensive scheme. They also urge the wastes of modern capitalism, in the duplication of plants, advertising (which amounts to $500,000,000 a year in the United States and serves little useful purpose), traveling salesmen, multiplication of small stores, etc. Finally, an artificial disharmony between the interests of society and private individuals is promoted by our system of private property and profit: a coal trust limits the supply, farmers rejoice over small crops, and planters burn part of their cotton, in short the bounty of nature is regarded as a calamity. Some truth may be admitted in these criticisms, but in answer it may be said that some of them are being corrected under individualism, while as to those that remain the remedy offered is worse than the disease. The first and fundamental question is the effect of socialism on the amount produced, for as we have seen any diminution would mean a worse economic condition of society, even though it were offset by a more equal distribution. Under individualism the appeal to industry and thrift is the self-interest of the individual, and under the stimulus of this motive the production of wealth has been increased enormously. It is doubtful whether the motives of altruism, desire for social approbation, and similar ones suggested by the socialists would promote industrial activity as efficiently as the individualistic desire for pecuniary gain.

Moreover the difficulties of organizing and managing all industries would be enormous. According to the socialist plan, statistics of consumption would be gathered in advance, the idle changes of fashion would of course disappear, and production could be accurately calculated. But aside from

the problem of securing an honest and efficient administration, the work of organizing industry from a centralized bureau would probably prove insurmountable. The distribution of the labor force among various employments suggests another difficulty. Under individualism the necessary distribution takes place through the agency of wage payments and the choice of an occupation is left free to the individual. As the wage-system would disappear with the abolition of private capital, some other means would have to be devised, as allotment by the Government. But more important would be the selection of the managers of industry; competition provides a process whereby the inefficient are eliminated and the able put in charge. As socialism would be an industrial democracy the selection of the captains of industry under that system would probably be made by election. Is it likely that the voters would place over themselves the ablest, that is the strictest, most economical, and most energetic man? Taking men as we find them today, this may well be doubted.

But it is as a scheme of distribution that socialism has been most warmly urged. The inequalities and injustices of present methods are pointed out and a more just system demanded. Socialists themselves, however, are not agreed as to what constitutes justice. Needs and merits have both been urged as bases of distribution, but suffer from vagueness and difficulty in administration; most socialists today agree that equality of income would best meet the requirements of justice. They claim that talented persons have been endowed by nature with their abilities and should use them as a trust for society and not expect greater rewards than their less talented brothers. To this individualists answer that the practical question is, how to secure the greatest exercise of these gifts, and that is now done by appealing to the motive of self-interest. Some writers even go further and assert that the desire for inequality is the chief stimulus to invention and enterprise. A crucial point in every socialistic scheme is the determination of value under such a system; most socialists follow Marx and say that this should be determined by the “socially necessary labor time” required for the production of an article. Such a measure leaves out of account entirely the aspect of utility or demand, and would clearly be inadequate. Prices would be fixed by the State and would be calculated in labor time, which would probably be represented by labor checks, which would constitute the media of exchange of the socialistic society.

Finally, in the definition given above, it was stated that private property would exist in the larger proportion of the social income after it was divided. There is no reason why this should not be true, for, though private capital would be abolished, the State would not interfere with the individual in the use of his income after it was earned. If one man preferred fine clothes and another pictures and books, it would be possible for the latter person to accumulate such articles of enjoyment or consumption. He could even have tools for private carpentering or a horse for riding, but under no circumstances would he be permitted to use these for production or as instruments of private gain. Socialism must stand or fall as a system of production and distribution; it is not necessary to criticise minor points. On these broad grounds it must be rejected, although it may fairly be admitted that socialists have often proved themselves keen and useful critics of existing institutions.

Many persons in this and other countries, who do not approve of socialism, nevertheless believe in the extension of state ownership or activity along particular lines. Thus Henry George, though in other respects an individualist, did not believe in the private ownership of land. Land is limited in quantity and yields, because of its monopoly character, an "unearned increment" or rent, quite apart from the return due the owner for improvements. He proposed that the Government should confiscate this unearned increment by levying a single tax on all land equal to it. He thought that this would provide revenue sufficient for all government needs without resorting to other forms of taxation; in this he was undoubtedly mistaken, but the main interest in the scheme for us is economic, and not financial. The reason for the scheme was that land, being a limited monopoly, would be increasingly in demand as society progressed, and that consequently the landlords would absorb in their increased rents most of the enlarged production of the future. This assumes that rents always increase and never decrease, which is historically untrue. Nor does the growth and progress of society necessarily increase the demand for land; it may be directed to other things, while improvements in the arts of agriculture may actually decrease this demand. We must, however, admit that there are many instances of unearned increments, not only in the case of ground rents, but also of monopoly profits from various sources; these might very properly be secured to society by means of special and heavy taxes.

The municipalization of local public utilities has been advocated by many persons who are not socialists, except in so far as they desire an extension of governmental activity along these lines. They urge this because the utilities in question—gas, water, electricity, telephone, street railways, etc.—are by their very nature monopolies, and because under private control they are often inefficiently or dishonestly managed. A less drastic remedy for these abuses might of course be found in regulation. Unrestricted private control of municipal monopolies is advocated by few; the real issue is between public regulation and public management. And this issue will depend in the last analysis upon the question which can give the best results to society.

XIX. ECONOMIC PROGRESS.

At the conclusion of a study of this character we are inevitably led to summarize our conclusions and to try to answer the question as to what the lessons of the past have taught us. In what direction are the forces of economic life taking us? The conclusion of this text is that they are making for economic progress, and it will be worth while to justify as far as possible this belief. It is, however, impossible to do this except in very general terms, for definite data for measuring this improvement do not exist, and economic progress itself is a somewhat vague conception. Even such comparatively simple facts as the rate of wages or the hours of labor can be stated only very generally. But both of these show a decided improvement in the condition of the working class. A careful investigation for Great Britain by Mr. A. L. Bowley[50] shows that if wages for the decade 1890-1900 be represented as 100 then the course of wages during the nineteenth century would have run somewhat as follows:

Decade	Relative Wages
1800-10	55-65
1810-20	65-70
1820-30	65
1830-40	60
1840-50	60
1850-60	65
1860-70	75
1870-80	95
1880-90	90
1890-1900	100

Without investigating the validity of the figures too closely, it may safely be affirmed that the movement of wages has been distinctly upward, and that the rise was certainly not less than 50 per cent. For the United States the

increase has not been so great, probably because wages started at a higher level. According to the Aldrich report, if wages and prices in 1860 in the United States be taken as 100, relative wages in 1840 were 82.5 and relative prices 98.5; in 1880, they were respectively 143 and 103.4; in 1903, they were 187 and 103. That is to say, relative wages showed a marked advance and real wages, owing to the fact that general prices remained almost stationary, an even greater improvement. So, too, the hours of labor appear to have been shortened in Great Britain about two hours a day (from 10 to 14 hours to 8 to 12), and in the United States probably as much, the average length of the working day in certain employments decreasing from 10.3 hours in 1880 to 9.6 hours in 1903.

In the field of production the most dramatic and striking advances have been achieved. The application of steam and more recently of electricity as the motive power for the newly invented and constantly improved machinery has permitted an enormous expansion of production, which has been made still greater by the opening up of new mines and new lands and improvements in the machinery of transportation and exchange and in the organization of business. Especially in the United States where the natural resources were especially rich and the people energetic and ingenious, has the growth of wealth been marvelous. And yet almost a century after the beginning of the Industrial Revolution in England, Mill alleged that labor-saving inventions had not lightened the toil of any human being; they have only enabled a greater number to live the same life of drudgery and imprisonment. What answer can we make to this indictment today? Why is it that the working class still has so little of this vast increase of wealth and still lives so close to the border line of poverty?

To answer this question thoroughly would require an analysis of the subject of distribution, but a few reasons may be briefly suggested.[51] While the social income has been greatly increased by these improvements the amount paid in rent to owners of land, water powers, etc., has also grown. If we approve of private property in land as best adapted to stimulate its use for society, then we must admit the justice of rent, and of its payment to present land owners. Similarly, too, the payment of interest to the owners of capital has absorbed a large part of the increased income of society, though the proportion going to this factor is probably growing smaller owing to the fall in the rate of interest. But as we have seen, modern industry is

essentially capitalistic, that is, it depends upon the use of capital for its operations. Since we allow private property in capital and believe that to be the best method yet devised for securing its accumulation, we must justify interest. Profits in general are fairly earned by industrial organizers and others who manage our businesses, and are necessary to enlist their services. Probably in most cases society does not overpay these leaders of industry. But some forms of profit, as those derived solely from monopoly, especially from the monopoly of limited natural resources, are both too large and socially unearned. These society should clearly control and absorb.

One reason then why labor has not profited more by the great increase in wealth is that the other factors in production have laid claim to their shares also. There is good reason for believing, however, that the share of labor has been steadily growing greater all the time, and that it today gets a larger proportion of the social income than ever before. This fact is obscured by the great growth in population, which has more than doubled in the last hundred years in Europe and has shown a twentyfold increase in the United States. The larger income is divided among more people, and though each today gets more than his grandfather, there is not yet enough produced to make all rich. Indeed, if the wealth of the United States were divided equally, it would not provide a competence for anybody. The difficulty is not merely that there is inequality in distribution, but that the need of a much greater production of wealth must also be met. Inequalities may be adjusted by such measures as progressive inheritance taxes, but resort to this or similar methods must not be so severe as to weaken the motives for the accumulation of capital. That must form one of the strongest reasons for rejecting the drastic proposals of socialism.

Improvements in production have, however, not merely increased the total output; they have greatly reduced the cost of many articles and have brought within the reach of the poorest consumers others which a century ago would have been unattainable. Improvements in transportation have served to bring an ever-increasing variety of products to market. The material progress of a people can be gaged fairly well by their consumption of certain semi-luxuries, such as tea, coffee, sugar, tobacco, beer, etc.; these show a steady increase during the past century. “Thus in the United States between 1871 and 1903 inclusive, the per capita consumption of coffee

increased from 7.91 to 10.79 pounds, that of sugar from 36.2 pounds to 71.1 pounds, that of malt liquors from 6.1 gallons to 18.04 gallons, that of wheat and flour from 4.69 bushels to 5.81 bushels."[52] A similar investigation for Great Britain shows an average increase in a considerably larger list of the same character of 40 per cent between 1860-64 and 1895-96. It must be admitted that there is much lack of economy in present consumption; there is often wasteful and positively injurious consumption, an illustration of which would be found by many persons in the increased consumption of malt liquors cited above. From a purely economic standpoint the enormous waste of war and the burdensome cost of military and naval armament must also be condemned.

The task of prophecy is usually a fruitless one, but at least it is now possible for us to indicate some of the lines along which reform is needed, and the goal towards which the future of progress will probably move. The natural resources of the nation must be more carefully conserved and reckless destruction prevented; at the same time the monopolization of limited resources by private individuals or corporations must be rigidly restricted. The growth of trusts seems but the last step in a steady growth in size of the business unit and may be accepted as an economical method of industrial organization, but the evils of corporate financial management must be carefully guarded against. The growth of labor organizations, on the other hand, must be admitted to be equally logical and desirable. While they often display monopolistic tendencies, yet our main reliance must be placed upon these agencies to secure bargains for laborers on terms of equality with their employers. But on behalf of wage-earners not easily organized we must resort to state interference by means of factory and labor legislation in order to secure equitable labor contracts. Free competition which exposes women and children to the greed of unscrupulous employers is defended by no one today, and it is clearly recognized that legislation along these lines must be further extended, as for instance in the direction of industrial insurance, old age pensions, adequate care for the unemployable, etc.

Reforms in our banking and currency laws, an extension of banking facilities to the working classes, the more careful regulation of railroad rates, reforms in methods of taxation, and a reduction in the tariff—all are called for by the development and readjustment of industry. On the other hand, much remains to be done in the education of the mass of the people to

habits of rational living and enjoyment. In the great cities housing conditions should be effectively regulated, sweatshops suppressed, intemperance discouraged, and where possible a love of art and outdoor life promoted. A more rational use of income would increase the material well-being of the people considerably. Problems of distribution are still more insistent. No one who has the welfare of the laboring classes or of our democratic society at heart can view with approval the existence of widely separated classes, with disproportionate political and economic power. Greater equality in fortunes—a leveling up of incomes—must certainly be regarded as a sound social ideal. On the other hand, we have seen reason to reject the drastic remedies of socialism as a cure for the injustices of present methods of distribution or production. Improvement must come by conservative reform along the lines of our past development. In the last analysis all attempts to improve conditions permanently depend upon the character and capacity of the individual. Because of this fact education assumes great importance—education not merely in the art of production but also in that supreme art, the art of living.

[1] Tarr, Economic Geology of the U. S., pp. 7, 119.

[2] In Quarterly Journal of Economics, Vol. XIX, p. 3.

[3] McVey, Modern Industrialism, p. 145.

[4] The Truth About the Trusts, p. 469.

[5] Tetter, Principles of Economics, p. 321.

[6] Bogart, Economic History of the U. S., p. 412.

[7] XIX, 645.

[8] Seager, Introduction to Economics, 176.

[9] Evolution of Modern Capitalism, 35.

[10] Economics, 121.

[11] F. J. Stimson, Labor in its Relation to Law, 51.

[12] Bullock, Introduction to the Study of Economics, 428.

[13] Stimson, op. cit., 71.

[14] A. H. Ruegg, Law of Employer & Workman in England, 99.

[15] Rep. of U. S. Ind. Com., XVII, 1.

[16] Rep. Ind. Com., XVII, xlii.

[17] E. L. Bogart, The Chicago Building Trades Dispute, in Pol. Sci. Quart., XVI., 134; also in Commons, Trade Unionism & Labor Problems, p. 107.

[18] Bogart, op. cit., p. 137.

[19] Economics, 353.

[20] Political Economy, 381.

[21] Evolution of Modern Capitalism, 297.

[22] Wealth & Progress, 171.

[23] Report Industrial Commission, XIX, 926.

[24] Getting a Living, 475.

[25] Report Industrial Commission, XIX, 746.

[26] Ind. Com., Rep: XIX, 757.

[27] Bull. of U. S. Bur. of Lab., Sept., 1908, p. 418.

[28] Economics, 337.

[29] Industrial Evolution of the United States, ch. 28.

[30] Evol. of Mod. Cap., 229.

[31] The Effects of Machinery on Wages, 65.

[32] Principles of Economics, I, 315.

[33] Industrial Efficiency, II, 451.

[34] Schloss, Methods of Industrial Remuneration, 305.

[35] Report, VII, 644.

[36] Economics, 377.

[37] Political Economy, 344, 345.

[38] Economics, 133.

[39] Bliss, Encyclopedia of Social Reform, art. Distribution, p. 501.

[40] Economics, 360.

[41] Stated technically, its marginal productivity is small and hence its reward is also small.

[42] More truly, the marginal productivity theory.

[43] J. R Commons, the Distribution of Wealth, 252.

[44] More, Wage-earners' Budgets, 269.

[45] Today the loss is probably double this sum.

[46] Gide, Political Economy, Rev. Ed., 663.

[47] Seager, Introduction to Economics, 73.

[48] Bullock, Introduction to Study of Economics, 106.

[49] Socialism and Social Reform, 19.

[50] Wages in the United Kingdom in the Nineteenth Century.

[51] Acknowledgment should be made at this point of indebtedness to the excellent final chapter in Prof. H. R. Seager's Introduction to Economics.

[52] Adams and Sumner, Labor Problems, 523.

MANUFACTURING.

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INTRODUCTION.

The production of manufactures for the requirements of the world’s population is conducted in a comparatively small section of its land surface. Just as the manager of a great estate devotes one section of his estate to the production of certain articles, and other sections to certain other articles, so the great business instinct which rules the business of the world carries on in its various sections the varied industries best suited to the physical, ethnological and financial conditions of its various sections.

The people of western Europe and eastern United States are, for various reasons better able to produce the manufactures required by the world than are those of South America, Africa or the Orient; while, on the other hand, the people of South America, the Orient, Australia, Canada, the western part of the United States or the eastern part of Europe are better able, for various reasons, to produce the raw materials of manufacturing and the food

supplies required by those engaged in the manufacturing industry than are the people of western Europe or eastern United States. South America and Australia produce wool in large quantities; Africa and the Amazon Valley produce the chief supply of india rubber; the Malayan peninsula and adjacent islands produce the bulk of the world's tin; India produces jute; the Philippines, Manila hemp; Mexico, sisal; China and Japan, the bulk of the world's silk; Egypt, India and the United States, the world's cotton; Russia, Austria-Hungary, India, Australasia, South America, Canada, the central and western parts of the United States produce the bulk of the world's wheat, corn and meats, at least the bulk of that in excess of the requirements for local consumption; Europe, the West Indies, the East Indies and the tropical sections of India, China and Central and South America produce the bulk of the world's sugar.

The manufacturing industries of the world—confining this term for the moment to those industries in which the great proportion of the work is performed by machinery—are conducted chiefly in, it might almost be said confined to, western Europe and eastern United States. True, the exclusive application of the word "manufactures" to that portion of the world's product of this character made by the use of machinery in conjunction with large sums of capital—the factory method—carries one beyond the original meaning of the word "manufactures," which primarily meant, of course, made by the hand (from manus, the hand; and facere, to make); but the industrial habits of the world have also passed beyond that stage in which manufacturing for the masses is carried on by hand methods.

It must not be understood from this that all of the world's manufactures are produced in western Europe and eastern United States, or produced by modern machine methods in conjunction with the investment of great sums of money—the factory system. On the contrary, large quantities of manufactures are still produced by hand in various parts of the world other than those in which manufactures by modern machine methods are a leading characteristic of the occupations of the people. Nor must it be assumed that the areas designated as the non-manufacturing sections are entirely dependent upon the manufacturing sections for their manufactures. On the contrary, large quantities of manufactures are still produced in the Orient, in Africa, South America, Australia and the islands of the sea by those simple processes which prevailed in Europe and the United States

prior to the development of the modern methods less than two centuries ago. The industrious population of China, of India, of Japan, the millions of people in Africa, in South America and in the islands of the sea produce by simple methods large quantities, and in many cases a large proportion, of the simple manufactures which they require for their daily life. The cloth with which they cover their bodies, the simple requirements of household life and of agriculture are, in many cases, largely of their own production and made in keeping with the original meaning of the word "manufacture"—made by hand.

But the statement is still true, that the great manufacturing areas of the world—the areas which give their chief attention, or the continuous attention of a large part of their population, to the production of those requirements of man other than the natural products and do this through the application of power, machinery and capital, and the operations thereof under the factory system, are western Europe and the eastern part of the United States, though the systems which prevail there are gradually extending to other parts of the world—eastern Europe, central, southern and western United States, Japan, India, Australia, Canada and South America.

As to the relative share of the world's manufactures now produced by the use of machinery, power and capital—the factory method—and by the hand process, respectively, no exact statement can be made; nor are there facilities for even offering an intelligent estimate of the relative production by these two methods. There is reason to believe that two-thirds of the cotton cloth consumed in China is still made by the hand process, and if this be true it may be estimated that perhaps two-thirds of the other manufactures consumed in that country are still made by hand; while in those other sections of the world in which railroads and the other methods which the people of the Occident are pleased to term "modern" do not yet prevail, a large proportion of the simple manufactures of the people, are still those produced by hand methods. The fact, however, that the sections which produce manufactures by modern methods are also supplied with modern facilities of transportation—the railroad and the steamship; and of communication—the telegraph, and also supplied with ample sums of capital and that other important quality born of long experience and the energy supplied by a temperate zone climate and the judicious admixture of the most energetic populations of the world—Europe and the United States

—has enabled them to distribute their factory products in great quantities to those sections not producing by the factory method, and whose peoples are willing to exchange their natural products, food and raw materials, for the finished products of the factory.

This brings us to a consideration of the exchanges of the world—the exchanges of natural products for the products of the factory. This exchange, as already intimated, occurs chiefly in the requirements of the manufacturing section—raw materials and food—for manufactures. Western Europe, the great manufacturing section of that grand division, does not produce cotton, jute, or a sufficient supply of wool, silk, or hemp. For its india rubber, its tin, its copper and the numerous articles of tropical production required for manufacturing, it is dependent wholly or chiefly upon other parts of the world. The United States, while producing a large share of the world's cotton and copper and iron, and a considerable supply of wool, must rely upon other parts of the world for its hemp and jute and sisal and india rubber and silk and many other of its tropical requirements. As a result the Orient exchanges its raw silk, its jute, its Manila hemp, its tin, and numerous less important articles, for the factory products of Europe and the United States. Australia exchanges its wool, its meats and its gold for the products of the manufacturing sections. Africa sends its india rubber, its ostrich feathers, its gold and diamonds in exchange for factory products of those sections in which the manufacturing system has developed. South America offers as its exchangeable products wool, wheat, corn, meats, coffee and india rubber. Canada gives in exchange for her factory requirements timber, ores, wheat and other agricultural products.

Thus the business intelligence that rules the world, adapting one to another those various conditions which prevail in its varying sections, has built up in certain sections of its great area—Europe and the United States—a great factory system, operated by the great supplies of power (coal) which there exist in conjunction with the wealth, the intelligence, the climatic conditions and the quality of population, which system, besides supplying its own six hundred millions of people with their own requirements, sends to the other ten hundred millions of people in other parts of the world its surplus products and takes in exchange the natural products, the manufacturing material and food required by its own people and its own industries.

George J. Chisholm, in the Introduction to Bartholomew's Atlas of the World's Commerce, outlines the history of the development of manufactures and the relation thereof to commerce as follows:

> "In the latter part of the eighteenth century there took place in England a number of inventions which have brought about a change in the conditions of manufacturing industry and of commerce, and an acceleration of the rate of the economic development of the world, to which all previous history presents no parallel or approach to a parallel. It is a change that has affected the entire world, bringing about an entirely new trade with the New World and the antipodes, and completely altering the character of the trade with the East, depriving spices of the peculiar value which they held in commerce for so many centuries, and developing a trade of incomparably greater magnitude with the East than was at one time ever dreamt of, and largely in commodities of a bulky character yielding comparatively little profit on small quantities. The revolution was inaugurated by the inventions in connection with the cotton industry between 1769 and 1785 and the concurrent improvements in the steam engine by James Watt, who thereby first made this a generally serviceable machine. These were followed by the introduction of steam locomotion by land and water in the first quarter, and the rapid extension of these modes of transport in the remainder of the nineteenth century. The result of these inventions was to give a new value to the stores of coal and iron in the United Kingdom, and ultimately a new value to undeveloped land in new countries. It was railways that first made it possible to fill great ships with bulky produce like grain drawn from the far interior. The remarkable expansion of commerce thus brought about greatly increased the commercial advantages of Great Britain due to its situation and local facilities for shipping. In so far, however, as the unexampled development of British manufacturing industry and commerce in the period immediately following the Industrial Revolution was due not to geographical conditions but merely to the fact that the great inventions originated there and consequently the resources of Great Britain for carrying on manufactures by the new methods were developed first, the expansion of British

manufactures and commerce was bound to be affected by the development of similar resources elsewhere; and the more rapid growth of manufactures in some rival countries resulting from this cause, and partly, it may be, from other causes, has been one of the marked features of recent economic history."

I. MODERN MANUFACTURING SYSTEMS OF THE WORLD.

The manufacturing systems of the world have developed from mere hand and household industries to those of the machine and factory in less than two centuries. For thousands of years the simple requirements of men—of clothing, of domestic life, of agriculture and of transportation—were met with articles produced by hand labor, performed for the greatest part in the household or in simple workshops adjacent thereto. Then, in the latter half of the eighteenth century, man discovered that he could harness the power of the waterfall and, by making the wheels which it turned turn other wheels, could utilize that power in performing many tasks which he had hitherto performed laboriously by hand. The turning wheels twisted the wool and flax and cotton into threads stronger and finer and better than his wife had been accustomed to twist with the spinning wheel and distaff, and produced in a single day as much of this yarn as a hundred industrious women could produce in a week or a fortnight. By gearing the wheels to operate a loom he could weave the yarn into cloth with a small fraction of the labor and time which had been required to weave it by the hand loom and obtain better results.

Thus arose the custom of manufacturing by machinery operated by the power of the waterfall the cloth which had hitherto been manufactured by hand labor in the household; this was the beginning of the modern manufacturing industry.

To do this, however, it was necessary to plant the machines beside the waterfall and bring to them the raw material and the persons necessary to operate them, for the machine was unable to perform its task unless assisted by the intelligent labor and guidance of experienced men and women. Thus arose the system of performing in a single workshop, with the aid of a considerable number of people and machines, the manufacturing which had been hitherto performed by many people in many households and with many machines of simpler form and operated by human power—the factory system.

This new system developed new occupations. The buildings in which the work was carried on must be constructed. The machinery required for operating the factory must be made and kept in repair, and new machines made to take the place of those worn out. So there came occupation for mechanics and skilled machinists in manufacturing and repairing the machines, and for others skilled in operating them. The material used in manufacturing the cloth must be transported to the factory, instead of being used at the place where it was grown as formerly; and the cloth must again be transported to the consumer; and thus there were new occupations for man and beast in transportation and in constructing and maintaining the roads over which the material was transported. Still another, and equally important, industry developed was that of supplying the food and other requirements of the men and women engaged in the factory, and this gave new activity to the agricultural industries near the factory and further occupation to those engaged in transportation.

To supply the wants of those employed in the factories, who were so busily engaged that they could not find time to grow their own food, or make their own clothing, other enterprising men and women established themselves near the factory to sell the required food and household supplies, to supply the fuel with which they cooked their daily food, to buy small portions of the cloth made in the factory and turn it into clothing to sell to the operatives, to shave their rough beards and occasionally trim their hair—and thus arose the factory town.

So the factory system, which at first threatened to take away the occupation of thousands who had formerly devoted their time to making yarn and cloth by hand labor, developed new occupations and new industries, and brought portions of the hitherto scattered people into groups, and these groups in time developed better accommodations for themselves and their families in homes, in comforts of life, in educational facilities, and in hours of labor; and in doing this they also supplied the masses with cloth at a less cost of labor than they had formerly expended in obtaining it.

Meantime man was learning another important lesson, one which was to develop even more rapidly the art of manufacturing. He found through a long series of experiments that power could be generated by heating water until it turned into an expansive vapor which he called steam, and that this

expansive force could be controlled in such manner as to put in operation a machine which he called the steam engine, which could in turn transmit its power to that machinery formerly operated exclusively by the power of the waterfall.

This discovery again revolutionized the manufacturing industry, which had hitherto been limited in the scope of its operations by the supply of water power so located that the raw material could be transported to it and the finished products in turn transported thence to market. With this new force, steam, by which the manufacturing machinery could be made entirely independent of the waterfall, the factories were located at points convenient to the natural supply of fuel and manufacturing material or to the market for the finished products. Where this was not practicable the factories were located at places to which the materials could be readily and cheaply carried by water transportation, either on some navigable stream or the sea-coast.

Another important contribution made by steam power to the development of the manufacturing industry was the decrease in cost of transportation. Before the development of the railway and the steamship the material of manufacture, unless produced within a short distance of some navigable water, canals, rivers, lakes or oceans, was of comparatively little value. It was not always practicable to plant the factory in the section which most readily produced the wool or cotton or flax or hemp or silk, or to place it alongside the iron or copper mine; and even if this were done the manufactured material was valueless unless it could be transported to those requiring it. Even the lighter articles of manufacture, such as wool or cotton or fibers or silk, could not be transported any considerable distance without greatly increasing the cost to the manufacturer, and thus proportionately advancing the cost of the manufactured article. But when, in the middle of the nineteenth century, the railways began to penetrate the continents and the steamships began to cross the ocean and extend their tours to the commercially undeveloped sections of the world, the manufacturers found new sources of supply open to them and quantities of raw material reaching them from distant lands at such comparatively low cost as to enable them to enlarge their output, increase the variety of their productions and reduce the cost of both the necessities and conveniences and luxuries which they were offering to the public. The railways of the world grew from 25,000 miles in 1850 to 500,000 miles in 1900 and 600,000 in 1909. The tonnage of steam

vessels on the navigable waters of the world grew from less than one million tons in 1850 to 24 million in 1909; and the carrying power of the sail and steam vessels of the world, measured in sail tons, grew from 15 million tons in 1850 to 100 million in 1909. The general reduction in freight rates meantime is illustrated by the fact that the price of transporting wheat from Chicago to New York by rail fell from 33½ cents per bushel in 1872 to 10 cents per bushel in 1900, and the charge for transporting wheat from New York to Liverpool fell from 17 cents per bushel in 1875 to 3 cents per bushel in 1905; and similar reductions were made in the charges for transporting manufacturers' materials.

Thus the application of steam to manufacturing and transportation multiplied the power of production. The area over which it could be performed was greatly enlarged, the cost of materials was reduced through cheaper transportation, new devices and processes were developed as a result of the competition, cheaper raw material was obtained from countries where plentiful supplies and cheap labor give low prices, and the opportunity of locating the factory near the place of production or at some convenient meeting point between the various places of production—all these contributed to reduction of cost and increase of supplies of material of manufacture. The great iron and steel works of western Pennsylvania, and northern Ohio, Indiana and Illinois, for example, are located not at the iron mines or the coal fields, but at places between these two fields to which these materials can be cheaply carried from their respective places of production. The iron ore is chiefly produced in the Lake Superior region and carried at a very low cost by vessels especially constructed for this purpose to the southern shores of Lake Erie. The coal is chiefly produced in western Pennsylvania and central Ohio, Indiana and Illinois. The cost of transporting the coal from the mine to the lake shore, or the ore from the lake shore to the mine, or both coal and ore to some mutually convenient meeting point by river or canal or railroads constructed for this purpose across a comparatively level country, is extremely small, less in many cases than that of carrying material to the waterfall which is not infrequently located at places difficult of access. The vessels carrying the manufactures of the United States or the manufacturing countries of Europe to South America, Africa and the Orient, bring back at a very low cost the india rubber, the tin, the fibers, the wool, the silk, the Egyptian cotton of those

distant countries; and the manufacturer who a century ago was limited in his supply of raw materials to the immediate vicinity of his factory may now bring his material from all parts of the world, while the area in which he may sell his products has been correspondingly enlarged.

One very recent contribution to the convenience and cheapness of manufacture is found in the transmission of power in the form of electricity. Formerly the machines of the factory were operated by power obtained from the steam engine or the water wheel through lines of shafting, gearing, belts, friction pulleys, etc. This made it necessary that the factory operated by water power be placed alongside the waterfall, or at least within a comparatively short distance of the source of power. Recent inventions have made it possible to transform power into electricity, carry that electricity hundreds of miles on a wire, and transform it back into power for the operation of the machinery of the factory or the transportation of the raw material or the finished product. This has increased greatly the value of the world's water power in its relation to manufacturing. Formerly only a small part of the waterfalls of the world were used at all, largely because of their comparative inaccessibility and the cost of transporting the raw material to them and the finished product from them. Now that power, generated at any point, however inaccessible for freight handling, may be transmitted in the form of electricity on a simple piece of wire to any convenient point within a hundred or even two hundred miles of the place of production, and by a simple process applied to the operations of machines small or large, simple or complex, the possibilities of the waterfall in supplying power for the manufacturer are greatly enlarged.

Not only is this true of the waterfalls now in existence but of those which may be brought into existence, for now that man has found a way to use the power thus generated he may readily increase the number of waterfalls by constructing dams at many places, and using the water over and over again in its flow from the place of origin to the ocean level. The great quantities of water stored up in the form of snow and ice in the mountain ranges of the world, and gradually liberated by melting may supply almost untold quantities of power as they flow down the mountain sides used not merely once but many times. The manufacturing power of Italy, Switzerland and southern France is now being greatly augmented by this process.

Another possibility of the use of this new distributor of power, electricity, is the multiplying of workshops and the return in some instances and certain articles to household or small shop manufacture. It is now so easy to introduce the electric wire and a small electric motor into the household or the shop adjoining the household and to so operate small machines for the various processes in many of the manufacturing industries, that this new use of electricity for the transmission of power is already making visible changes in the factory systems of the world, and promises still greater changes. In many lines of manufacture in which the machinery occupies small space and requires little power and the quantity of material handled is not great, such as watch and clock making, the manufacture of clothing, boots and shoes, toys, etc., a part or all of the work can now be performed in the household or small shop through the power generated miles away and brought into the workman's home on a simple piece of wire.

On the other hand the use of electricity in the great factory or manufacturing establishment is equally important. Instead of transmitting the power of the engine to the various classes of machinery by belts, shafting and gearing, much of it is now transmitted and applied in the form of electricity. Great cranes which handle many tons of material are operated by the electric motor without the intervention of the costly shafting, belting and gearing; and the great magnet, made such by electricity, picks up its ton of steel rails with the same ease that the toy magnet picks up the needle, and is managed with no greater physical exertion than the other.

Cassier's Magazine, an accepted authority on engineering matters, publishes with favorable editorial comment, in its issue of September, 1909, a statement by Sylvester Stewart that "we could take out in regions where water power is needed at least a hundred times as much water power as is now employed, furnishing a safer and cleaner power than steam, at a lower cost, and thus prolong the existence of our coal fields. * * * A running stream may be compared to an endless driving belt only awaiting connection to the machinery it is capable of driving, but it has not been appreciated because we have become so familiar with it; if it had suddenly been discovered, doubtless it would have been harnessed immediately. Coal is passing away, but water flows continuously. A hundred thousand horsepower may be taken from a river and its place is still filled, but the coal vein once emptied is emptied forever." Mr. Stewart adds that probably

not one-thousandth part of the water power of the world is now utilized, and that while the greater part of this power is not at present available, because of its existence in out-of-the-way places, or in rivers so deep and sluggish that the energy obtainable from them would cost more than steam power, at least a hundred times as much water power as is now used could be, under present conditions, utilized in a manner to supply it at less than the cost of coal at present prices.

II. THE USE OF MACHINERY IN MANUFACTURING.

The statements made in this discussion that the great expansion in the production of manufactures came with the adoption of machinery for manufacturing must not be understood as meaning that no machinery was used in manufacturing prior to the period of expansion. Machines have been used in manufacturing for many centuries.

The spinning wheel, used many hundred years ago, was a machine, and so was the hand loom, by which the threads spun by the wheel were woven into cloth. Flax and wool were originally turned into thread by the use of the distaff, a stick to which the spinner attached a small portion of the fiber, and by revolving the stick against his body twisted the fibers into a thread. Then by letting the end of the stick drop downward he drew out the thread, and with another roll of the stick against his body again twisted the fibers and lengthened the thread, which he then wound around the distaff. After many years of this process it occurred to somebody that by setting the distaff in a frame and passing a cord or a piece of rawhide around it and also around a large wheel and turning the wheel he could get a much more rapid and regular revolution of the distaff. This was the beginning of the use of the “machine” in the making of yarn, for the spinning wheel was a machine, of a crude type, to be sure, but a machine. This served many generations of men and women for the manufacture of thread and yarn, from flax, from wool and from cotton.

To turn this thread or yarn into cloth another “machine” was used, the loom, which, by fixing the thread on certain frames and passing other threads back and forth as the frames were raised or lowered, formed the cloth. But this “machine,” the loom, was operated by human power, as was that other machine, the spinning wheel. The women and children spun the thread or yarn, the father and sons operated the loom, chiefly in the winter months in which they had no occupation in the fields. If a man chose to give his time to weaving and became a weaver by trade he lightened his heavy labors at times by attention to the garden surrounding his workshop, performing the

necessary work for the production of his food supply. “The workshop of the weaver,” says Ure in his History of the Cotton Manufactures, “was a rural cottage from which, when he was tired of the sedentary labor, he could sally forth into his little garden and with the spade or hoe attend to his culinary products. The cotton which was to form his weft was picked clean by the fingers of his younger children and was carded and spun by the older girls assisted by his wife, and the yarn was woven by himself assisted by his sons.” In the manufacture of woolen goods conditions were similar. “The work,” says James in his History of the Worsted Manufactures, “was entirely domestic, and its different branches widely scattered over the country. The manufacturer had to travel on horseback to purchase his wool among the farmers or at the great fairs or markets, and the wool, after being sorted and combed, was distributed among the peasantry and received back as yarn. The machine used by them was still the old one-thread spinning wheel, and in summer weather on many a village green might be seen the housewives plying their busy trade. Returning with his yarn the manufacturer had to seek out his weavers, who ultimately delivered to him his camelets or russells or calimancoes ready for sale to the merchant or delivery to the dyer.”

These are pictures of the manufacturing industry in England as late as 1770. “Machines” were in use, but of the simplest type, and all operated by the power of the man or woman using them, or at the best by human or animal power, and in most cases the work was performed in the household or a small shop adjoining the household.

The transformation to the “machine method” or factory system began when some power greater than that of man or beast was applied to the operation of the machines, and the machines themselves were so enlarged as to multiply their producing power. “In tracing the effect of the application of modern machinery to English industry,” says Hobson in his Evolution of Modern Capitalism, “there appear two prominent factors, the growth of improved mechanical apparatus, and the evolution of extra-human motor power. We speak of the industry which has prevailed since the middle of the eighteenth century as ‘machine production’ not because there were no machines before that time but, firstly, because a vast acceleration in the invention of complex machinery applied to almost all industrial arts dates from that period, and secondly, because the application upon an extended

scale of non-human motor powers manifested itself then for the first time." "The water frame, the carding engine, and the other machines which Arkwright brought out, in a finished state," says Cooke Taylor in his History of the Factory System, "required both more space than could be found in a cottage and more power than could be applied by the human arm. Their weight required them to be placed in strongly built walls, and they could not be advantageously turned by any power then known but that of water. Further, the use of machinery was accompanied by a greater division of labor, and therefore a greater co-operation was necessary to bring all the processes under a central supervision."

The new and enlarged machines which were thus operated by water power and brought together in factories had been invented chiefly during the eighteenth century. John Kay, in 1738, invented what was known as the flying shuttle, which doubled the amount of weaving which could be performed by one man in a given time. Hargreaves, in 1764, invented the spinning jenny, a machine which operated a number of spindles for spinning yarn, and so did many times as much as one spinner with a spinning wheel could do. Arkwright, a few years later, devised the water frame, by which the spinning jenny could be operated by water power. Crompton, a little later developed the "spinning mule," which combined the important qualities of the spinning jenny and the water frame. Before the end of the century the steam engine began to supply power and was utilized in many cases where water power was not available. Then, in 1792, came Whitney's cotton gin, by which the seeds were readily extracted from the cotton, and that valuable fiber rendered much more available for manufacturing purposes.

The effect of the development of the machine and factory system, through the devices of these thoughtful men, enormously increased the manufacturing industries of England and later of the other parts of the world. The importations of cotton into England prior to the invention of the spinning jenny averaged less than 2 million pounds per annum. With the invention of the spinning jenny and the water frame the importation of cotton and cotton manufacture quickly doubled and trebled and then grew at such rapid rate that by 1800 the importation was about 40 million pounds, by 1830, 260 million pounds and by 1840 over 400 million pounds. The importation of wool grew from less than 2 million pounds in the latter part

of the eighteenth century to 150 million pounds in 1860 and over 700 million pounds in 1890, though in this article of manufacture the growth in importation was less strongly marked than in cotton because of the fact that much of the wool used in manufacture was produced at home, while all of the cotton used was imported.

In the iron and steel industry the growth in the use of machinery was even more closely connected with the great development of recent years than in that of textiles. It was quite natural that man should seek the use of machinery in the iron and steel industry. The material to be handled was of such great weight that it could not be handled in quantities without the aid of extra-human power, and the fact that it must be manipulated while at an intense heat necessitated the use of devices of some sort for its handling. Yet a long time, a very long time, elapsed after the beginning of the manufacture of iron and steel before men developed the machinery which has resulted in such a wonderful development in the manufacture. The slow rate of growth in the earlier centuries, and the rapid rate in the past century may be measured in some degree by the world's production of pig iron, the basis of all iron and steel manufactures. Mulhall estimates the world's production of pig iron in the year 1500 at 60,000 tons, in 1700 at 100,000 tons, and in 1800 at 460,000 tons. Then the increase began to be more sharply defined, the production reaching 1 million tons in 1820, 2½ million in 1840, 7 million in 1860, 18 million in 1880, 40 million in 1900 and nearly 60 million in 1907. The increase in the eighteenth century was about one third of a million tons, and that of the nineteenth century was 39½ million tons, or more than 100 times as much as that of the eighteenth century. The great development in the transformation of iron into steel did not come until the second half of the nineteenth century, the world's production of steel in 1850 being, according to Mulhall, 71,000 tons, in 1870, 540,000 tons, in 1880, 4 million tons, in 1890,12 million, in 1900, approximately 20 million, and in 1907 about 40 million. The growth in production of pig iron and steel was more rapid in Europe than in the United States in the earlier part of the nineteenth century, but in the latter part of that century the United States outstripped all her rivals, and her production of iron and steel is now more than that of any other two countries of the world.

These wonderful developments in the production of iron and steel were even more dependent upon the development of machinery for transporting the material and handling it in the factory than was the case with the textiles. Pig iron cannot be made without having in immediate conjunction three natural materials, iron ore, limestone and some material to produce intense heat. The iron is only found in the form of “ore,” being iron mixed with rocks, earth or other matter which must be removed in order to use the iron. To do this the ore must be heated. Formerly this was done by placing small quantities of charcoal in a hole in the ground and placing the iron on top of it, and then more charcoal on top of the ore. By fanning the burning charcoal or blowing the fire from the lungs through a reed the heat was increased and the ore was softened, and by hammering it while hot the useless material was worked out. Then by further heatings it could be hammered into such form as desired. After a while it occurred to men to build a wall of stones and mud and place the ore and charcoal in this, and to make a bellows of the skin of some animal (the prototype of those which blacksmiths and other workers in metals now use), and so force the air into the bottom of the mass of charcoal and iron. With this the iron could be so heated that it actually melted and ran to the bottom of the furnace, and when cooled was ready for the finer processes by which it was made into the desired articles. After a time the walls of the furnace were built higher and if it could be located near to a waterfall the shaft of the water wheel was so adjusted as to operate the bellows and keep the stream of air flowing into the fire, for the heat of the burning charcoal was not sufficient to melt the iron without this forced draft.

This was the process by which men made iron for many generations. But it was a very expensive process, for the quantity of wood which must be used to produce the charcoal was so great that the forests were soon depleted, especially in England, where iron making became active. Efforts were made to use coal instead of charcoal, but the weight of the iron ore was so great that it crushed out the fire in the coal which softened as it burned. Then after a time it occurred to somebody to treat the coal in a manner somewhat similar to that by which the wood had been transformed into charcoal, and coke was produced and successfully substituted for charcoal in heating the iron ore and making iron.

In the United States the charcoal process was used until a period much later than that of its abandonment in England, for the supplies of timber were very great and men who were clearing the land for use in agriculture were glad to turn the wood into charcoal and find a market for it. The simple charcoal furnace and forced draft by a simple process furnished the iron-making systems of the world until the early part of the nineteenth century. As a result there were hundreds of small furnaces, simply operated, and turning out small quantities of iron, in various sections of the United States. Meantime somebody discovered that if the air which was forced into the furnace was heated before being sent into the fire it would greatly increase the heat-giving power of a given quantity of charcoal or coke, and the hot blast became a part of the larger furnaces. Then it was found that the anthracite coal of the United States was hard enough to bear the weight of the ore and would produce a heat sufficiently intense to melt it; and so a great iron industry developed in the anthracite region of the United States. Then it was found that certain bituminous coal in western Pennsylvania would make excellent coke for the manufacture of iron, and the Connellsville coke became a successful competitor of anthracite coal, and later other cokes were also used. Later came the natural gas discoveries and they contributed to iron making and working. Meantime railways were built to carry the ore to the coal or the coal to the ore or both the ore and coal to some convenient meeting point, and machinery began to be introduced for handling the ore and the coal along the railway and at the furnace. This led to the devising of other machinery for handling the iron after it left the furnace and of rollers for rolling the iron into bars and for giving it the sort of manipulation that the hammer of the earlier iron maker had given it when produced in the primitive furnaces. Then great deposits of iron ore, the richest known to the world, were discovered in the Lake Superior regions; and steam-driven machinery was devised to scoop it up from the beds in which it was found, place it in cars, which in turn carried it to the water’s edge, and dumped it into great receptacles from which it could run by the force of gravity into the hold of the steamer. Then other machinery operated by steam was devised to take it from the hold of the steamer and load it again on the cars which transported it to the furnace where it met the coal or the coke, produced, transported and handled by similar machine processes, and was turned into iron to also be handled by great machines.

While all this was happening—indeed long before the later happenings above mentioned—workers in iron had found that the pig iron coming from the furnaces contained so much carbon that it could not be successfully worked. So they managed to get rid of the carbon, by melting the iron in an open hearth and passing flames over it, and as the carbon is combustible it was gradually burned out. This made soft malleable iron, but not of the consistency to have the required strength or serve the purposes that are now served by steel. To bring it to the proper condition it was necessary to reintroduce a very small quantity of carbon so evenly that both the quantity and the distribution could be determined. This was done for many years by placing the bars of iron in a crucible or other closed receptacle surrounded by charcoal, and subjecting them to intense heat for several hours or days. So the making of steel was a slow and expensive process until about the middle of the nineteenth century. Then Sir Henry Bessemer, an Englishman, discovered that by forcing air into the bottom of a great retort containing molten iron the oxygen of the air would combine with the carbon of the iron and in a few minutes the objectionable carbon would be all burned out, and that by then reintroducing in this molten mass of pure iron the required amount of carbon in the form of spiegel iron or ferro manganese, steel could be made much more cheaply and quickly than before. William Kelly, an American, also devised a similar process about the same time. Thus began the process of modern steel making, which has in a single half century increased tenfold the world's consumption of steel and thus of iron, for a very large proportion of the iron now utilized in the world is transformed into steel before being applied to the service which it is to perform for men.

In all the processes by which iron and steel making have been transformed from the simple methods of a century or two centuries ago to the present system by which a single establishment may now make in a week or month or year as much iron or steel as the whole world then made in an equal length of time, machinery and capital have been the great causes of the development—machinery for digging iron and coal, for transporting them to the place of manufacture, for handling the material in the natural state, for handling it in the furnace, for handling it in the molten state, for rolling and shaping it after it passes from the molten state to that in which it begins to take the form of the finished product, and capital to purchase this

machinery and the great quantities of material required. “The very richness of our resources,” says J. Russell Smith in The Story of Iron and Steel, “has made such a wealth of opportunity for occupation in the United States that labor is and has been scarce. As a consequence the American iron industry has been driven over to a machine basis, and its very success has arisen from the fact that a scarcity of labor has compelled the introduction of machinery which has surpassed the dreams of its inventors. In the iron and steel industry of America man does little more than touch levers, while the balance is done by steam and electricity. Four large Bessemer converters, holding 15 or 20 tons of molten iron do their work by an air blast driven through the molten material by the force of an engine. The electric cranes swing the 20-ton charges and the heavy converters as easily as a schoolboy swings his dinner pail, and pours the new made steel into a metal mold which stands on a tram ready to take it to the hydraulic machine which draws the mold off the red-hot ingot. The manless way in which this great steel ingot is turned into a useful piece of steel never ceases to be a marvel. The great machines are seen but the plant seems to be deserted. Then there arises a rumble and roaring noise and the great piece of red-hot metal is seen to travel with all the independence of a serpent across a lot of black rollers and dive into the jaws of the rollers which squeeze it into flatter shape. Then it stops, turns over and dives again through the same rollers, which flatten it still more. After this has been repeated a few times you discover, standing on a high platform, a man or two pulling the levers which start the machinery of the six or seven thousand horsepower engines that drive the knowing rollers which are crushing and rolling the ingot into the shapes which man can use.”

“Perhaps the greatest difference between English and American steel works,” said an English writer on this subject, “is the absence of laborers in the American mills. The large and growing employment of propelling and directing machinery is responsible for this. In a mill rolling three thousand tons of rails in a day not a dozen men are to be seen on the mill floor. To witness in such a mill the conversion in a half hour of a red-hot steel ingot weighing several tons into finished stamped steel rails ninety feet long, and all this perfectly, by the agency of unseen hands, is to gain new ideas of the possibilities of mechanism, of the subservience of matter to mind.”

These are some of the steps by which the systems of the manufacturing world have been, in the past 150 years, transformed from household work, or that of the small shop, into that of the factory—and the factory developed into enormous establishments through the investment of great sums of money in the purchase and installation of ever-improving machinery, more ingenious, more productive, more costly, but turning out more and better of the finished product with each new device and new investment of capital.

III. DEVELOPMENT OF THE FACTORY SYSTEM.

The inventions by which the manufacturing of the world was transformed from the household and the workshop to the great factory were the result of years, generations indeed, of study of conditions one by one as they arose. “No one of the inventions which were greatest in their effect,” says Hobson, “was in the main attributable to the effort or ability of a single man: each represented in its successful shape the addition of many successive increments of discovery; in most cases the successful invention was the slightly superior survivor of many similar attempts. This is the history of most inventions. The pressure of industrial circumstances directs the intelligence of many minds toward the comprehension of some single point of difficulty, the common knowledge of the age induces many to reach similar solutions, that solution which is slightly better adapted to the facts comes out victorious, and the inventor, purveyor or in some cases the robber is crowned as a great inventive genius.”

England was the earliest scene of the development of the factory system, the bringing together of great buildings and centers of great masses of machinery operated by water or steam power and manned by great numbers of people—for however ingenious the machine a certain amount of human intelligence is necessary for its management and the conduct of the work which it is to perform. The reasons for the earlier development in England are not difficult to find. It had its colonies in all parts of the world, from which to draw the raw material and in which to market the manufactures, for it for many years discouraged or prohibited manufacture in the colonies; it had great shipping facilities for transporting its products to all parts of the world, and to bring raw material and food supplies to its workers at home; the ownership of its lands in great estates had a tendency to send to the cities and manufacturing centers that part of the population which under other circumstances would have employed itself in agriculture; the laboring population yielded more readily to the methods of the manufacturing interests than in other countries where trade guilds determined more definitely the occupations and methods of occupation of the working

classes; and the comparative freedom from wars permitted a more rapid growth than that of other countries in which disturbances of this character were more frequent and more liable to frequency than in an insular country, England. “When Crompton’s mule, Cartwright’s power loom and Watt’s engines were transforming the industry of England,” says Hobson, “her continental rivals had all their energies absorbed in wars and political revolutions.”

Much of the wool and flax required in the English industries was produced at home. The colonies supplied the other fibers; the ships returning from their voyages to the colonies brought the raw silk; the absence of mountains to separate the country and the people into districts and classes enabled the interchange of labor and materials; the early development of rivers and canals gave cheap transportation; the plentiful supply of coal encouraged the development of steam power; and the proximity of iron ore and coal aided in developing that other great manufacturing industry, iron and steel. Mr. Mulhall, the celebrated statistician, estimates the value of the manufactures of the United Kingdom in 1780 at 177 million pounds sterling, France 147 million, Germany 50 million, Austria 30 million, Russia, Italy and Spain 10 million each, and the United States 15 million. In 1896 he estimated the value of the manufactures of the same countries as follows: United Kingdom, 876 million pounds sterling; France, 596 million; Germany, 690 million; Austria, 328 million; Russia, 380 million; Italy, 190 million; Spain, 121 million; and the United States, 1,980 million. According to his estimate the gain in the 116 years, from 1780 to 1896, was: United Kingdom, from 191 to 876 million pounds sterling; France, from 115 to 596 million; Germany, from 50 to 690 million; Austria, from 30 to 328 million; Russia, from 10 to 380 million; and the United States, from 15 to 1,980 million. Mr. Mulhall’s estimates put the total value of the manufactures of continental Europe in 1780 at about 1½ times those of the United Kingdom; in 1896 at about 3 times those of the United Kingdom. His estimates put the value of manufactures in the United States in 1870 at about 3⅓ per cent that of all Europe; in 1896 at about 55 per cent that of all Europe.

It must not be supposed, however, that this transformation was, by any means, instantaneous. It was, in fact, a matter of slow growth, even in the older countries, and still more so in those countries which had not yet developed their natural products or their agricultural industries. In the case

of the United States, for example, the transformation from the hand to the machine methods did not come until many years after that of the leading countries of Europe. The reason for this slow movement on the part of the United States is not difficult to understand. Her people were chiefly engaged in agriculture, in felling the trees and clearing the lands in the eastern part of the country, and in opening farms on the prairies of the great West. Those who had capital to invest in enterprises other than that of agriculture gave their attention to the construction of methods of transportation, first, toll roads, stage coaches and pack trains, then, canals, and finally railways. This occupied the attention of the people of this new country for a generation after the people of Europe and especially England were engaged in developing their manufacturing industries.

So it is not surprising to see that Mr. Mulhall's figures show that English manufactures in 1820 were nearly 6 times as much as those of the United States, and in 1840, 4 times as much as those of this country; and even in 1860, considerably exceeded our own. But in the next twenty-year period there came a great change. The Civil War in the United States, with the home demands in the manufacturing section, the North, rapidly developed the manufacturing industries, and the development thus created continued after the close of that unhappy period. So his figures indicate that in 1888, the next date which his table touches, that our manufactures were 1¾ times as much as those of the United Kingdom, and in 1896, 2¼ times as much in value as those of the United Kingdom and half as great as those of all Europe. Accepting the figures of Eugene Parsons, elsewhere referred to, for the European countries in 1904, and accepting the official figures of the United States for that same year, we find that the figures of the value of manufactures in the United States are nearly 3 times those accredited to the United Kingdom and but little less than those of all Europe.

It is proper to say, however, that these statements, whether of Mulhall, Parsons, or other authorities on this subject, are liable to be extremely misleading unless carefully and intelligently considered. The reason of this is found chiefly in the fact that the official figures of the United States are made up on a materially different basis from those of the other countries in question. To be sure, the figures of the United States are official and therefore may be considered reliable as to the facts which they purport to show, but in fact some of the things which they purport to show are

presumably quite different from those quoted for the other countries included in these estimates—for they can be only estimates for the other countries, since no country other than the United States takes a census of manufactures (England is taking one as this text is being issued, but has not yet completed it), and the figures quoted regarding their manufactures are necessarily estimates. Generally speaking, it may be said that the census of the United States includes certain articles which are not usually classified as manufactures in other countries, such as products of slaughtering, canning, the milling industry, etc. Aside from this it must also be remembered that the usually quoted figures of the United States' manufactures include many duplications, due, as elsewhere explained, to the fact that the total so quoted is merely an aggregation of the product of all factories; and as the product of one factory often becomes the manufacturing material of another, its value is again reported by the manufacturer who reports merely the total value of his products. These duplications are so numerous and prevail in such important and costly articles that the census estimates the net or true value of our manufactures at but about two-thirds as much as the usually quoted figures of gross products. It would appear, therefore, that the usually quoted figures of "manufactures in the United States," when compared with the estimate of manufacturing in other countries, should be reduced about one-third to make them properly comparable with those usually quoted for the other countries of the world. Even if this were done, however, it would show the value of the United States' manufactures probably about twice as great as those of the United Kingdom and probably little less than those of continental Europe.

Taking Mulhall's figures for the other countries which he includes, as presented in a table on another page of this text, it will be seen that the chief growth in manufacturing during the 116 years covered by the table under consideration has occurred in the last third of the period. English manufactures, he says, grew from 177 million pounds sterling to 290 million in the 40-year period from 1780 to 1820; from 290 to 577 million in the next 40 years, from 1820 to 1860; and from 577 to 976 million in the 36 years from 1860 to 1896—a growth of 113 million pounds sterling in the first 40 years, of 287 million in the second 40 years, and of 400 million in the third period of 36 years. Germany showed a more rapid growth in the third period; the growth in the first 40-year period being from 50 million

pounds sterling to 85 million; in the second 40-year period, from 85 to 310 million; and in the third period, of 36 years only, from 310 to 690 million. France has not made as rapid a gain as Germany, the figures showing her products in 1780, 147 million pounds sterling; in 1840, 220 million; in 1860, 380 million; and in 1896, 596 million.

The total of Mulhall's table, including the somewhat over-estimated figures of the United States, and relating chiefly to the products of Europe and the United States, show total manufactures of all the countries named, in 1780, 480 million pounds sterling; in 1820, 865 million; in 1860, 2,404 million; and in 1896, 5,710 million, again indicating that the chief growth has occurred in the last third of the period under consideration, the period of transformation from the hand industries to those of machine production in conjunction with vast sums of capital and plentiful transportation facilities for collecting the raw material and distributing the finished product.

When we consider nations or groups of people and their use of modern methods of manufacturing, we may properly say that the principal manufacturing sections of the world are western Europe and the United States, and that, as above indicated, the bulk of the world's manufactures by the factory process are now produced in those two sections of the world. Manufacturing by machinery may perhaps be said to have originated in England, spreading thence to France, to Germany, and westward to the United States. More recently it has extended in a somewhat limited form into Canada in the west and India and Japan at the extreme east. India has utilized modern methods of manufacture, especially in cottons and certain other industries, for more than a score of years, while the one other country of the Orient which has as yet entered the field of machine manufacture, Japan, though somewhat later in adopting machine methods, has been more active and extended modern manufacturing to a much greater variety of industries than have the people of India.

While certain of the European countries were earlier in the manufacturing field than the United States, the larger population, the greater supply of natural materials, the larger supplies of fuel for cheap power, the ingenuity of the American workman, and the enormous domestic demand of an active and prosperous people, have brought the United States clearly to the head of the list of manufacturing nations. It may safely be said that the value of

manufactures produced in the United States is approximately twice as great as that of any other manufacturing nation, and that the stated value of our manufactures is nearly as great as the estimated value of the manufactures of all Europe. The latest official figures on the value of the manufactures of the United States are those of the Census Bureau, which put the value of manufactures produced in the calendar year 1904, as recorded by the Census of 1905, at 16,867 million dollars, including in this an estimate of a little more than 2 billion dollars' worth of manufactures classed as "mechanical and neighborhood industries," which were included in all former census reports, but not recorded by the Census of 1905, which was by law merely a census of manufactures produced under "the factory system."

No other country than the United States takes a periodic census of its manufactures. The United Kingdom is at the present time about taking for the first time a census of its manufactures, but no figures with reference thereto are as yet available. As a consequence all statements regarding the value of manufactures of European countries, or indeed of any country other than the United States, are estimates and estimates only. True, they are based upon certain known facts of quantities of raw materials consumed in manufacturing, values of manufactures exported, and the estimated proportion which these form of the total manufactures; but in no other country than the United States are there available official statements of the total value of manufactures produced in the country in question. Therefore the estimates of the value of the manufactures produced by European countries which are quoted from time to time and which are presented elsewhere in this text, must be accepted as merely estimates. A comparatively recent estimate, and one which has been given wide publicity, and appears to have been generally accepted, is that of William J. Clark, published in The Engineering Magazine in 1904, which put the value of the manufactures of the United Kingdom at 5 billion dollars, Germany 4,600 million, France 3,450 million, Austria-Hungary 2 billion, Russia 1,980 million, Italy 1,700 million, Belgium 750 million. These estimates, if accepted, would bring the value of the manufactures of the countries enumerated to a figure slightly in excess of that officially reported by the Census Office as the value of the product of all manufacturing establishments of the United States in 1904. The figures above quoted for

certain European countries present however no estimate of the value of the product of Switzerland, Spain, Holland and the Scandinavian countries, so that it probably might be said with greater accuracy that the stated value of the manufactures of the United States is about equal to the estimated value of continental Europe, and about three times as great as the estimated value of the manufactures of the United Kingdom.

It is proper, however, before leaving this question of the relative value of the manufactures of the various countries, to again call attention to the fact that the official figures of the value of manufactures produced in the United States include certain articles not classed in certain other countries as manufactures, and in addition to this contain many duplications due to the fact that the products of one manufacturer frequently become the raw material of another, and thus the grand totals which merely combine the stated value of the product of each manufacturer necessarily include a second and in some cases a third valuation of the products thus utilized. The manufacturer of yarn, for example, reports to the Census Office the full value of the product of his factory. The manufacturer of cloth, who utilized that yarn, also reports the full value of the product of his factory, and thus includes in that valuation the value of the yarn purchased by him but already reported by the manufacturer of yarn. The manufacturer of clothing, in stating the value of the product of his factory, includes the sums which he paid for the cloth already reported by the manufacturer of clothing and included in his statement. Thus many duplications occur in our census statement of the gross value of the products of the manufacturing industries of the United States. “This gross value,” says the Census Report of 1900, page cxxxix, “does not represent the final value of the manufactured products of the country. It does fairly represent the total value of commercial transactions involved in manufacturing enterprises.... As the finished products of one branch of manufacture are constantly used as materials in other branches, in the ascending scale of modern industry, it follows that they are counted over and over again, swelling in this manner the gross total value of products. Thus in cotton manufacture, the product of the yarn mill, manufacturing yarn for sale as the material of the cloth mill, and the product of the cloth mill as the material for the manufacturer, so that by the time the aggregate is made the value of the yarn has been counted three times and the value of the cloth twice.... Duplications and re-

duplications of this sort run all through the total value of products as reported by this (the Census) office. * * * The net or true value of the products is found by subtracting from the gross value the cost of all materials purchased in a partially manufactured form. In 1900 the cost of these manufactures was $4,633,804,967 and" (subtracting this sum from the gross value, $13,004,400,143), "the net value of products was therefore $8,370,595,176."

When it is further considered that the Census of Manufactures in the United States includes in its list of manufactures all products of slaughtering and meat-packing establishments wholesale, valued in 1905 at 112 million dollars, the product of printing and publishing newspapers and periodicals only, valued at 309 million, and the product of canning and preserving fish, oysters and vegetables, valued at over 100 million—it will be seen that an effort to determine even approximately the share of the world's manufactures produced by the United States or by the various manufacturing nations of the world is a difficult—an impossible—task.

It may safely be asserted, however, that the United States is the world's greatest manufacturing nation, and that the value of our manufactures exceeds those of any other country. This is due, as already indicated, to the fact that our supply of raw materials is greater than that of any other country, our supply of materials for producing power also greater than that of any other country, our use of machinery for manufacturing far in advance of that of any other nation, the activity of our inventors and the skill of our workmen quite equal to those of any other part of the world, and the demands of our home population upon our own manufacturers far in excess of those of any other country, both by reason of the large population and high purchasing power of a people prosperous and active in all lines of industry—agriculture, transportation, manufacture. The country which produces three-fourths of the world's cotton, twice as much iron and steel as any other single nation, as much copper as all of the remainder of the world combined, more of wood suitable for use in manufacturing than any other country, more wool than any other of the manufacturing nations, and a population much larger than that of any other country actively engaged in the manufacturing industries, has quite naturally and almost necessarily become the leading manufacturer of the world.

The growth of the manufacturing industry in the United States has been phenomenal. Stated in the methods of valuation followed by the census above referred to—the gross valuation—the value of manufactures produced in the United States has been, speaking in round terms, in 1850, 1 billion dollars, in 1860, a little less than 2 billion, in 1870, 4¼ billion, in 1880, 5⅓ billion, in 1890, 9⅓ billion, in 1900, 13 billion, and in 1905, a little less than 17 billion, though the figures usually quoted for 1905 are 14.8 billion, owing to the fact that the Census of 1905 only included factory products, and added parenthetically an estimate of 2 billion as the probable value of the "mechanical and neighborhood industries," thus bringing up to nearly 17 billion the total properly comparable with the totals of earlier periods, which in all cases included the mechanical and neighborhood industries.

That this rapid growth in the value of manufactures has been far in excess of the consuming capacity of the home population is evidenced by the growth in exportation of manufactures, which aggregated in 1880, 122 million dollars, in 1890, 179 million, in 1900, 484 million, and in 1908, 750 million. Manufactures formed in 1880 but 15 per cent of the total exports, in 1890, 23 per cent, in 1900, 35 per cent, and in 1908, 41 per cent of the total merchandise exported from the United States.

IV. CAPITAL IN MANUFACTURING.

Another factor which entered into the modern system of production, and a very important one, was that of capital. The factory could not be established or operated without considerable amounts of money or its equivalent, credit. The machinery which transformed the raw material into the finished product, the material itself, the very buildings in which the work was performed, the payment for the transportation which brought it together, the wages of the men and women engaged in the work, all required capital, and in large sums. The accumulation of this capital, its management, the keeping of accounts of cost of material and labor and of the finished product, required financial skill and acquaintance in the markets in which this capital could be obtained; for often the sums required were in excess of the quantity possessed by the individual who had invested his all in the buildings and machinery, and must needs borrow of some other capitalist the additional sums required for purchasing material and paying the wages of his workmen. Sometimes the owner of the capital preferred to supply it and take a proportionate share in the earnings of the factory, and thus developed the company. Then, as the business grew and the investments of various men in a single establishment increased, it became necessary for them to take an active share in the management either in person or by representatives who became known as the “directors” of the work.

Thus arose the successors of the individual manufacturer, the company, and the corporation. Man must die and the death of an individual manufacturer, or the manager of a manufacturing firm or partnership, must affect disadvantageously the interests of the factory and its employes. Thus the importance of organizations which would continue unchanged in form and general management in case of the absence or death of any individual. This was one of the reasons for the establishment of the corporation. More important than this was the facility which it offered to holders of capital in sums large or small to invest their money in manufacturing without being compelled to give their individual attention to the industry in which the money was invested. The board of directors, which the investors might

choose, managed the business either by personal attention or by the selection of competent and experienced persons for that service, and the investor felt assured that his money would be properly managed by the competent business men forming the board of directors and the experts whom these directors might employ to manage the details. Hence the corporation, under which the manufacturing establishments grew to enormous proportions, employing thousands and tens of thousands of people, and bringing material from the places in which it could be most cheaply obtained, investing money if need be in facilities for transporting and even producing the raw material, and cheapening the cost of production.

Another step which increased the importance of capital as a factor in the great manufacturing industries of the world came in more recent combinations of great corporations, in which a number of great manufacturing establishments agree to operate under one general management, thus adjusting production in the various lines of manufacture to the general demand, existing supply and prospective consuming power of the markets, establishing systematic methods for exploiting and selling the finished product, and so further minimizing cost of production and distribution. This last combination, the corporation of corporations, is generally known as the “trust” or “combine,” and under it the great manufacturing industries of the world have reached their greatest development, the cost of production has been minimized, the field for the selection of the materials has been enlarged, and the area in which the products are offered for sale also greatly extended.

While these great organizations, made up by placing under one general management a number of great establishments manufacturing articles of like character, are doubtless able to reduce the cost of production and distribution and prevent production in excess of probable demand, it is also true that they are in many cases able to exercise a greater control over prices of labor, of material and of finished product than when operating singly.

Meantime the world’s supply of money for investing in manufacturing, and the industries which contribute thereto, greatly increased. The world’s gold production in the decade ending with 1840 averaged but 13½ million

dollars per annum. Then, owing to the gold discoveries in California and a little later in Australia, the production so much increased that the annual average in the decade ending with 1860 was 135 million dollars per annum, or ten times as much as on the average in the decade ending with 1840. For the next 35 years the production averaged about 125 million per annum. Then, suddenly, through the discoveries of great gold deposits in Africa and Alaska, the production began to exceed 200 million per annum, then 300 million, and in 1906, 1907, 1908 and 1909 averaged more than 400 million per annum, or as much in a single year as in the 40 years from 1800 to 1840.

Gold, unlike most other productions prized by man, is not consumed. It has enduring qualities; and the facility with which it can be transformed without material loss from one form for use to any other required form enables man to retain and accumulate a large part of the products of a long period. The wheat produced in one year is eaten before the next year is ended. The cotton crop of one summer is turned into clothing and worn to rags by the time another crop is ready for the factory and workshop. But the gold is conserved and utilized as money or the basis of money, and the accumulations of the recurring years merely increase the stock of that generally accepted medium of exchange. To be sure a small share, perhaps one-fifth, is used in manufacturing and the arts, and a small percentage lost in various ways; but probably three-fourths of the gold product enters circulation in the form of money or its equivalent, and thus increases very rapidly the world’s money supply.

Meantime the systems built up in the business world by which business is performed with mere pieces of paper which represent the gold and silver accumulations have greatly multiplied the available stock of money; and the ease with which it may be transferred from place to place, from country to country, and from continent to continent also adds to its availability and frequency of use in the world’s transactions. The supply of that article which the manufacturing and business world terms “money,” whether in the form of gold, silver, paper, credits, instruments of exchange, or otherwise, has increased beyond accurate computation. The world’s stock of gold has, according to the estimates of experts, doubled in the last 25 years; and it is probable that the supplies of other forms of currency; which serve as money; have increased quite as rapidly.

All of this increase in the world's supply of money has increased the amount available for investment in manufacturing, and the increased use of machinery meantime in that industry has required great increases in the investment. While there are no ways of accurately measuring the world's investments in manufacturing, it is practicable to do so in the case of the United States, the only country which regularly takes a census of its manufacturing industries. Its figures for the census years from 1850 to 1905, as to number of establishments, persons employed, wages paid, capital invested and value of product, are as follows:

Census year.	Establish-ments, number.	Capital, million dollars.	Wage-earners, number.
1850	123,025	533	957,059
1860	140,433	1,010	1,311,246
1870	252,148	2,118	2,053,996
1880	253,852	2,790	2,732,595
1890	355,415	6,525	4,251,613
1900	512,254	9,817	5,308,406
1905	533,769	13,872	6,157,751

Census year.	Wages Paid, million dollars.	Cost of Material, million dollars.	Value of Product, million dollars.
1850	237	555	1,019
1860	379	1,032	1,886
1870	776	2,488	4,232
1880	948	3,397	5,370
1890	1,891	5,162	9,372
1900	2,322	7,345	13,004
1905	3,017	9,498	16,867

It will be seen from a study of this statement, which compares conditions in the manufacturing industries at each recurring census from 1850 to 1905, that while the number of establishments in 1905 was four and one-third times as many as in 1850 the number of wage-earners was six and one-half times as many, the wages paid twelve and one-third times as much, the value of the product sixteen and one-half times as much and the capital employed twenty-six times as much.

This gives at least a suggestion as to the growth of investment in manufacturing. So far as relates to the United States, the only country for which we have statistics on this subject, the enormous increase in the use of costly machinery in manufacturing has increased the sums required for carrying on the industry, and machinery has in a marked degree been substituted for man in the factory operations. The number of wage-earners employed increased, it will be seen, a little more than fivefold while the capital employed increased twenty-fivefold. The tendency to bring the manufacturing industries into large establishments is also shown in some degree in the fact that while the number of establishments increased but about threefold the number of employes increased fivefold and the value of the manufactures turned out increased twelvefold.

Even these figures do not, however, give a complete view of the relative growth in the number of large manufacturing establishments, the capital invested and the product turned out, because of the fact that the census enumeration of “manufacturing establishments” includes hand and

household industries, such as blacksmith shops, wheelwright and wagon repair shops, boot and shoe repairers, harness makers, tailor shops, dress making, millinery, carpenter shops, custom, saw and gristmills, etc., etc., in all of which the capital invested or the product per establishment at this time averages probably little more than formerly. It is in the greater establishments, the factories, that the increase in investment and in producing power per factory has occurred. The Census of 1905, which was by law confined to manufacturing establishments conducted under the factory system, and that exclusive of neighborhood and mechanical industries, found that the number of establishments manufacturing for the general market and not merely for local orders or neighborhood consumption, and which could thus be considered as manufacturing establishments conducted under the factory system, was but 216,262, while under the former method of including hand and neighborhood industries the number of establishments would, it is estimated by the census, have been in 1905, 533,769. The 216,262 establishments enumerated as "conducted under the factory system" employed $12,686,000,000 capital and 5,470,321 wage-earners, or an average of 25 each, and turned out $14,802,000,000 worth of manufactures; while the 317,506 smaller establishments, the "hand and neighborhood industries" formerly included in the general census returns, are estimated as having employed $1,186,000,000 of capital and 687,430 wage-earners, or an average of about 2 employes each, and turned out $2,066,000,000 worth of manufactures.

It will thus be seen that the larger manufacturing establishments, those "conducted under the factory system producing articles for the general market as distinguished from the product made upon order for a customer," are those proper to be included in a study of the development, capital invested, persons employed, wages paid, material used and value of the product turned out. Unfortunately a study in this form cannot be extended over any considerable term of years, because of the fact that the United States census only began in 1905 to make this distinction or separation of the true "factory" from the great mass of establishments turning out manufactured products. It did, however, present in 1905 an estimate for the year 1900 of the number of establishments properly comparable with those enumerated in the factory census of 1905. This estimate puts the total number of "establishments conducted under the factory system" in 1900 at

207,562, and in 1905 at 216,262, an increase of but 4.2 per cent in the number, while the capital employed in 1900 was $8,979,000,000, and in 1905, $12,686,000,000, an increase of 41.3 per cent; the wage-earners in 1900, 4,715,023, and in 1905, 5,470,321, an increase of 16 per cent; wages paid in 1900, $1,736,000,000, and in 1905, $2,266,000,000, an increase of 30.5 per cent; materials used in 1900, $6,578,000,000, and in 1905, $8,504,000,000, an increase of 29.3 per cent; value of product in 1900, $11,411,000,000, and in 1905, $14,802,000,000, an increase of 29.7 per cent.

It will thus be seen that even in the recent period, 1900 to 1905, the percentage of growth in “capital invested” was greater than in any other important branches of the industry, the increases being: in capital 41.3 per cent, in wages paid 30.5 per cent, in value of product 29.7 per cent, and in number of wage-earners 16 per cent, while the number of establishments increased meantime but 4.2 per cent. It is thus apparent that although the tendency of the past thirty years has been distinctly toward an enlargement of the factory through the increase in capitalization rather than an increase in the number of establishments, that tendency still continues as the most distinctly marked characteristic of the development of the period 1900 to 1905.

Unfortunately the facilities for comparing the capitalization, product, etc., in 1905 with that of earlier years only extends, in its relation to all the factory industries, to the Census of 1900. In a few of the important industries, however, it is possible to compare conditions in 1900 with those of earlier censuses. The Census of 1900 shows that the number of boot and shoe factories in the United States fell from 1,959 in 1880 to 1,600 in the year 1900, while the capitalization increased from an average of $21,957 per factory to $63,622 per factory, the number of wage-earners from 57 to 89 per factory, the wages paid from $21,951 to $36,985 per factory, and the value of the year’s product turned out from $84,763 per factory to $163,142 per factory. In cotton goods the number of establishments in 1880 was 1,005, and in 1900, 1,055, the capital per establishment in 1880, $218,412, and in 1900, $442,882, the number of wage-earners in 1880, 185 per establishment, and in 1900, 287, the wages paid in 1880, $45,387 per establishment, and in 1900, $80,180, the value of product in 1880, $209,901 per establishment, and in 1900, $362,349. In iron and steel the number of

establishments was in 1880, 699, and in 1900, 668, average capital per establishment in 1880, $294,652, and in 1900, $858,371, wage-earners per establishment in 1880, 197, and in 1900, 333, wages paid per establishment in 1880, $78,020, and in 1900, $180,869, value of product turned out per establishment in 1880, $418,583, and in 1900, $1,203,545. In woolen goods the number of factories fell from 1,990 in 1880 to 1,035 in 1900, the capital per establishment increased from $48,289 in 1880 to $120,180 in 1900, and the value of the product increased from $53,755 per establishment in 1880 to $114,425 in 1900.

It will be seen from the figures above presented that in these four great industries the tendency from 1880 to 1900 was distinctly in the direction of reduction of the number of factories, and a greater increase in capitalization than in that of persons employed, wages paid or in value of product turned out; while the figures covering the operations of the entire factory system for the period 1900 to 1905 also show a continuation of this same tendency toward a greater growth in capital than in persons employed, wages paid or value of product turned out.

V. TRUSTS AND COMBINATIONS.

The great increase in the size of the manufacturing establishment and of the capital invested in the manufacturing industry which necessarily followed the adoption of expensive machinery for manufacturing purposes was followed by a tendency toward co-operation and mutual agreements among the great organizations engaged in similar lines of work, the purpose being to reduce expenses, increase profits and control prices. Originally the persons, firms or companies engaged in manufacturing disposed of their products as best they could and in direct competition with others in their own line of manufacture. If the market for their product was good they demanded higher prices. If there was an oversupply they sold for whatever profit they could get, or if necessary at cost or even lower than cost, in order to prevent accumulations of stocks or the closing of their factories. The competition thus grew intense. In order to dispose of their goods they must put many salesmen into the field, they must advertise freely, and often their orders came from such distances that the cost of delivery formed a large percentage of the cost of the goods by the time they reached the purchaser.

This competition of one manufacturer with another making the same line of goods was not only expensive but resulted in working at cross purposes in many ways, and in loss of energy and money. So certain of the companies or corporations engaged in like industries began to make agreements among themselves by which they could co-operate in distributing their supplies to a given field and reduce the expenses of supplying that field. It was argued that the people of any section would only use a given amount of any standard product, and that the expense which the various manufacturers were incurring in competing among themselves for their respective shares in that trade might be materially reduced by an agreement through which the extraordinary efforts to sell in competition with each other should be abandoned and each manufacturer receive the share of the sales to which his proportion of production would entitle him. Not only would this reduce unnecessary expenses but it would in some degree render possible the maintenance of prices as they might be mutually agreed upon.

The first steps in combinations or agreements of this sort are known as “pools.” “This form of agreement,” says J. Russell Smith, “provides that each of the makers of a certain material for a certain territory should make a stipulated proportion of the product to be sold at an agreed price. If a factory made more than its share the owner made a cash payment to the pool and the money went to some manufacturer who had made less than his share. The weak spot of these pools was their absolute lack of power of coercion and that no member had faith in the others.” Often members took advantage of technicalities to violate the spirit of the agreement, and the agreements were short-lived. The system, while it is still working satisfactorily in Germany under the name of the “cartel,” failed to give satisfactory results in the United States, and also met with disaster in the fact that the courts held it to be a combination in restraint of trade and therefore unlawful.

To overcome these defects and create a system of division of production, control of prices and distribution of profits in proportion to the value of the plants co-operating, a new form of agreement was devised. It provided that the companies or corporations entering the agreement for mutual operation and proportionate distribution of profits should transfer the shares of their respective properties to a new corporation with full powers to manage the same, receiving in lieu thereof certificates which should entitle the holder to his proportionate share of the net earnings of the new corporation. “Under this form of organization,” says the Universal Encyclopedia, “the stockholders of each of the separate companies assigned their stock to a few trustees, giving thus an irrevocable power of attorney. In lieu of the stock assigned the trustees issued stock certificates to the stockholders of the separate companies and upon these trust certificates profits were divided. All of the earnings of the different members of the company were pooled and each manufacturer received his proportionate share as evidenced by the certificates, regardless of the question whether his establishment was running or closed. The trustees, having in their hands the voting power of all the stockholders, elected whatever persons seemed to them best as officers of the separate companies. In this way the management was absolutely unified and the interests of all parties concerned became as one. The courts finally holding that this trust agreement was illegal, the plan was later adopted of organizing a new company which should buy up all of the

separate plants of the different companies entering the combination, so that in this way a unified management was secured within the law. In order that a more convenient form of handling the properties of the different companies might be secured, a third form of organization was later adopted in which a new company is organized as a stockholding company. This company then buys up all, or a large proportion of, the stock of each of the companies coming into the organization and controls these stocks. The officers of the central organization are thus in a position, by voting the stocks of different companies, to elect the directors and officers of those companies and thus control their policy."

The advantages of this combination over competition are summed up by the Encyclopedia Britannica, in its 1902 edition, as follows: (1) The cost of selling may be greatly lessened; (2) the salaries of commercial travelers and their traveling expenses can be largely reduced; (3) if different manufacturing establishments, scattered throughout the country, are brought under one management it will be possible for orders for goods to be distributed so that goods can be dispatched to customers in each case from the nearest establishment and freight expenses reduced; (4) when several establishments are combined the most skillful of the managers can be selected for the general manager; (5) each business manager is likely to have some special excellence in his methods of management, and by combining the establishments it is possible to so distribute this managerial skill as to give to each branch of the work the man best suited to its conduct; (6) it is also possible to distribute the various branches of the manufacturing to the various mills or factories of the combination best suited for that particular branch of the work; (7) the advantages of unifying in one establishment the machinery of selling the product of all; (8) the ability of an establishment to fill large orders on short notice gains and retains business; (9) the great financial and business strength and skill of the combined organization gives it special facilities for pushing its goods into foreign markets, as is shown by the success abroad of the Standard Oil Company, and the American Tobacco Company; (10) better facilities for dealing with credits and thus aiding the business community.

Whether trusts, through their control of prices of the particular commodities which they manufacture, have actually advanced the selling price to the consumer, has been and is still the subject of much discussion. It has been

urged that the mere reduction of the cost of production and distribution which results from the combinations would enable them to realize larger profits than formerly, even if the manufactures are sold at former prices, and that although their profits have doubtless been large it has not been accomplished through an actual advance in prices to the public, but rather through economies of production and sale. Nelson's Encyclopedia, issued in 1908, discussing this subject, says, "The weight of evidence indicates that, judged from the margin between price and finished product and cost of raw materials, prices are increased somewhat by the existence of trusts. It is a fair conclusion that the actual prices of goods have as a rule been somewhat increased by trusts, although not in the measure that was anticipated at the inception of the trust movement." The Encyclopedia Britannica of 1902 in discussing this subject says, "Experience seems to show beyond question that whenever the combinations are powerful enough to secure a monopolistic control it has usually been the policy to increase the prices above those obtained during the period of competition which preceded the formation of the combination."

As to the effect of trusts upon wages it may be said that up to the present time no very strongly marked change is perceptible in the matter of rates of wages paid by the trusts as compared with other employers in the same line. Doubtless the combinations of numerous establishments under one general management have reduced the numbers of employes in certain lines, but in those lines in which the trusts require labor for the carrying on of their work no marked changes in the rates of wages have been developed as a result of the combinations. In steadiness of employment for the men and women engaged in the work of the establishments it seems probable that the trusts or great combinations of this character offer certain advantages, since their business is less liable to fluctuations than that of the smaller, and even in the absence of orders they are more likely to continue work accumulating stocks for future use than is the small manufacturer with limited capital or credits. In the matter of relations with the labor organizations certain of the trusts have made long time agreements with the labor organizations, thus adding to the steadiness of employment, though in some cases the trusts have declined to recognize the demands of labor organizations.

An example of the causes and methods of the combination of kindred manufacturing interests under one general central organization is found in

the United States Steel Corporation as described by J. Russell Smith, in his "The Story of Iron and Steel." No industry, he says, is naturally so uncertain and consequently so competitive as the steel industry. The demand for the product is fitful and uncertain because most of it goes into new constructions and new enterprises, and these are notorious for the spurts and depressions of demand which affect them.... The uncontrolled iron and steel market can make wild rises unknown to many commodities, because it is difficult to suddenly increase the amount of manufactures in response to sudden demand. A wave of prosperity sends a thousand industries which must have iron and steel clamoring, begging for steel. When the industrial sky darkens purchases of iron and steel cease as suddenly as they began and the price must tumble if the output is sold. These were the normal conditions through which all steel makers lived down to the depression of 1893-98. The numerous independent manufacturers thought that if they could get together and agree upon prices they could improve their condition. Attempts to achieve this in the form of pools provided that each of the makers of a certain material should make a stipulated proportion of the product to be sold at an agreed price, and if a factory made more than its share, the owner made a cash payment to the pool. The weak part of these pools was their absolute lack of power of coercion, and the further fact that no member had faith in the other.

The failures in the attempt at price control resulted in the consolidation of many companies, formerly rivals, under one control. The chief companies which later became members of the United States Steel Corporation formed two distinct groups, each group classified according to the product. One group included the manufacturers of unfinished steel, such as ingots, billets, plates and slabs, and included the Carnegie Steel Company, the Federal Steel Company, and the National Steel Company. Other companies which purchased the product of these manufacturers of unfinished steel and turned it into the finished state included the American Tin Plate Company, the National Tube Company, the American Steel and Wire Company and others. The first thought which came to the minds of this finishing group when hard times compelled them to cut down costs was to cheapen their raw material (such as pig iron, steel ingots, billets, etc.) by becoming manufacturers of their own pig iron. The Carnegie Steel Company had already done this and had obtained facilities for transporting the ore to the

coal fields of Ohio and Pennsylvania and facilities for transforming the ore into the classes of material which it supplied. The Carnegie Steel Company thus became independent of other companies in the supply of its fuel, its ore, and the transportation of the same, and all of the requirements of operation. When the finishing companies announced their purpose to also supply themselves with the same facilities for producing their own raw material through the ownership of ore lands, transportation, facilities for smelting, manufacture of pig iron and the steel which they themselves required, the raw materials group could not view this operation with unconcern. It meant the loss of their market and necessity of seeking new markets in the United States or in foreign countries. As a consequence, the companies designated as the raw materials group, making pig iron, steel billets, etc., announced that they would establish their own finishing plants and thus compete directly with the group of companies which had formerly occupied the field without interference by the great organizations transforming the ore into the earlier processes of pig iron and steel billets. Mr. Carnegie announced that he would build a finishing mill in northern Ohio at the end of his ore railway which would eclipse anything that the world had ever seen and would be in equipment without a rival in the world. The Federal Steel Company increased its holdings of ore and coal, of upper-lake railways, and of lake steamers, and prepared to establish its plants for turning out finished products. Thus was threatened a doubling of the capacity of production of iron and steel in all of its stages, a capacity already far beyond that of the markets of the United States. Pools had failed, and the earlier trusts, aiming at monopolizing each line of the iron trade, had in the first temporary depression come face to face with the immediate prospect of ruinous competition among themselves. Then came the supreme effort at controlling prices through the creation of the most stupendous corporation that man has yet dared to launch—the United States Steel Corporation. This combination included most of the companies of both groups referred to—the producers of unfinished steel and those transforming the same into the finished product. The combination formed under the leadership of Mr. J. Pierpont Morgan controlled two-thirds of the steel output of the country.

The new company began business in April, 1901, and a comparison of prices since that date with those of earlier years shows regularity and

steadiness of prices rather than any marked decline or advance. “This price-steadying,” says J. Russell Smith, “is of incalculable benefit to the independent manufacturer (as well as to the combinations) even when it limits the heights to which a price spurt will go. Rapidly rising prices start a feverish, intoxicated condition of the market very pleasant while it lasts, but followed by a more unpleasant reaction; therefore the Trust tries to keep sober and keep its little brothers sober also, and all are profiting by the new temperance.... Despite its efforts at control, the Trust is not as near monopoly as it was the day it began. The four full years of its operation, 1902-1905, inclusive, did not indicate any increased share of production. The bulletin of the American Iron and Steel Association shows that during these four years there was an almost universal decline in the percentages of iron and steel products made by the Trust.”

VI. THE IRON AND STEEL INDUSTRY.

The history of the iron and steel industry of the world forms an excellent example of the recent advance in manufacturing. The manufacture of iron and steel has made perhaps a more rapid advance than have many others, and its development is due in such a marked degree to the use of machinery and the investment of large sums of capital in the industry that a detailed study of the history and causes of its development seems justified.

Pig iron is the basis of all iron and steel manufacturing, in whatever form, and the record of production of this single article gives at least a suggestion of the growth in the other lines of the industry, the growth in production of the finished articles ready for consumption. The pig iron production of the world in 1800 is estimated at 460,000 tons; in 1850, 4,422,000 tons; in 1895, 29,300,000 tons, and in 1903, 46,381,000 tons. The product of 1850 was thus nearly ten times as much as in 1800, that of 1895, 63 times as much, and that of 1903, 100 times as much as in 1800, while the figures for the year 1907, give a total of 50 million tons or 109 times as much as in 1800.

Great Britain was the world's greatest pig iron producer in 1800 and in 1850. In 1800 she produced 41 per cent of the world's pig iron, and in 1850, 50 per cent. By 1895, however, she had begun to take second place, the United States standing at the head of the list of pig iron-producing countries at that time, the product of Great Britain forming 27 per cent of the world's total and that of the United States 32 per cent. In 1903 the United States showed a still greater lead in this industry, producing in that year 39 per cent of the world's total product; while Germany, which held a low rank as a producer in 1800 and 1850, actually exceeded Great Britain in 1903, producing 22 per cent of the world's total, while Great Britain produced but 19 per cent of the total. Great Britain's production grew from 190,000 tons in 1800 to 8,935,000 tons in 1903; Germany, from 40,000 tons to 10,085,000 tons; the United States, from 40,000 tons to 18,009,000 tons; and all other countries, from 190,000 tons to 9,352,000 tons. In 1800 the

United States produced but 9 per cent of the world's pig iron; in 1903, 38 per cent; and in 1907, 41 per cent.

It will be seen from these figures that the greatest growth in the world's pig iron production has occurred in the United States.

Turning from the comparison of growth in pig iron production in the leading iron-producing countries of the world and comparing the growth of the iron industry in the United States with that of other manufacturing industries, we find that the development in this line has been greater than that of other leading industries. The census figures show that the value of the product of the blast furnaces, steel works and rolling mills of the United States, combined, grew from 297 million dollars in 1880 to 906 million in 1905, having thus more than trebled in value in that period, while the value of the cotton manufactures grew from 211 million to 250 million, having little more than doubled; that of the woolen and worsted manufactures, from 194 million to 308 million; lumber and timber products, from 234 million to 580 million; boots and shoes, from 166 million to 320 million; leather, from 200 million to 253 million; and flour and gristmill products, from 505 million to 713 million in the same time. In the various branches of iron and steel manufacturing there was also a remarkable growth. Foundry and modern ship products grew in value from 215 million dollars in 1880 to 800 million in 1905; structural iron work, from 3½ million to 91 million; and wire and wire work, from 19 million to 71 million.

This increase in value of the various classes of iron and steel products does not by any means show the actual increase in quantity produced, because of the fall in prices meantime. Practically all of the important classes of iron and steel products have fallen greatly in price as the quantity produced has increased. Pig iron, for example, averaged $33 per ton in 1870, and $18 per ton in 1908; steel rails, $107 per ton in 1870 and $28 per ton in 1908; bar iron, rolled, $79 per ton in 1870 and $38 per ton in 1908; and cut nails, 4.4 cents per pound in 1870 and 2.2 cents in 1908. The iron ore production in the United States grew from 3 million tons in 1870 to 52 million in 1907; pig iron, from 1.6 million tons to 26 million; and from 69 thousand tons in 1870 to 23 million tons in 1907.

Another characteristic of modern manufacturing is exemplified in the study of the iron and steel industry and the relation of capital, labor and product, as is also the concentration of industries into great establishments and groups of establishments. As has already been noted, the value of the product of the iron and steel blast furnaces, steel works and rolling mills grew from 297 million in 1880 to 906 million in 1905, having thus a little more than trebled in that time. In the same period the capital invested in these same establishments increased from 231 million dollars to 936 million; the capital having quadrupled while the product was trebling in value. During the same time the same establishments increased the number of their employes from 140,978 to 242,640, the number of employes having therefore increased but about 75 per cent while the capital was increasing 300 per cent and the value of the product about 200 per cent. The wages paid to the employes increased from 55 million dollars in 1880 to 141 million in 1905; the total wages paid having increased 156 per cent while the number of employes increased 73 per cent, indicating a marked increase in wages paid per individual.

The tendency to concentrate the production of manufactures into great establishments is also strikingly shown in the record of the iron and steel industry in the past few years. The census figures show the number of establishments in the United States in the group, “Iron and steel, including blast furnaces, steel works and rolling mills” at 1,005 in 1880, 645 in 1890, 668 in 1900, and 605 in 1905. The 1,005 establishments in 1880 produced 297 million dollars’ worth of the product; the 645 establishments in 1890 produced 431 million dollars’ worth; the 668 establishments in 1900 produced 804 million dollars’ worth; and the 605 establishments in 1905 produced 906 million dollars’ worth of the product. Thus the average production per establishment was, in round terms, in 1880, $296,000 worth; in 1890, $668,000 worth; in 1900, $1,200,000 worth, and in 1905, practically $1,500,000 worth. This gives an average product in 1905 of 5 times as much value per establishment as in 1880, while the fact that prices of 1905 were less than those of 1880 indicates that the growth in product per establishment was even greater than the above figures of value would suggest. Prices of pig iron, for example, which averaged for “No. 1 foundry” $28.48 per ton at Philadelphia in 1880, averaged but $17.88 per ton in 1905; bar iron, rolled, $62.04 in 1880 and $38.49 in 1905; steel rails,

$67.52 per ton in 1880 and $28.00 per ton in 1905; and cut nails, $3.68 per keg of 100 pounds in 1880 and $2.00 per keg in 1905. It will be seen from these figures that prices in 1905 were little more than half as much as in 1880 and that the figures which give an average of five times as much value of product per establishment in 1905 as in 1880 therefore really indicate an average product of probably ten times as much in quantity per establishment in 1905 as in 1880.

That the iron and steel industry is especially suited to production in large establishments is indicated by the fact that the value of the product of the steel works and rolling mills of the United States in 1905 averaged nearly four times as much per establishment as that of those engaged in cotton manufacturing.

Even these figures of value of product per establishment at the various dates and in the various industries do not, by any means, measure the degree of concentration of the industry which has come in recent years, because of the fact that under the most recent methods, many of the establishments are managed in groups, many large mills or factories which were considered by the census as separate establishments being, in fact, combined under one management, as is shown in another part of this work in which trusts and combinations are discussed.

This tremendous growth of the iron and steel industry of the United States —of the world, in fact, but more especially of the United States, seems to justify a somewhat detailed historical and descriptive account of iron and steel making, ancient and modern.

The manufacture of iron and steel is older than history. The material is so widely distributed over the surface of the globe that man in every part of the world and in nearly every stage of civilization long since learned its value. There is evidence that it was known to the Egyptians, the Assyrians, the Chaldeans, the Babylonians, the Israelites, the Greeks, the Persians, the Romans. Caesar found the Britons in possession of iron weapons which they had made, and the Scandinavians of that period were also acquainted with its manufacture. The people of Spain seem to have been early and successful workers in iron and steel, if the wonderful stories about the

swords and other weapons of the early history of that country are to be believed.

Iron, wherever found in the native condition, is so mixed with rock, dirt and other foreign matter that it can only be utilized by heating and hammering or rolling until the pure iron is separated from the foreign substances. Originally the method seems to have been to heat the ore in fires built on the ground until it became softened, and by hammering it in this condition work out the foreign substances. Then man found that by building the fire in a hole at the top of a hill and leaving an opening at the bottom so that air could be forced into it, the heat could be intensified. Then he learned to build up a wall of mud and stones with an opening at the bottom, and by placing in it alternate layers of charcoal and iron ore and forcing in air at the bottom with rude bellows similar to those now used by blacksmiths, he was able to heat the ore until the iron melted and ran together into a mass which he worked into the steel with which the famous “Toledo blades” and other weapons of that early day were made. Later, the Germans, by building the walls higher and getting a greater mass of the fuel and ore, were able to melt it so that it ran in liquid form into little ditches at the bottom of the furnace. This furnace, which came to be known as the “stuckofen” and “blow oven,” was the precursor of the blast furnace. Meantime the English were developing the process, and before the year 1700 were manufacturing considerable quantities of iron in furnaces in which charcoal supplied heat sufficient, when a blast of air was introduced, to melt the iron. This method of manufacturing iron continued in the European countries during all of the seventeenth century and until the early part of the eighteenth century. Meantime the forests of England were being rapidly destroyed in the sections which produced the iron ore. Prior to that time it had not been found practicable to use coal in smelting the ore, because the weight of the ore was so great that the fire was extinguished as the coal grew soft from the heat. Then, in the early part of the eighteenth century, somebody tried the experiment of treating the coal in a manner similar to that by which wood is turned into charcoal, and coke was produced and found available for smelting the iron ore, the coke being substituted for charcoal. And so the manufacture of iron in Europe went on, developing most rapidly in England which had ore, timber from which to make charcoal, and coal from which to make coke.

Meantime the making of iron began to develop in the United States. The early colonists found ore in Virginia and New England. Small quantities of pig iron were made in Virginia within a few years after the settlement of Jamestown, and in the latter half of the century New England began manufacturing iron from bog ore and charcoal made in the forests which were then so plentiful. Most of these early iron furnaces were “bloomaries,” merely heating the iron so that it formed a lump of 100 to 200 pounds weight at the bottom of the furnace, called a “bloom,” though there were some furnaces which heated the ore until the iron ran into little channels at the bottom and became “pig iron.” Before the year 1800 the State of Massachusetts alone had some 75 iron works, chiefly furnaces, making small quantities of iron. A little later there was built in that state a furnace then declared to be “the finest in America,” having two bellows twenty feet in length and operated by a water wheel. During the next century the size of the furnaces grew slowly and before the year 1800 there were furnaces capable of making two to three tons of iron per day each.

The history of the early iron industry in Massachusetts is not materially different from that of others of the colonies and early settlements. Connecticut, New York, New Jersey, Pennsylvania, Maryland, Delaware, Virginia, and the Carolinas all had numbers of small furnaces capable of making from a half ton to two or three tons of iron per day. They used charcoal altogether as the fuel, and it was estimated in Virginia and Maryland that for one furnace of average size four square miles of woodland and 100 slaves were required. The fact that there were then no means of transportation other than pack trains and that iron was too heavy to transport any considerable distances, encouraged every neighborhood to sustain its furnace and forge, and from these local factories of pig iron and iron bars the local blacksmith and others who aided him in supplying local wants drew their supplies. It is probable that the number of furnaces and forges in the United States at the beginning of the nineteenth century was much greater than at the end of the century, though the product of 1800 was but 40,000 tons of pig iron, against 14,000,000 tons in 1900 and 26,000,000 tons in 1907.

Meantime the English iron manufacturers had learned to smelt the ore with coke instead of charcoal. The quantity of wood required to make charcoal for smelting the ore had been so great that the forests of England were

being rapidly destroyed, and a series of experiments had developed the fact that by heating coal in a pit or oven, in a manner similar to that by which charcoal was produced from wood, the charred coal, called coke, could be used as a substitute for charcoal in iron furnaces. This substitute for charcoal did not come into use in the United States until much later, however, for the reason that the people of the eastern part of the United States were still anxious to get the timber off their lands to use them for agricultural purposes, and so were glad to turn it into charcoal and dispose of it to the iron furnaces at a low cost. In time, however, the supply of charcoal began to run low and the Americans began to cast about for a substitute. After a series of experiments it became evident that the anthracite coal of Pennsylvania could be used for iron smelting, as it was hard enough to bear the weight of the iron ore piled upon it, and also made a much more intense heat than did the bituminous coal which grew soft as it was heated and was useless in the furnace. By 1840 the making of pig iron with anthracite coal became an established industry and by 1854 the quantity of iron made by the use of anthracite was as great as that from charcoal, about 350,000 tons for each. But as the supply of anthracite was limited to a comparatively small area, those sections which had no anthracite and had run short of the timber supply for making charcoal began to cast about for a substitute, and hearing of the success of the English, with “charred coal,” or coke, began its use in the United States; and by 1856 there were more than a score of furnaces making pig iron by the use of coke. It was also found that if the air which was forced into the furnace was heated before entering a much more intense heat could be obtained and the use of the hot blast was soon established.

With iron being made by the use of anthracite coal and coke made from bituminous coal, the people began to realize that the destruction of the forests to produce charcoal should not continue longer, and the making of charcoal iron rapidly decreased. Meantime the railways began to develop and were able to carry coal and coke to the places where the ore could be easily obtained, or to which it could be easily brought. Such a place was Pittsburg, for example. Iron ore was produced in certain parts of Pennsylvania and on the northern shores of the Great Lakes. Coal of a suitable quality for making excellent coke was produced at Connellsville, in western Pennsylvania. Limestone is required in great quantities in smelting

iron ore, as the alkaline quality of the limestone neutralizes the acid of the waste matter forming a part of the iron ore and makes it melt at a lower temperature, the melted limestone also carrying off the impurities in the form of “slag,” and limestone was also plentiful near Pittsburg. Some of these materials could be floated down the rivers or on the Great Lakes, at least a part of the way from the place of production to the place at which they were combined, and for the remainder of the distance railways carried them over comparatively level or down-grade routes at small cost.

So, with the advent of the railway and the steamship the methods of iron making changed. The railway and the river or lake steamer could carry the finished product at such low cost that it was no longer necessary that each county should make its own iron, and more than that, they could carry the ore and the limestone and the coal or coke to any place convenient for assembling these necessary materials and distributing the finished product.

This combination of the raw materials and the manufacture of the iron in a few great establishments instead of many small ones encouraged the use of machinery in manufacturing. Machines were wanted for handling the ore, for handling the coal, for handling the limestone, for handling the molten material which issued from the furnace, and for turning it into the finished form, sometimes accomplishing this without allowing the material to grow cold and harden at any point between the time it trickles from the blast furnace and its completion as a steel billet, a rail for the railway, or a roll of barbed wire for the ranchero of South America.

The iron as it leaves the blast furnace is not in a condition in which it can be used for manufacturing. It contains so much carbon and other impurities that it is brittle and breaks easily. This condition is similar to that of the “blooms,” or chunks of metal which came from the early furnaces and which had to be refined by laborious processes of reheating and hammering until the impurities were worked out.

Before the year 1800 it had occurred to somebody in England that if flames could be forced across the surface of the molten iron and the iron kept in a state of constant agitation the flames would burn out the carbon. This was accomplished by making an open hearth to contain the molten material and “puddling” the iron as the flames were forced across the surface. Then a

series of grooved rollers was devised, between which pieces of partially cooled iron could be passed and repassed, and this machine process worked out the “slag” and other impurities which had been formerly worked out with hammers. This puddling and rolling began in England before the year 1800 and “the puddle and the grooved roll,” says J. Russell Smith, “closed the era of the blacksmith’s supremacy and opened the era of machine manufacture.” It was an adaptation of these methods and combination of them with the concentration of the material at convenient centers that proved the beginning of the machine-manufacturing methods in the United States at a considerably later period than in England.

The most notable step in developing the use of iron, however, was that by which it was quickly and cheaply turned into the reliable form known as “steel.” As already explained, the iron when it leaves the blast furnace contains such quantities of carbon, silicon, sulphur, phosphorus, and other impurities that it is brittle and unreliable as to tensile strength, flexibility, or the qualities which make it available for edged tools. The puddling process already described deprived it of the carbon and sulphur, but left it too soft for immediate use. It required a small and fixed amount of carbon to give it the qualities of steel and this was replaced by reheating it in air-tight receptacles in combination with powdered charcoal. By this process steel was made, but it was a slow and expensive process. About the middle of the last century, William Kelly, of Pittsburg, conceived the idea that by forcing air through the molten iron as it came from the furnace the oxygen of the air would combine with the carbon of the iron and burn out the carbon, leaving the remainder pure iron. A series of experiments proved the accuracy of his theory, and he made steel by this process. About the same time Sir Henry Bessemer, of England, devised a similar process and it was put into practical operation in England and later in the United States. By this process, developed almost simultaneously in America and England by these two men, the transformation of iron into steel in a brief space of time and at a small cost was established, and the manufacture of steel developed with wonderful rapidity. The quantity of steel manufactured in the United States in 1870 was but 69,000 tons; in 1880, 1,247,000 tons; in 1890, 4,277,000 tons; in 1900, 10,188,000 tons; and in 1907, 23,363,000 tons. With this great development in manufacturing came a great development in the use of machinery for handling not only the finished steel itself but the pig iron

from which it was manufactured, the iron ore from which it was produced and the coal and limestone used in its production. With this growing use of machinery in the manufacture and the great increase in the quantity used in the industries of the world have come the enlargement of the establishments and the increase in the capital invested described at the opening of this section.

This process of burning out the carbon and other impurities from the molten iron by forcing air and thus combining the oxygen of the air with the carbon of the iron, although it seems to have been devised almost simultaneously by Kelly in the United States and Bessemer in England, is usually denominated the "Bessemer process," and while Kelly obtained certain patents and a half million dollars for his invention, Bessemer also obtained other patents and it is said ten millions of dollars for his.

The process of transforming iron into steel by the Bessemer process is described by Herbert N. Casson in "The Romance of Steel," as follows:

> "A converter is a huge iron pot twice as high as a man. It is swung on an axle, so that it can be tilted up and down. Although it weighs as much as a battalion of five hundred men, it can be handled by a boy. About thirty thousand pounds of molten iron are poured into it; and then, from two hundred little holes in the bottom, a strong blast of air is turned on, rushing like a tornado through the metal. Millions of red and yellow sparks fly a hundred feet into the air.
>
> "The converter roars like a volcano in eruption. It is the fiercest and most strenuous of all the inventions of man. The impurities in the iron—the phosphorus, sulphur, silicon and carbon—are being hurled out of the metal in this paroxysm of fury. The sparks change from red to yellow; then suddenly they become white.
>
> "'All right!' shouts the grimy workman in charge.
>
> "The great pot is tilted sideways, gasping and coughing like a monster in pain. A workman feeds it with several hundred pounds of a carbon mixture, to restore a necessary element that has been blown out. Then it is tilted still farther; its lake of white fire is poured into a swinging ladle and slopped from the ladle into a train

> of huge clay pots, pushed into place by a little locomotive. The converter then swings up and receives another fifteen tons of molten metal, the whole process having taken only a quarter of an hour.... Today there are more than a hundred Bessemer converters in the United States, breathing iron into steel at the rate of eighteen billion pounds a year. It is well worth a visit to Pittsburg to see one of these tamed Etnas in full blast. Nothing else in the world is like it."

Discussing the importance of the discovery of the method by which common iron is thus cheaply and quickly transformed into steel, J. Russell Smith, in his "The Story of Iron and Steel," says:

> "Archaeologists and ethnologists agree that before the dawn of datable history a milestone of progress was marked when our ancestors had, at enormous cost, won a pound or so of iron per capita and begun the iron age. The keen analyst of the present, seeing our railways, our ships, our cannon, our sky scrapers, has erected another milestone, and this he calls the Age of Steel.
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> "The close of the Civil War found the iron-making world in full possession of the Bessemer process of converting that metal into steel.... The variety of uses for this metal is absolutely beyond enumeration.... Within the space of a generation we have increased our iron consumption fourfold.... This is the age of power. Man has changed his economic and social conditions in that he has harnessed the forces of nature to make them do his work. Our main dependence, thus far, has been upon fuel, chiefly coal. The power in the form of the steam generated in the boiler is kept imprisoned in iron pipes until released in the steel cylinder, where a steel piston drives forward a steel rod, which communicates the force to a steel fly wheel, turning on a steel shaft, and sending the power away to various places where man wishes to use it.
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> "Portable engines, entirely made of iron and steel, are drawn about the country, or move themselves and carry loads.... The dynamo rests upon a heavy iron frame and swings its iron arms and iron magnets through space, whence it mysteriously winds out power.... The second of the great iron uses is to be found in the machines

driven by the power that man has learned to harness.... Transport is the third member of the mechanical trinity which goes with power and machines to make the present epoch. For a long time the railways consumed half of man's total iron product. The street railway of the city is also a heavy consumer. The elevated railway is nothing but a bridge spanning the city in all directions, and the subway, its latest rival, is but a steel tunnel burrowing beneath the ground. In the country, the erection of the trolley lines is now giving us a second set of railways, and even the poles are coming to be made of iron. Half a century ago iron ships began to be common, a quarter of a century ago the ship-builder turned to steel, and now there is almost nothing else afloat upon the high seas.... Our structures are becoming more and more dependent upon the products of the blast furnace and the steel mills. Our fathers contented themselves with brick and stone and wood. The limitation of wooden beams and the cheapness of Bessemer steel caused that material to be used in heavy structures in a limited way, and as wood increased in value and knowledge of the use of steel increased, we now see the modern sky scraper in which wood is eliminated and steel the absolute essential....

"It is therefore natural to expect that the blast furnace should be among the most thoroughly organized and most highly developed pieces of mechanism yet devised. It is certainly the most fearful of all man's creations, and considering the character of the process which goes on within it and its unapproachable heat, it is under a wonderful degree of control. At the present time, the blast furnaces are a hundred feet high, consist of a great iron stack lined with some nonfusible material, and when in operation are filled from top to bottom with roaring fire. Into their fiery throats are fed alternately small carloads of coke and iron and limestone, and from the bottom there flows away at intervals two molten streams—one the precious iron upon which our civilization rests; the other the useless slag, to be got rid of in the cheapest possible way.... The burning of this modern furnace takes place under a forced draught of air blast from eight to twenty pounds per square inch. This pressure serves to drive the air upward through the hundred-foot mass which burns within

> the furnace. Otherwise, the fire would smother. The gas which results from the imperfect combustion within the furnace is a most valuable by-product and serves a valuable purpose in promoting the furnace operation, and sometimes leaves a product to sell. A part of the gas is taken to the boilers, where it generates power for the blowing engines. Another part of it is used in the so-called stoves to heat the air blast on its way to the furnaces."

The iron obtained by this Bessemer process, by which the carbon and other impurities are burned out, is, when it leaves the converter and cools, merely soft, malleable iron, and to transform it into steel there must be re-inserted a small but fixed and definitely determined amount of carbon. "Steel," says J. Russell Smith, "is simply a mixture of iron with a small amount of carbon, very intimately and evenly associated in its mass. The carbon content of steel varies from .40 per cent to 1.50 per cent. Steel making is, therefore, a process of mixing carbon and iron in proper proportions. Inasmuch as it cannot be made satisfactorily in a puddling furnace, by reducing the carbon to a proper point and then stopping the furnace, it has been found necessary to burn the carbon all out, making wrought iron, and then working it back to steel by recarbonizing under such conditions that the carbon can be controlled. The iron, after having all of its carbon and other impurities burned out by the Bessemer process, is raised to steel by having thrown into it spiegel iron or ferro manganese. Both are rich in manganese and carbon. As the iron content of the Bessemer converter is known and the content of the spiegel iron is known, the carbon in the steel is under perfect control. The workman watching the flames cuts off the blast at the moment when the changing color tells him the carbon is gone. The carbon of the added material makes steel, and the manganese gives to the steel a toughness needed to make it stand the strain of being rolled into desired shapes while red-hot, without breaking....

> "The steel for the greater industries is shaped in a rolling mill. It comes from the Bessemer or open-hearth converter molded into a great billet like a piece of a large wooden beam, and this billet is carried red-hot to a so-called soaking pit, where the tongues of a flame from a gas-fire keep it heated until it is ready to start on its journey through the mills. This soaking pit is the starting point of many roads through the mill. It goes off in one direction, and

successive rollers squeeze it, crush it, and lengthen it into steel rails, in which form it emerges a thousand feet away. Other sets of rolls make the billet into flat beams for bridges or elevated railways. A third set of rolls, also starting near the soaking pits, send the product out of the distant door of the steel mill in the form of great flat plates to make the boiler of a locomotive, or a marine engine, or the sides of a steamship, and yet other sets of rollers will make square rods which finally pass under heavy shears and are chopped into pieces called billets or blooms. These pieces of steel are the raw material for other mills which may make wire, nails, or manufacture steel of any other of a thousand forms. Some billets are as big as cord wood, some no larger than lead pencils—thus it passes out into the manifold world of manufacture."

VII. THE TEXTILE INDUSTRY.

Cotton manufacturing is an important illustration of the growth in the textile industries of the world during the period in which the use of machinery has multiplied the producing power of man in the industrial lines. In all lines of textile manufacture the growth has been rapid, but especially so in cotton, which has made greater gains in the work of supplying man with the necessary requirements of life, in clothing for his body and the comforts of life, than other branches of the textile industries and than many other branches of manufacture. Mulhall estimates the consumption of cotton by all nations at 303 million pounds in 1800 and 5,900 million pounds in 1896; wool, 460 million pounds in 1800 and 2,400 million pounds in 1896; flax, 600 million pounds in 1800 and 200 million pounds in 1896; silk, 30 million pounds in 1800 and 50 million pounds in 1897. It will be seen from these estimates that the growth in consumption of cotton has been far in excess of that of any other of the important fibers. Cotton consumption in 1896 was, according to these figures, 5,900 million pounds, against 303 million in 1800, or practically 20 times as much in 1896 as in 1800, while wool consumption is set down at 2,400 million pounds in 1896, against 460 million in 1800, or only about 5 times as much in 1896 as in 1800; while in the other materials used in textile manufactures the growth has been much less than that of cotton.

Before entering upon a discussion of the growth in cotton manufacturing and the causes thereof, it is proper to say that the value of all textile manufactures in the principal countries of Europe has, according to Mulhall, grown from £96,000,000 in 1800 to £660,000,000 in 1896, and in the United States, from £3,000,000 in 1800 to £188,000,000 in 1896, the value of textile manufactures produced in Europe having thus increased about sixfold in the period in question, and in the United States about sixtyfold. It is apparent from these figures that the growth in the manufacture of cotton during the last century has far outstripped that of any other of the textiles. It is also quite apparent that the capital invested in cotton manufacturing is much greater than that in other textiles. The United

States Census reports the capital invested in the manufacture of cotton goods in 1880 at 320 million dollars; in 1905, 613 million; the value of the products of these manufacturing establishments in 1880, 211 million dollars, and in 1905, 450 million dollars. Even these figures of increased production—from 211 million dollars' value in 1880 to 450 million in 1905--do not fully indicate the increase in quantity of products, since prices in 1905 were materially less than those of 1880. The average price of standard sheetings in the New York markets was quoted at 8½ cents per yard in 1880 and 7 cents per yard in 1905; of standard drillings, 8½ cents per yard in 1880 and 7 cents per yard in 1905; of New York mills bleached shirtings, 12¾ cents per yard in 1880 and 9 cents per yard in 1905; of standard prints, 7.4 cents per yard in 1880 and 4¾ cents per yard in 1905; and of 64 by 64 printing cloths, 4½ cents per yard in 1880 and 3.6 cents per yard 1905. This indicates that the increased valuation in cotton products from 211 million dollars in 1880 to 450 million dollars in 1905, fails to fully reflect the increased quantity produced in 1905, and suggests that the quantity produced in 1905 was probably approximately three times as great as in 1880.

The disposition to increase production through enlargements of existing factories rather than by the establishment of new ones, or the combination of existing factories as an offset to the establishment of new ones, is indicated by the fact that the total number of establishments, which was reported in 1880 at 1,005, was, in 1905, but 1,154, an increase of about 12 per cent in the number of establishments, while capital was increasing nearly 200 per cent, the value of product more than 100 per cent, and quantity of product probably nearly 200 per cent.

Great Britain is in proportion to population the greatest cotton-manufacturing country of the world. She was earliest in the field as a manufacturer, developing that industry while the countries of continental Europe were engaged in wars and while the United States, now the leading producer of cotton, was developing her agricultural industries and had scarcely as yet entered upon the development of her manufacturing possibilities. The United States, by far the largest producer of raw cotton, ranks second as a manufacturer of cotton goods.

Accurate estimates of the relative standing of the various countries in the manufacture of cotton are difficult, almost impossible, especially in view of the fact that no country other than the United States takes a periodic census of its industries. There are, however, three ways by which the production of cotton manufactures in the various countries can be approximately measured: first, by the number of spindles in cotton mills; second, by the quantity of cotton used; and, third, a method which has been suggested in some quarters, a measurement of the quantity or value of cotton goods exported. This, however, would not give at all an accurate picture of the quantity produced, since the population of the cotton-manufacturing countries varies so greatly and, what is more important, the habits of life, the climatic conditions, and therefore the quantities of cotton cloths and cotton manufactures of various sorts used by their respective populations renders the third method of estimate of little value. Even the first and second methods mentioned—the determination of the number of spindles and the determination of the quantity of cotton used—do not, by any means, give an accurate picture of the relative quantity or value of cotton goods manufactured. In the United States, where cotton is plentiful, much larger quantities of cotton are used per spindle than in the European countries, and greater quantities of cotton are also used for each 100 yards of cotton manufactured than is the case in other countries. This is due, in part, to the fact that the manufacturers of the United States are producing cotton goods for their home population, living in a temperate zone climate and requiring, therefore, heavy cottons; while many of the factories of Europe are manufacturing for exportation to tropical countries, where cottons of very light weight are required. As a consequence, the European manufacturers use a less quantity of cotton per spindle and a less quantity of cotton per square yard of product than is the case with the manufacturers of the United States. The number of spindles in cotton mills in Great Britain is estimated at 44½ million in the season 1896-7 and 52 million in 1906-7, an increase of 16¾ per cent; in continental Europe, 30⅓ million in 1896-7 and 35¾ million in 1906-7, an increase of 18 per cent; in the United States, 17¼ million in 1896-7 and 25¾ million in 1906-7, an increase of 50 per cent; and in India, 4 million in 1896-7, and 5⅓ million in 1906-7, an increase of 33 per cent. The annual consumption of cotton in cotton mills is estimated, in Great Britain, 3¼ million bales of 500 pounds net in 1896-7, and 3-9⁄10 million bales in 1906-7, an increase of 21 per cent; in continental Europe,

4⅓ million bales in 1896-7, and 5½ million bales in 1906-7, an increase of 44 per cent; in the United States, 2¾ million bales in 1896-7, and 4-5⁄6 million bales in 1906-7, an increase of 77 per cent; and in India, 1 million bales in 1896-7, and 1½ million bales in 1906-7, an increase of 50 per cent.

It will be noted that although the number of spindles in the cotton mills in the United States was but 25¾ million, against 52 million in Great Britain, or about half as many in the United States as in Great Britain, the quantity of cotton used in the United States was greater than in Great Britain, being 4,822,000 bales, against 3,915,000 bales in Great Britain.

The textile industry of the United States, according to census reports, represented in 1900 investments amounting to 1,043 million dollars, employed 661,000 wage-earners, paid 209 million dollars per annum of wages, used 521 million dollars' worth of materials, and turned out products valued at 931 million dollars. The number of establishments was 4,312. Cotton manufactures formed a larger share of these enormous totals, both as to investment, wages paid, and value of products, than did any other of the manufacturing industries included under the general term of textiles. The value of cotton manufactures in 1900 was 339 million dollars, while that of wool manufactures was 297 million; silk manufactures, 107 million; hosiery; and knit goods, 95 million; and flax, hemp and jute manufactures, 48 million. Adding to this 45 million for dyeing and finishing of textiles, the value of the combined textiles in 1900 is set down at $931,494,566.

"Textiles," or "textile fabrics," may be properly described as stuffs made by weaving together of threads of any sort to produce a material with a nearly solid surface. "A fishing net," says the Encyclopedia Americana, "is not a textile, because the cords which compose it are not woven together but merely cross one another at equally distant intervals and are strongly knotted at those points. But mosquito-netting is a textile, although very open, because the threads are merely held by their own friction." Textiles in the usual sense are made of the twisted fibers spun into thread of flax or linen, cotton, hemp, jute, silk or wool, woven together by the use of a loom. "The general nature of a loom," says the above quoted authority, "is that the threads of the warp are divided into two sets, one of which is thrown upward, while the other is thrown down, and at the same moment a shuttle carrying a thread of the woof is driven through between the two sets of

warp threads. The next movement of the loom reverses the two sets of warp threads, throwing the upper one down and the lower one up, compressing and drawing tight the woof thread into the loops which show on the surface of the stuff and go to form the surface, and the shuttle is driven through again in the opposite direction. The constant repetition of this forward and backward movement of the shuttle gives a strip of woven fabric which constantly grows: and as each movement of the shuttle is made, an appliance drives the last thread of the woof back against the others, so that this growing strip of woven stuff is kept at a uniform state of firmness and solidity. It is in this way that the simplest fabrics of linens and cottons are made. If it be desired to produce a somewhat more elaborate weave, this is done by raising two threads of the warp and dropping one; or by raising three threads of the warp and dropping one, and so on. In this way the threads of the woof are seen lying in loops, or what seems to be stitches longer than those of the simplest weave.... If we take a step further and use three or four warp threads, say, of red, while the rest remain white, and do the same thing with the woof threads, we produce stripes and where these stripes cross one another there will be a little square of the solid color of the three or four threads, while the stripes elsewhere remain of the half-way tint.... In such weaving of patterns it is here assumed that the threads are dyed before the weaving is begun. The matter of printing colors upon calico, thin silk, or the like, is entirely apart from consideration of the textile fabric. Printing is done from blocks (or rolls) with color almost exactly as if the material receiving the pattern were paper instead of a woven stuff."

The above description of the method of producing textiles is sufficiently elaborate for a study of this character. The methods of producing brocades, satins, velvets and other elaborately figured textiles of any sort may be studied more in detail by reference to any standard encyclopedia or work of this character.

The fact that cotton is, as has been already shown, the most important of the textile industries, utilizing larger sums of capital, turning out greater values of product, distributing its products over a wider area and to a larger number of people than any other of the textiles, justifies a somewhat more elaborate discussion of this industry and its development during the period in which the manufacturing industries of the world have been transferred

from hand labor to that of machines, and in which capital has come to form so important a factor in production.

The manufacture of textiles from cotton is, like that of iron and steel, “older than written history.” The art of cotton spinning and weaving is believed to have been practised in India, still a great cotton-producing section of the world, from 20 to 30 centuries ago. From India the production of cotton and manufacture of cotton goods moved westward into Persia, thence to the area immediately east of the Mediterranean, then to Egypt, and even southern Europe. The Moors are said to have introduced the cultivation and manufacture of cotton into Spain during their control of that section of Europe, but the cotton-manufacturing industry which existed at Seville, Cordova and Grenada fell into decay after their expulsion from Spain and was only resumed after the British, followed by the French and Germans, had developed the art of manufacturing cotton goods by machine methods. While the manufacture of yarn or threads from cotton declined in Spain, it later made its appearance in Italy in the fourteenth century and in Germany, Prussia, the Netherlands and England in the sixteenth century, and France in the seventeenth century, but it was not thought practicable to manufacture cloth exclusively from cotton until toward the close of the eighteenth century, the cotton yarn being used only for woof, while the warp used in conjunction therewith was either wool, flax, or silk. The so-called “Manchester cottons” of earlier date were composed in part of cotton and in part of wool or linen. The first acquaintance of western Europe with cloths made entirely from cotton seems to have been in those brought from Calcutta, India (and therefore called calicoes); but the calicoes made in Europe at that time and for more than a century after were made, in part at least, of wool or linen.

Prior to the latter part of the eighteenth century all cloths, whether of wool, cotton, silk, or flax, were manufactured by hand labor. The natural fabrics were, as described elsewhere in this work, spun into threads by the use of the simple spinning wheel, chiefly by the labor of women who were termed “Spinsters.” The threads thus obtained were made into cloth by the use of a loom upon the general principles above described, but of extremely simple design and operated solely by human power. Up to this time the making of threads or yarn and their transformation into cloth by the weavers, chiefly men, kept pace fairly with one another, the supply of thread or yarn being

about equal to the demand by the weavers. “One good weaver,” says Dr. Ure, “could keep three active women at work spinning weft. In operating the loom, the shuttle which carried the thread back and forth between the raised and lowered sections of the warp was thrown back and forth with the hand, which required a constant extension of the hands to each side of the warp. In 1738 John Kay, an Englishman, devised a system by which the shuttle was thrown back and forth by means of strings attached at opposite ends of the lathe in which the shuttles ran, enabling a weaver to double the amount of cloth which he could manufacture within a given space of time, thus making the demand for yarn in excess of the supply.” “It was no uncommon thing,” says a writer on that subject, “for a weaver to walk three or four miles in a morning, and call on four or five spinners, before he could collect weft to serve him for the remainder of the day.”

This stimulated active minds in those industries to devise some method for increasing the facilities for turning the wool or cotton or flax into the needed yarn, and James Hargreaves, a weaver, devised about 1764 a machine which he called the “spinning jenny,” in which were set eight spindles in a frame put in motion by a single wheel, and by moving backward and forward a moveable carriage containing a horizontal clasp to hold the material being twisted into threads, the quantity of yarn which one person could produce in a given length of time was greatly increased. Subsequently the number of spindles in the frame was increased to 20 or 30, and in time to more than 1,000. Hargreaves kept this invention secret for a time, using it merely to manufacture yarn for his own weaving, but it finally became known and the spinners of the neighborhood, believing that it would throw many out of employment, broke into his establishment and destroyed the machine. He, however, retired to Nottingham, erected a small mill and took out a patent for the “spinning jenny,” and in time it became to be an established method of manufacturing yarn and in a more elaborate form is the principal factor in the manufacture of cotton yarns in the great factories today, the number of spindles which a modern machine of this character now uses being often in excess of 1,000, instead of the 8 utilized by the original spinning jenny.

Meantime another method was being utilized and brought into operation, by which a stronger yarn could be produced. It seems to have been originally devised by John Wyatt, of Birmingham, England, and operated upon a

system entirely different from that of the jenny. “The method adopted,” says Ellison, in his “Cotton Trade of Great Britain,” “was to pass the cotton through pairs of small grooved rollers placed horizontally, the upper and lower roller of each pair revolving in contact, the sliver of cotton, after passing through these rollers, being caught by another pair of rollers placed immediately in front which revolve with three, four, or five times the velocity of the first pair and therefore draw out the sliver of cotton into three, four, or five times its former length and degree of fineness. After passing through this second pair of rollers it was attached to a spindle, the rapid revolutions of which twisted it into a thread and at the same time wound it upon a bobbin.” This method, devised by Wyatt in 1730 and patented in 1738, was perfected by Arkwright 30 years later and was known as the “spinning frame,” but since it was operated by water power, received the name of the “water frame.” By the use of this process the cotton yarn was made of sufficient strength to permit its use for the warp as well as for the woof, and thus, for the first time, the making of cloth entirely from cotton became practicable.

“With the invention of the jenny and water frame,” says Ellison, “commenced a new era in the history of the cotton trade; in fact, so far as Europe is concerned, it may be said that the history of the cotton manufacture, as a separate and distinct industry, began with the invention of these two machines; for until the introduction of Arkwright’s contrivance for spinning by rollers, it was impossible to produce a piece of cloth composed wholly of cotton.”

Still another important device for use in the manufacture of cotton cloths was the “carding machine.” Originally the raw cotton was prepared for spinning by the use of brushes made of short pieces of wire instead of bristles, the wire being stuck into a sheet of leather at a certain angle, the cotton being spread upon one piece and combed with another until the fibers were laid straight, when it was ready for the use of the spinner. In 1748 a carding machine was devised to supersede the hand process, but it was not until toward the close of the century that carding machines took such form as to become an important factor in the cotton-manufacturing industry. Even in the closing quarter of the eighteenth century the prejudice on the part of hand laborers against machines was so great that for several miles around Blackwell every spinning jenny containing more than 20

spindles was destroyed, while a mill erected by Arkwright near Chorley was destroyed by a mob. A little later another machine was invented by Samuel Crompton, which he designated the “spinning mule,” which combined the drawing rollers of Arkwright and the jenny of Hargreaves; and it was looked upon as an improvement upon the machines of Arkwright and Hargreaves. These devices—the spinning jenny of Hargreaves, the water frame of Arkwright, and the combination of those principles in the spinning mule of Crompton—revolutionized the cotton-manufacturing industry and the principles thus embodied are still the chief factors in the great cotton-manufacturing establishments of the world today.

Another device which added greatly to the manufacturing possibilities with reference to cotton was the invention by Eli Whitney in America of the cotton gin, a machine for stripping the cotton fiber from the seeds and technically called the “gin,” probably a contraction of the word engine. It performs its work through the operation of a series of revolving saws which come in contact with the cotton through openings sufficiently narrow to prevent the passing of the seeds but permitting the fibers torn therefrom to pass downward into a receptacle, while the seeds, freed from the fiber, pass through another opening and are subsequently utilized in the manufacture of oil; though this utilization of the seeds did not develop until long after the cotton gin had become an important factor in the cotton-manufacturing industries of the world.

Through the application of these machines—the spinning jenny, the water frame, the spinning mule, and the cotton gin, driven by power generated by water or steam, and in more recent years applied, in some cases in the form of electricity—the cotton manufacturing of the world has been transferred from hand work to that of machines, and the world’s consumption of cotton today is many times as much as that of the period in which these machines were being perfected, while the quantity of cotton goods produced from a given amount of cotton is, through the refinement of machine processes, much greater than formerly. The quantity of cotton cloth produced at the present time through the development of machinery and the encouragement which its use has given to production of cotton and consumption of cotton goods multiplies many times that of the period in which the transformation from hand to machine production began, and has made cotton the leading textile material of the world.

True, other branches of the textile industry have also benefited by the application of machine methods of spinning and weaving similar to those above described; but no other important textile has seen such a remarkable growth under the stimulus of machine production as has cotton. Even as late as 1830 the cotton consumed by those sections of the world for which statistics are available only amounted to about 500 million pounds, against 8,500 million in 1907, while, as already indicated, a pound of cotton under present conditions of manufacture produces probably twice as much of a given line of manufactures as a century ago. When it is remembered that the population of the world has only doubled since 1830 and the consumption of cotton is 17 times as great as at that time, the relative growth of cotton consumption to population will be seen to have been very great.

The above figures relating to consumption of cotton and to comparison of present consumption with that of a century ago relate chiefly to Europe and the United States. Statistics of consumption are available, in addition to Europe and the United States, for India and Japan, and a few communities in which the consumption is small, such as Canada, Mexico and Australia. In addition to this, however, it must be remembered that large quantities of cotton goods are still being manufactured in certain parts of the world by the crude processes which prevailed in Europe and the United States before the adoption of the machine methods above described. In China, for example, large quantities of cotton are turned into yarn by hand spinning, and into cloth by hand weaving, and there is reason to believe that the quantity of cotton cloth manufactured in China by hand weaving, partly from yarns spun by hand and partly from yarns manufactured by machine methods, is greater than that manufactured by modern machinery. In many of the oriental countries, in large portions of South America, in large sections of Africa, and in the islands of the Pacific, millions, hundreds of millions of people are still clothed with textiles—cotton, wool, silk, or fibers—manufactured by hand processes or by simple machines operated by man power. In Europe and the United States, however, the system has been completely transformed, and machinery and money, in combination with a steadily decreasing percentage of human labor, now manufacture the cotton goods worn not only by their own people, but by large sections of the inhabitants of the oriental countries and the continents of Africa, South America and Australia.

The relative growth in the manufacture of cotton in recent years by the principal countries in which this industry has developed is indicated by the fact that the quantity of cotton consumed in Great Britain in 1887 was 2,955,000 bales and in 1907, 3,900,000 bales; that of the continent of Europe, in 1887, 2,912,000 bales, in 1907, 5,460,000 bales; in the United States, in 1887, 1,939,000 bales, in 1907, 4,950,000 bales; in India, in 1887, 569,000 bales, in 1907, 1,600,000 bales; in Japan, in 1892, the first year for which statistics are available, 99,000 bales, and in 1907, 925,000 bales; and in all other countries for which figures are available, in 1891, 106,000 bales, and in 1907, 171,000 bales.

With this elaborate use of machinery and increase of cotton production, manufacture and consumption, has come great reduction in cost of production and in prices. “In the last half of the nineteenth century,” says S. N. D. North, late Director of the Census, in the Encyclopedia Americana, “there was an increase in value of textile products in the United States of about six times and not less than ten times if it were possible to measure this product by quantity instead of by value. Even the largest figures convey an inadequate idea of the relative importance of our textile mills in the industrial economy of the nation, for those mills supply the materials for a great group of subsidiary factory industries, such as the wholesale clothing manufacture, etc. When we aggregate these, and add to them the value of the products of the linen, jute, hemp, and bagging mills of the country, we find that the product of our textile mills is larger in value than that of any single line of related industries, iron and steel excepted. The decrease in the cost of goods during the last half of the century has been one of the most striking phases of the development. This decrease is due—in some measure, of course, to the decreased price of the raw materials, but in even larger measure to the remarkable advance in methods of manufacture—to the new and more perfect machinery employed, in the invention of which American mechanical genius has contributed certainly as much as that of any other people, and perhaps more. All the fundamental inventions in spinning-machinery were of English origin. The French and Germans have also done much in the invention of labor-saving textile machinery, but the American record may be shown to have surpassed them all. The wool-carding machinery of all countries owes its chief improvement over the machines of a century ago to the invention of John Goulding, of Worcester, Mass. The

modern cotton spindle, making 10,000 revolutions a minute, is an evolution of our own mechanics, and the saving effected by new forms of spindles invented and adopted in the United States since 1870, when 5,000 revolutions per minute was the average speed, has been more than equal to the capacity of all the warp-spinning machinery in use in this country in that year. In structural equipment, the modern American mill," continues Mr. North, "is, in some respects, superior to the average foreign mill. It is not so massive a structure, nor so solidly built, brick being used here while the English usually use stone; and in the lightness and airiness of its rooms, in economy of arrangement and general completeness of equipment and care for the comfort and convenience of the operatives, it is usually superior. While many parts of the machinery required for the equipment of our textile mills are still necessarily imported from England because not made, or less perfectly made, in the United States, our machine manufacturers have been advancing as rapidly in recent years as the textile mills themselves, and the time cannot now be far distant when every new mill built in America will be equipped throughout with American-made machinery. The American textile mills now supply practically every variety of fabric made in the world, with the exception of linens and the very finest grades of other fabrics."

The Census of 1905 shows the value of cotton manufactures of the United States in 1850, 62 million dollars; in 1860, 115 million; in 1880, 192 million; in 1900, 331 million; and in 1905, 442 million; the capital invested in 1850, 75 million dollars; and in 1905, 605 million; the wages paid in 1860 (no figures for 1850), 24 million dollars; in 1905, 94 million; the number of wage-earners in 1850, 122,000; in 1905, 310,000; the number of spindles, in 1860, 5¼ million; in 1905, 23 million; the number of looms, in 1860, 126,313; in 1905, 540,910; the cotton consumed, in 1860, 423 million pounds; in 1905, 1,873 million pounds.

A marked characteristic of the cotton industry of the United States in recent years has been the gradual movement of the industry away from New England, where it was originally established, toward the cotton-producing section, the South. The number of cotton-manufacturing establishments in the New England States fell from 439 in 1880 to 308 in 1905, while those in the South increased from 161 to 550 in the same time. The number of spindles as shown by the Bureau of Statistics of the Department of

Commerce and Labor, in the Northern States as a whole, increased from 10 million in 1880 to 17⅓ million in 1908, while those in the Southern States increased from a little over a half million in 1880 to over 10 million in 1908. In the principal cotton-manufacturing countries of the world the increase in spindles during the last decade has been as follows: Great Britain, from 44½ million in 1897 to 52 million in 1907; continental Europe, from 30⅓ million in 1897 to 36 million in 1907; the United States, from 17 million to 25¾ million; India, from 4 million to 5⅓ million; and Japan, from a half million to a little over 1½ million. The 36 million cotton spindles in continental Europe are, according to Ellison, distributed as follows: Germany, 9 million; Russia and Poland, 7 million; France, 6 million; Austria-Hungary, 3¾ million; Italy, 3 million; Spain, 2¾ million; Switzerland, 1½ million; Belgium, 1⅓ million, and the remainder distributed among Switzerland, Holland, Portugal and Greece.

VIII. THE MANUFACTURING INDUSTRIES OF THE UNITED STATES.

The fact that this story of the world's manufactures is intended primarily for the information of people of the United States, coupled with the further fact that the United States is itself the world's largest producer of manufactures, seems to justify a somewhat detailed study of the manufactures of this country, the growth of the manufacturing industry, and especially the part which they bear in our foreign commerce. Originally the United States, like all new countries, devoted its attention chiefly to agriculture. The products of the soil are man's first requirements. He must have food. When he obtains food his next thought is of clothing, but that he can obtain temporarily from the skins of the beasts whose bodies supply him with food. So the production of manufactures was of secondary importance in the early development of that part of the North American Continent which is now known as the United States. The eastern part of the area being densely wooded, the work of the first and second and third generations of our forefathers was to fell the trees and prepare the ground for agriculture for the production of the wheat and corn and other foodstuffs which they must have to sustain life. If there came as a result a given quantity of potash and pearlash and leather and other manufactures of this crude type which could be utilized by the people or exported to foreign countries they accepted this thankfully, but made no special effort to develop the manufacturing industry. During the colonial days little effort was made in the development of manufacturing, except to supply the household requirements. The housewife spun and wove the wool and flax into threads and cloth, and a large part of the population was clothed in "linsey-woolsey," produced in this manner. Even during the period of the Confederation, which immediately followed the Revolutionary War, conditions in the manufacturing industries did not materially change and nobody seems to have thought them of sufficient importance to justify any governmental attention or action. Shortly after the adoption of the Constitution, however, Alexander Hamilton, the first Secretary of the

Treasury, submitted to the Congress of the United States, in 1791, a “Report on Manufactures,” which pictured manufacturing conditions in this country at that day. He enumerated some 17 industries which had “grown up and flourished with a rapidity which surprises, affording an assurance of success in future attempts.” These 17 industries were as follows:

1. Skins.—Tanned and tawed leather, dressed skins, shoes, boots and slippers, harness and saddlery of all kinds, portmanteaus and trunks, leather breeches, gloves, muffs and tippets, parchment and glue.

2. Iron.—Bar and sheet iron, steel, nail rods and nails, implements of husbandry, stoves, pots and other household utensils, the steel and iron work of carriages, and for shipbuilding, anchors, scale beams and weights, and various tools of artificers, arms of different kinds; though the manufacture of these last has diminished for want of a demand.

3. Wood.—Ships, cabinet wares and turnery, wool and cotton cards and other machinery for manufacture and husbandry, mathematical instruments, coopers’ wares of every kind.

4. Flax and hemp.—Cables, sail cloth, cordage, twine and pack thread.

5. Bricks and coarse tiles and potters’ wares.

6. Ardent spirits and malt liquors.

7. Writing and printing paper, sheathing and wrapping paper, pasteboard, fullers’ or press papers, paper hangings.

8. Hats of fur and wool and mixture of both, women’s stuff and silk shoes.

9. Refined sugars.

10. Oils of animals and seeds, soap, spermaceti and tallow candles.

11. Copper and brass wires, particularly utensils for distillers, sugar refiners and brewers; andirons and other articles for household use, philosophical apparatus.

12. Tinware for most purposes of ordinary use.

13. Carriages of all kinds.

14. Snuff, chewing and smoking tobacco.

15. Starch and hair powder.

16. Lampblack and other painters' colors.

17. Gunpowder.

In addition to the industries above enumerated, which were carried on as regular trades in many localities, Mr. Hamilton went on to describe—"a vast scene of household manufacturing, which contributes more largely to the supply of the community than could be imagined without having made it an object of particular inquiry—" and he continues—

> "Great quantities of coarse cloths, coatings, serges and flannels, linsey-woolseys; hosiery of wool, cotton and thread; coarse fustians, jeans and muslins; checked and striped cotton and linen goods; bed ticks, coverlets and counterpanes; tow linens; coarse shirtings, sheetings, toweling and table-linen, and various mixtures of wool and cotton, and of cotton and flax are made in the household way and, in many instances, to an extent not only sufficient for the supply of the families in which they are made, but for sale, and even, in some cases, for exportation. It is computed in a number of districts that two-thirds, three-fourths and even four-fifths of all the clothing of the inhabitants are made by themselves. The importance of so great a progress as appears to have been made in family manufactures within a few years, both in a moral and political view, renders the fact highly interesting. Neither does the above enumeration comprehend all the articles that are manufactured as regular trades. Many others occur, which are equally well established, but which, not being of equal importance, have been omitted. And there are many attempts, still in their infancy, which, though attended with very favorable appearances, could not have been properly comprised in an enumeration of manufactories already established. There are other articles, also, of great importance, which, though, strictly speaking, manufactures, are

> omitted as being immediately connected with husbandry, such as flour, pot and pearl ashes, pitch, tar, turpentine and the like."

The "manufactories carried on as regular trades," and included in Mr. Hamilton's category, says the U. S. Census Report of 1900, comprised such as would naturally spring up in a new country to supply the immediate necessities of the inhabitants, together with those whose materials were most abundant and inviting. Agricultural implements and other tools of industry were made in quantities fully equal to the demand. Firearms were also made. The dressing of skins, especially tanning, had become an important industry, and was carried on both in establishments exclusively devoted to the purpose, and by many shoemakers and farmers as a subsidiary occupation. The number of brewers and distillers was remarkable, and nearly the entire domestic demand for beverages was supplied by home production. Sawmills, gristmills, brick kilns, wool-carding mills, and fulling mills existed in great number, but always on a small scale, supplying only local needs. The manufacture of paper, which had been a successful colonial industry, also supplied the domestic requirements, and several glass works existed. "Iron works have greatly increased in the United States," said Mr. Hamilton, "and are prosecuted with much more advantage than formerly." The shipbuilding industry was particularly well developed and widespread. In 1793 the tonnage of the United States exceeded that of every other nation except England. In the main, however, the people had confined themselves to such manufactures as could not be imported to advantage. Foreign goods, chiefly textiles, were largely imported in exchange for agricultural products.

Such was the general condition of our manufactures at the opening of the nineteenth century. Although some progress in this direction has been made, the occupations of the people were chiefly agricultural; commerce was becoming a factor of constantly increasing importance in the development of the industrial resources of the country, while manufactures occupied the third and subordinate position.

In 1810 Albert Gallatin, Secretary of the Treasury, in response to a resolution of the House of Representatives of June 7, 1908, made a report which is an admirable summary of the condition of American manufactures at that date. Secretary Gallatin estimated that in 1809 the value of the

products of American manufactures exceeded $120,000,000. Tench Coxe's estimate, based upon the returns obtained at the Census of 1810, was $198,613,471. The censuses of 1810, 1820, 1830 and 1840 gave certain figures on the manufacturing industries of the United States, but they did not approach the completeness of the censuses of recent years, and the figures of those earlier records must be accepted only with this view of their incompleteness. Tench Coxe, as already shown, estimated the real value of the manufactures of 1810 at a little less than 200 million. The censuses of 1820 and 1830 were confessedly incomplete and their showing of manufactures does not compare favorably with the Coxe estimate for 1810. In 1840 the value of the manufactures was put at about 500 million dollars; in 1850, at one billion; in 1860, a little less than 2 billion; in 1870, 4¼ billion; in 1880, 3⅓ billion; in 1890, 9⅓ billion; in 1900, 13 billion; and in 1905, 16 billion—a sum three times the estimated value of manufactures of the next great manufacturing nation, the United Kingdom.

It must be remembered, however, that these figures of the value of the manufactures of the United States are "gross values," or, in other words, contain many duplications, as explained elsewhere, and that the net or real value of the manufactures of the country was but two-thirds of the figures above named. Even this estimate which puts the net or true value of the manufactures of the country at about two-thirds of the census gross valuation still leaves the United States so far in the lead that there can be no doubt that it is the greatest manufacturing nation of the world. Tables printed elsewhere in this text show that her production of manufactures is, even under an acceptance of the "net" value and an exclusion of certain articles not classed as manufactures by other countries, far in excess of that of any other country.

The growth by industries cannot be shown in detail in a work of this character. Suffice to say that every line of manufactures is now produced in the United States, save only those in which the work is wholly, or chiefly, performed by hand labor. The growth of the more important industries, such as iron and steel, textiles, etc., is pictured in sections devoted to those industries, and an outline of the growth in the principal articles is shown in the table on another page which presents official figures of the number of factories, persons employed, capital invested and product turned out in the

principal manufacturing industries of the country in 1880, 1890, 1900, and 1905.

The increase in the production of manufactures in the United States, far in excess of home requirements, has forced our manufacturers to seek markets in other parts of the world for their surplus product. The result has been a rapid increase in the exportation of manufactures. The total value of manufactures exported from the United States has grown from less than 8 million dollars in 1820 to 23 million dollars in 1850, 48½ million in 1860, 70 million in 1870, 122 million in 1880, 179 million in 1890, and 485 million in 1900, since which time the annual total has not fallen below the 400-million-dollar line, while in the year 1908 the total exceeded 750 million dollars. In the fiscal year 1908, the latest period for which detailed figures of the exports by countries are available, the exports of manufactures were valued at 750 million dollars, of which 368 million dollars' worth went to Europe, 188 million to North America, 72 million to South America, and 71 million to Asia, while the remainder was divided between Oceania and Africa.

That this growth has been especially marked in recent years is shown by the fact that the actual increase by decades in exports of manufactures has been as follows: During the decade ending with 1830, 1.8 millions; 1840, 5.8 millions; 1850, 7.8 millions; 1860, 25.2 millions; 1870, 21.6 millions; 1880, 51.8 millions; 1890, 57.2 millions; 1900, 305.9 millions; and during the eight years ending with 1906, 265 millions. Thus the growth of exports of manufactures in the eighteen years following 1890 was practically three times as great as that of the entire seventy years preceding that year.

Exports of manufactures from the United States now exceed 750 million dollars per annum and have doubled in value in a single decade. Not only has the exportation of manufactures doubled in a decade, but the share which products of the factory form of the total exports is steadily increasing. In 1880 manufactures formed but 15 per cent of the total exports of domestic products; in 1890 they formed 21 per cent, in 1900, 35 per cent, and in 1908, 41 per cent.

With the rapid increase of population in the United States, and therefore of the consumption of natural products, the quantity of food and raw materials

remaining for distribution to other parts of the world has not increased proportionately; and with the development of manufacturing facilities and the trend of population to the manufacturing centers, production of manufactures has rapidly increased, and the surplus of these manufactures which may be spared for foreign markets has also increased. Foodstuffs, which in 1890 formed 42 per cent of the total exports of domestic products, formed in 1908 but 28 per cent of the total; articles in a crude condition for use in manufacturing, which in 1890 formed 36 per cent of the totals, formed in 1908 but 30 per cent; while manufactures, as already indicated, increased their share in the exports from 21 per cent in 1890 to 41 per cent in 1908.

In the decade ending with 1905 exports of manufactures from the United States increased 198 per cent, while those from Germany increased 75 per cent, those from the United Kingdom 40 per cent, and those from France 25 per cent. This rapid increase in the exports of manufactures from the United States has brought her to the third rank in the list of the world's exporters of manufactures. The four greatest producers of manufactures for exportation and the value of manufactures exported by each of them in 1906 are as follows: The United Kingdom, 1,400 million dollars; Germany, 1,000 million; the United States, 700 million; and France, 500 million.

To Europe the exports of manufactures from the United States in 1892 was 76 million dollars, in 1901, 213 million, and in 1908, 368 million. To North America the exports of manufactures from the United States in 1892 were 33 million dollars, in 1908, 189 million; to Asia and Oceania the total was 25 million dollars in 1892 and 112 million in 1908; to Africa, in 1892, less than 4 million dollars, in 1908, more than 10 million; to South America, in 1892, 17 million, in 1908, 72 million. Considering the distribution by principal countries, it may be said that the total exports of manufactures from the United States to the United Kingdom was, in 1892, 40 million dollars, in 1902, 100 million; to British North America, in 1892, less than 10 million, in 1902, over 54 million; to Germany, in 1892, 14 million, in 1902, 30 million; to Mexico, in 1892, less than 8 million, in 1902, over 26 million; to British Australasia, in 1892, less than 9 million, in 1902, over 23 million; and to China, in 1892, 5½ million, in 1902, more than 23 million.

Considering the exports by great articles or groups of articles, it may be said that manufactures of iron and steel as a group form the largest item in the exports of manufactures, having grown from 52 thousand dollars in 1800 to 322 thousand in 1830, 1 million dollars in 1850, about 6 million in 1860, 13 million in 1870, 25 million in 1890, 121 million in 1900, and 184 million in 1908. Mineral oils form the second largest item among the groups of manufactures, having grown from 30 million in 1870 to 98 million in 1908. Copper manufactures rank third, the total exports having grown from 1½ million dollars in 1860 to 2⅓ million in 1890 and 104 million in 1908. Leather and its manufactures have increased their exportations from 1½ million in 1860 to 6¾ million in 1880, 12 million in 1890, 27 million in 1900, and 41 million in 1908. Exports of agricultural implements have grown from 1 million dollars in 1870 to 4 million in 1890, 16 million in 1900, and 24 million in 1908. Thirty articles or groups of articles exceeded 1 million dollars in the value of their respective exports in the fiscal year 1908. Of these thirty groups now exceeding 1 million dollars each in value annually, not one aggregated as much as a million dollars in 1820, and only three groups exceeded 1 million in 1850; in 1860 eight groups exceeded each 1 million; in 1880 the number of groups exceeding 1 million in value was 13; in 1890, 20; and in 1908, as already indicated, 30 exceeded 1 million each in the value of their annual exportations.

The causes of the rapid growth in the exports of manufactures from the United States are not difficult to determine. The growth as already indicated, has occurred chiefly since 1880, and especially in the last decade. From 1790 to 1880 the growth was a hundred million in ninety years' time. This was a period which was devoted to the development of the agricultural resources of the country and to the construction of railroads. The value of agricultural products exported grew in this period from 19 million dollars to 686 million, an increase of 667 million, while exports of manufactures were increasing 100 million. From 1880 to 1900 agricultural exports showed a gain of 206 million dollars and those of manufactures 330 million. Thus the development of domestic exports from the United States has occurred in definitely rounded periods: The first, a long period of growth of agricultural products; the second, a shorter and more recent period, in which the largest growth, and especially the largest proportionate growth, has been in exports of manufactures.

A study of the production in the United States of a few of the great articles which form the basis of manufactures and the manufacturing industries offers ready explanation of the great increase in the production of manufactures and the consequent marked increase in the exportation of manufactures. Six great articles supply the principal requisites for manufacturing, viz, iron, copper, wood, cotton, wool, and coal as the material which supplies the power by which they are first assembled and afterwards converted into manufactures. The production of pig iron in the United States which up to 1880 had never reached 4 million tons, was by 1890, 9 million; in 1900, 13½ million, and in 1907, 25 million. Of steel, the production in the United States in 1880 for the first time exceeded 1 million tons; in 1890 it exceeded 4 million tons; in 1900, more than 10 million, and in 1907, more than 23 million. Of copper, for which the demands of the world are now great, the United States produced in 1880, 27 thousand tons, in 1890, 116 thousand tons, and in 1906, 409 thousand tons. The total value of the mineral products of the United States was in 1880, 369 million dollars; in 1890, 619 million, and in 1908, 2,069 million, or 5½ times that of 1880. The cotton production of the United States was in 1880, 5½ million bales, in 1890, 7½ million, and in 1908, over 13½ million. In 1880, American mills took 31 per cent of the total American production of cotton, and in 1907 they took 32 per cent of the greatly increased total. Of wool, the production of 1880 was 232½ million pounds; of 1890, 276 million, and that of 1908, 311 million. Of coal, which has an important relation to manufactures, both in supplying the motive power for the assembling of materials and heat for smelting ores and other features of manufacturing work, as well as the power for operating the machinery of manufacture, the production in 1880 was 64 million tons; in 1890, 141 million; in 1900, 241 million; and in 1907, 428 million.

Of the six great articles here enumerated as the chief requisites of manufacturing, the United States is the world’s largest producer of all except wool. Of cotton, the United States produces three-fourths of the world’s entire supply; of copper, fully one-half; of pig iron and steel, the United States produces 40 per cent of the world’s entire supply; and in 1907 produced more than Germany, the United Kingdom, and Belgium combined, these three countries being, in the order named, the world’s next largest producers of pig iron. Of timber and wood suitable for use in

manufacturing, the United States is the world's largest producer at the present time. Of wool, the United States is only exceeded in its production by Australasia, Argentina and Russia, its total product being in 1901, 302 million pounds against 360 million in Russia, including Poland, Argentina, 370 million, and Australasia, 510 million.

In transportation, for assembling these great natural products for use in manufacturing, the facilities in the United States by far surpass those of any other country. The railroads have grown from 30 thousand miles in 1860 to 53 thousand miles in 1870, 93 thousand miles in 1880, 166 thousand miles in 1890, and 240 thousand miles in 1908, giving to the United States two-fifths of the entire railway mileage of the world; while in transportation upon the Great Lakes the registered tonnage of vessels passing through the Sault Ste. Marie Canal alone in 1907 was 44 million tons, or practically three times as much as the tonnage passing through the Suez Canal in the same year.

Proportionately the growth in exports of manufactures has been even greater than that in production of manufactures. The census figures show that the gross value of manufactures produced in 1850 was, in round terms, 1 billion dollars, and in 1905, nearly 17 billion, so that the product of 1905 may be said to be about seventeen times as great as that of 1850; while the exportation of manufactures, which in 1850 was $17,580,456, was in 1908, $750,000,000, or forty-two times as great as in 1850, indicating that the percentage of growth in exportation has been more than twice as great as that in the production of manufactures.

Of the articles which form the great and growing export trade of the United States, those grouped under the term "manufactures" number over two hundred distinct articles, though many of these are included within the special groupings, such as agricultural implements, iron and steel manufactures, mineral oils, leather and its manufactures, etc. The group agricultural implements, for example, is subdivided into mowers and reapers, plows and cultivators, and "all other," the latter term including numerous articles which are not of sufficient value to justify at present a separate statement. The group cotton manufactures includes cloths colored and uncolored, wearing apparel, waste cotton, and all other. The group iron and steel includes pig iron, bar iron, wire rods, billets, ingots and blooms,

hoop, band and scroll iron, rails for railways, tin plates, structural iron and steel, wire, locks, hinges, saws and tools, car wheels, castings, table cutlery, firearms, cash registers, electrical machinery, laundry machinery, metal-working machinery, printing presses, pumps and pumping machinery, shoe machinery, locomotives (stationary and railway), typewriters, nails (cut and wire), pipes, safes, scales, stoves and ranges, each of which is separately stated, and following these a class “all other,” which includes the less important articles not separately enumerated. Under the group leather and its manufactures are included sole leather, glazed, kid, patent, split, and other upper leather, boots and shoes, harness and saddles. Under the general title of refined or manufactured mineral oils are included naphthas, illuminating oil, and lubricating and heavy paraffin oil. Under the general title of musical instruments are included organs, pianos, and all other. Paper and its manufactures include paper hangings, printing paper, writing paper, envelopes, and all other. Manufactures of tobacco include cigars and cigarettes, plug tobacco, and all other. Wood manufactures include doors, sash and blinds; furniture; hogsheads and barrels; trimmings, moldings and other house finishings; woodenware, wood pulp, and all other. Wool manufactures include carpets, dress goods, flannels and blankets, wearing apparel, separately stated, and all other.

Taking up the various groups or classes, and with them the articles which are not subdivided, it may be said that thirty general articles show a total exceeding $1,000,000 in the exports of recent years. Exports of iron and steel manufactures as a whole amounted in 1908 to 184 million dollars; manufactured or refined mineral oils, 99 million; copper manufactures, 100 million; cotton manufactures, 25 million; leather and its manufactures, 27 million; agricultural implements, 24 million; chemicals, drugs and dyes, 21 million; cars and carriages, 22 million; paraffin, 8 million; paper and its manufactures, 8 million; tobacco manufactures, 5 million; scientific instruments, 11 million; fiber manufactures, 5 million; india-rubber manufactures, 7½ million; books, maps and engravings, 6 million.

Tracing the more important of these articles through the period from 1790 to 1908 it may be said that iron and steel manufactures, which began their record in 1790 with a total exportation of $117,060, did not reach $1,000,000 until 1840, when the total export was $1,127,877. Even in 1850 it was only $1,953,702, but by 1860 was $5,870,114; in 1870, $13,483,163;

in 1880, $14,716,524; in 1890, $25,542,208, and in the decade from 1890 to 1900 it increased nearly fourfold, the total for 1908 being $183,982,182 against $25,542,208 in 1890. The growth in the exportation of manufactures of iron and steel has been more strongly marked than that in any other important article of export except copper. It has been coincidental with the development of the great iron mines of the United States and the production of pig iron and steel.

The next article in the order of its magnitude in our exportations is refined mineral oil, which only became an article of export after the great oil discoveries in the decade 1860-1870. Its first appearance in the list of exports was in 1864, in which year the total amounted to $6,918,502, the small quantities exported in preceding years not having separately enumerated in the list of articles exported. The value of the exportations of mineral oil increased very rapidly, the total for 1864 being slightly less than 7 millions; for 1865, nearly 10 millions; 1866, over 18 millions; 1867, 22 millions; 1870, 30 millions; 1880, 34 millions; 1890, 44 millions; 1900, 68 millions, and 1908, 99 millions.

Copper, which forms the third article in rank in the exports of manufactures, is of recent date as an article of importance in the export trade. The existence of large copper deposits in the United States had been known for many years, but it was only upon the greatly increased demand for copper owing to the developments in the use of electricity as a motive power that the world began to demand copper in greatly increased quantities; and to this demand the mines of the United States promptly responded. The copper production of the United States had never reached as much as 20,000 tons prior to 1877. By 1887 it was 81,000 tons; by 1897, 220,000 tons; and in 1907, 410,000 tons. The most strongly marked increase occurred during the period of 1890-1907, the production of 1890 being 115,000 tons, and in 1907, 410,000 tons. The growth in exportation was coincidental with the growth in production. The value of copper manufactures exported in 1890 was but $2,349,392; in 1891, it was $4,614,597; in 1892, $7,226,392; in 1895, $14,468,703; in 1896, $19,720,104; in 1897, $31,621,125; and in 1908, $104,064,580 or nearly fifty times as much in 1908 as in 1890.

Leather and manufactures thereof grew from 1½ million in 1860 to 6½ million in 1880, 12½ million in 1890, 27 million in 1900, practically 30

million in 1902, and 42 million in 1909. Agricultural implements have also shown a rapid increase in exportation. In 1870 they amounted to only 1 million dollars in value; in 1880, to a little over 2 million; in 1890, nearly 4 million; in 1900, 16 million; and in 1902, 16¼ million.

Chemicals, drugs, dyes, etc., formed the largest single item of exports in 1790, pot and pearl ashes being then the principal article in the list, and have slowly but steadily increased, reaching a million dollars in 1830, 2½ million in 1870, 5½ million in 1890, 12 million in 1902, and 21 million in 1908. It is proper to add that in the later years patent medicines, which are included under this general classification of chemicals, etc., have formed a considerable proportion of this increase, the total value of patent medicines exported being in 1902, 3 million dollars out of the total of 12 million. The chemical industry of the United States has not made as rapid gains either in the relative value of its products, in the supply of the home market, or in the distribution of exports as accomplished by many other industries. The total value of the chemical productions of the country, according to the census, was in 1880, $38,640,458; in 1890, $59,352,548; and in 1900, $62,676,730, having less than doubled the value of the product from 1880 to 1900, the increase being but 60 per cent, while manufactures as a whole increased 142 per cent.

Considering the grand divisions and countries to which we send this $750,000,000 worth of manufactures exported from the United States, it may be said that literally every country of the world is a purchaser of American manufactures. In each grand division and in every country of the world the manufactured products of the United States are being consumed in steadily increasing quantities and varieties; and this consumption of the products of the manufacturing establishments of the United States by other parts of the world is a voluntary one, and not an “invasion” in the ordinarily accepted sense of the term. The growth in the consumption of American manufactures in other parts of the world is quite as voluntary as is the consumption of American flour, or meat, or cotton. This is illustrated by the fact that, while the iron and steel manufacturing establishments have been unable to meet the orders of the home consumers, and, therefore, have made little effort to “invade” other markets, more than $184,000,000 worth of iron and steel manufactures was exported in 1908, presumably, in most cases, to fill orders from other parts of the world. The fact that the home

demand for iron and steel manufactures was in 1907 so great as to more than double the importation of iron and steel manufactures in a single year, shows clearly that the condition of a home market was such that the iron and steel manufactures of the United States needed make no effort to "invade" the markets of other parts of the world, and that whatever sales they made in those lines outside of the United States were, as a rule, in response to calls from the countries to which these classes of merchandise are sent. The exportations of iron and steel manufactures from the United States in the fiscal year 1908, were: To Europe, 47 million dollars; North America, 72 million; Oceania, 14 million; South America, 22 million; Asia, 25 million; and Africa, 3 million. Of American copper the purchases by Europe were, in 1891, $4,433,015 in value, and in 1908, $97,324,230. For agricultural implements the home demand is large and active, yet the exportation of agricultural implements, presumably all or nearly all orders, was in 1908, to Europe, 13 million dollars; to North America, 2½ million; to South America, 5 million; to Oceania, over 1 million; and to Asia and Africa, 13 million. The railroads of the United States were in 1906 and 7, according to repeated statements, unable to obtain cars in sufficient number to meet their requirements, yet the exportation of cars for steam railways in the fiscal year 1908 amounted to about $5,000,000.

The large share which manufactures form in the exports of the United States is shown by an analysis by the Bureau of Statistics of the Department of Commerce and Labor of the trade, by articles and groups of articles, with every country and grand division of the world. These figures show that manufactures formed 86 per cent of exports to South America in 1906, 85 per cent of the exports to Oceania, 75 per cent of the exports to Asia, 66 per cent of the exports to Africa, 62 per cent of the exports to North America, while even to Europe manufactures formed 27 per cent of the total domestic merchandise sent in the fiscal year 1906.

This general group, "manufactures," upon which the above percentages are based, includes both manufactures ready for consumption and manufactures for further use in manufacturing. The first group includes all manufactures in the fully completed form and ready for immediate use. The second is made up chiefly of chemicals, leather, naval stores, lumber, copper in pigs, bars, and ingots, and various grades of iron and steel which have passed through a process of manufacture but are to be further used in

manufacturing, such as steel bars, billets, ingots, blooms, sheets and plates, tin plate, wire rods, and pig iron.

Of the 75 million dollars' worth sent to South America, 72.4 per cent was manufactures ready for consumption and 14.02 per cent manufactures for further use in manufacturing. Of the 105 million dollars' worth sent to Asia, 65.79 was manufactures ready for consumption and 9.14 per cent manufactures for further use in manufacturing. Of the 35 million dollars' worth sent to Oceania, 72.97 per cent was manufactures ready for consumption and 11.78 per cent manufactures for further use in manufacturing. Of the 20 million dollars' worth sent to Africa, 58.79 per cent was manufactures ready for consumption and 6.85 per cent manufactures for further use in manufacturing. Of the 295 million dollars' worth exported to North America, 50.46 per cent was manufactures ready for consumption and 11.37 per cent manufactures for further use in manufacturing. Of the 1,189 million dollars' worth of domestic merchandise sent from the United States to Europe in 1906, 12.72 per cent was manufactures ready for consumption and 14.06 per cent manufactures for further use in manufacturing.

Thus, more than one-half of the domestic merchandise sent out of the United States to each grand division except Europe goes in the fully manufactured form, ready for consumption; in the case of South America and Oceania practically three-fourths, in the case of Asia practically two-thirds, and in the case of North America practically one-half goes in the fully manufactured form.

Taking up the principal countries, the figures of the Bureau of Statistics show that 11.85 per cent of the exports of the United Kingdom was manufactures ready for consumption and 11.22 per cent manufactures for further use in manufacturing. Of the exports to Germany, 10.98 per cent was manufactures ready for consumption and 12.96 per cent manufactures for further use in manufacturing. To France, 12.67 per cent of the exports was manufactures ready for consumption and 18.44 per cent manufactures for further use in manufacturing. To Canada, 48.8 per cent of the exports was manufactures ready for consumption and 13.1 per cent manufactures for further use in manufacturing. To Mexico, 58.77 per cent was manufactures ready for consumption and 11.61 per cent manufactures for

further use in manufacturing. To Cuba, 45.94 per cent of the exports was manufactures ready for consumption and 9.31 per cent manufactures for further use in manufacturing. To Argentina, 79.93 per cent of the exports was manufactures ready for consumption and 18.67 per cent manufactures for further use in manufacturing. To Brazil, 72.9 per cent of the exports was manufactures ready for consumption and 10.24 per cent manufactures for further use in manufacturing. To Chile, 74.82 per cent of the exports was manufactures ready for consumption and 10.71 per cent manufactures for further use in manufacturing. To China, 85.12 per cent was manufactures ready for consumption and 10.65 per cent manufactures for further use in manufacturing. To Japan, 45.89 per cent of the exports was manufactures ready for consumption and 10.28 per cent manufactures for further use in manufacturing. To the Philippine Islands, 59.75 per cent of the shipments was manufactures ready for consumption and 9.13 per cent manufactures for further use in manufacturing. To Australia, 76.48 per cent of the exports was manufactures ready for consumption and 12.26 per cent manufactures for further use in manufacturing.

Foodstuffs and manufacturers' material form the larger share of the merchandise sent to Europe and a considerable percentage of that sent to North America, while to the other grand divisions neither foodstuffs nor raw material for manufacturing form any considerable per cent of the total. To Europe, foodstuffs (chiefly wheat flour, corn and meats) formed 36.3 per cent of the total merchandise sent in 1906, while raw materials for use in manufacturing (chiefly cotton) formed 36.83 per cent of the total, the remainder being, as above indicated, manufactures ready for consumption or manufactures for further use in manufacturing. To North America, foodstuffs formed 20.23 per cent of the total and manufacturers' raw material 16.12 per cent. To South America, foodstuffs formed 13.32 per cent of the total and manufacturers' raw material less than 1 per cent. To Asia, foodstuffs formed 13.83 per cent and manufacturers' raw material 11.2 per cent, this larger percentage of the raw material being due chiefly to sales of raw cotton to Japan. To Oceania, foodstuffs formed 9.65 per cent of the total and manufacturers' raw material 4.96 per cent. To Africa, foodstuffs formed 28.39 per cent of the total exports and manufacturers' raw material 5.86 per cent.

Taking up the analysis of exports to other parts of the world, the figures show that of the exports to the United Kingdom 34.07 per cent was crude materials for use in manufacturing; 27.29 per cent foodstuffs partly or wholly manufactured, including in this group flour, meats, dried and preserved fruits, etc.; 15.46 per cent foodstuffs in a crude condition, and food animals; 13.1 per cent manufactures for further use in manufacturing, and 11.85 per cent manufactures ready for consumption. Of the exports to Germany, 48.28 per cent was crude materials for use in manufacturing; 19 per cent foodstuffs partly or wholly manufactured; 8.65 per cent foodstuffs in a crude condition, including food animals; 12.96 per cent manufactures for further use in manufacturing, and 10.98 per cent manufactures ready for consumption. In the case of France, 55.38 per cent of the total was crude materials for use in manufacturing; 5.52 per cent foodstuffs partly or wholly manufactured; 7.96 per cent foodstuffs in a crude condition; 18.44 per cent manufactures for further use in manufacturing, and 12.67 per cent manufactures ready for consumption. In the case of Canada, 24.39 per cent was raw materials for use in manufacturing; 4.74 per cent foodstuffs partly or wholly manufactured; 6.23 per cent foodstuffs in a crude condition, and food animals; 13.1 per cent manufactures for further use in manufacturing and 48.8 per cent manufactures ready for consumption.

Summing up this study of the share which manufactures formed of the exports of the United States to the principal countries and grand divisions in 1906, the figures show that 151 million dollars' worth of manufactures ready for consumption went to Europe, 149 million dollars' worth to North America, 69 million dollars' worth to Asia, 54 million dollars' worth to South America, 26 million dollars' worth to Oceania, and 11 million dollars' worth to Africa; while of the manufactures for further use in manufacturing 167 million dollars' worth went to Europe, 33 million to North America, 10 million to South America, 10 million to Asia, 4 million to Oceania, and a little over 1 million dollars' worth to Africa. Thus while manufactures formed but a comparatively small percentage of the exports to Europe because of the large quantities of foodstuffs and raw material demanded by that country, they actually aggregated a greater sum than the manufactures sent to any other of the grand divisions, though in the other cases the percentage which manufactures formed of the total was much larger than in the trade with Europe.

Even with this large production of manufactures in the United States it may safely be said that less than one-tenth of our manufactures are exported, while those imported equal in stated value about one-twentieth that of the home product. This statement is the result of a comparison of the figures of production, exportation, and importation of manufactures in the United States presented by the Statistical Abstract of the United States, issued by the Bureau of Statistics of the Department of Commerce and Labor.

The Census of 1905 shows the gross value of the factory product of manufactures in 1904 at 14,802 million dollars, and estimates the value of all other manufactures, mechanical and neighborhood, at about 2 billion, making the gross value of all manufactures produced in the United States in 1904, 16,867 million dollars. This gross valuation, however, includes many duplications, because the products reported by one manufacturer often become the manufacturing material of another, who also includes their cost in the report of the value of the products of his factory. By deducting from the gross valuation the value of this manufacturing material used in a partly manufactured form, the Census Office states the net or true value of the manufactures of the country in the census year. This process reduced the valuation of the factory product of 1904 from the gross figure of 14,802 million, to a net valuation of 9,821 million; and an application of the same method of reduction to the non-factory manufactures would place the net value of all manufactures in 1904 at 10,892 million dollars. The Census of 1900, which reported the gross value of all manufactures in 1899 at 13,014 million dollars, places the net value for that year at 8,371 million.

The Bureau of Statistics' figures show that the exportation in the year ending June 30, 1905, of all articles classed by the census as manufactures, amounted in value to 895 million dollars, a sum which equals 8.2 per cent of the 10,892 million estimated as the net value of all manufactures in 1904. The imports in the year ended June 30, 1905, of all articles similar to those classed by the census as manufactures, were valued at 576 million dollars, which equals 5.3 per cent of the net value of the domestic manufactures of 1904.

Even these figures, which show that the valuation of manufactures exported equals 8.2 per cent of the valuation of the manufactures produced, and that the valuation of the manufactures imported equals 5.3 per cent of the

valuation of the manufactures produced, are, however, only approximate, in an attempt to determine the true relation of imports or exports of manufactures to the home production. The valuation of manufactures, supplied to the Census Office, by the various manufacturers, states the value of the product at the place of production; while the Bureau of Statistics' figures of exportations state the wholesale market value of the article at the port from which exported. Thus the stated values of the articles exported are doubtless in most cases higher than the stated values of the same articles at the place of production since the cost of transportation and dealers' profits are presumably added in the valuations at which the domestic merchandise in question is wholesaled at the various ports whose current prices determine the valuation placed upon the articles when exported. On the other hand, the values of the imported articles quoted by the Bureau of Statistics are by law "the actual market values or wholesale prices of such merchandise in the principal markets of the country whence imported," and if freights and profits are added to this figure the valuation at the point where it actually enters the United States would be somewhat in excess of that quoted. Thus the value of manufactures produced are those of the place of production, the figures of exports are those of the wholesale markets of the port from which exported, and those of importation are those of the wholesale market of the country whence imported. Could production, exports, and imports be brought to a common basis of valuation, the percentage which exports bear to the total production would be slightly reduced and that which imports bear to the total production be slightly increased; and the percentages which exports and imports, respectively, bear to the total production would become more nearly identical than those above quoted, of 8.2 per cent on the export side and 5.3 per cent on the import side.

The share exported of the manufactures of the country seems to have slowly but steadily increased. The gross valuation of manufactures produced was, speaking in very round terms, in 1850, 1 billion dollars; in 1860, 1¾ billion; in 1870, 4¼ billion; in 1880, 5⅓ billion; in 1890, 9⅓% billion; in 1900, 13 billion; and in 1905, 16¾ billion. Reducing these gross valuations to net value at the same ratio as that indicated by the census reduction of 1900, the net value of manufactures in 1850 would stand at ⅔ of 1 billion dollars, in 1860 at 1¼ billion, in 1870 at 2¾ billion, in 1880 at 3½ billion, in 1890 at 6

billion, in 1900 at 8⅓ billion, and in 1905 at a little less than 11 billion. The exportation of all articles now classed by the census as manufactures was in 1850, 43 million dollars; in 1860, 87 million; in 1870, 160 million (currency values); in 1880, 315 million; in 1890, 404 million; in 1900, 803 million; and in 1905, 895 million. These figures of net products and exports, when compared statistically, show that the exports equalled in 1850, 6.6 per cent of the figures of net production; in 1860, 7.2 per cent; in 1870, 5.9 per cent; in 1880, 9.1 per cent; in 1890, 6.7 per cent; in 1900, 9.6 per cent; and in 1905, 8.2 per cent. That the exportation has grown even more rapidly than the production is also apparent from a comparison of the figures of 1905 with those of 1850, since the production of manufactures in 1905 was practically seventeen times as great as that of 1850, while the exportation of manufactures in 1905 was twenty-one times as great as in 1850.

On the import side the ratio of imports of manufactures to production has steadily fallen. Imports of all articles now included by the census classification of manufactures amounted in 1850 to 143 million dollars, in 1860 to 267 million, in 1870 to 433 million (currency values), in 1880 to 426 million, in 1890 to 481 million, in 1900 to 470 million, and in 1905 to 576 million. The percentage which imports of manufactures bore to production of manufactures was, in 1850, 21.8 per cent; in 1860, 22 per cent; in 1870, 15.9 per cent; in 1880, 12.3 per cent; in 1890, 8 per cent; in 1900, 5.6 per cent; and in 1905, 5.3 per cent.

It is proper to add that the figures above cited as representing the exportation of articles classed by the census as manufactures do not coincide with the usual statement of “Manufactures Exported,” as issued by the Bureau of Statistics from month to month and year to year, but includes many articles classed as manufactures by the census, but ordinarily classed by the Bureau of Statistics as “Foodstuffs Partly or Wholly Manufactured.” The Bureau of Statistics in its import and export statements groups under one title of “Manufactures Ready for Consumption” all articles completely manufactured and ready for use, such as boots and shoes, cars and carriages, and illuminating oil; under another head, “Articles for Further Use in Manufacturing,” all articles in a partially manufactured state, but requiring further processes before ready for final use, such as pig copper, pig iron, pig tin, lumber, etc.; while the group “Foodstuffs Partly or Wholly

Manufactured" includes food articles which have undergone certain processes of preparation for use, such as salted meats, canned fruit and vegetables, dried fruits, flour, sugar, and other articles usually classed by the great importing and exporting nations under the general title of foodstuffs. The two groups, "Manufactures Ready for Use," and "Manufactures for Further Use in Manufacturing," are usually included by the bureau in its statements of exports of manufactures, while the third group, "Foodstuffs Partly or Wholly Manufactured," is not usually so classed. In the above statement, however, in which the attempt is made to compare imports and exports with the census figures of manufactures, the third group, "Foodstuffs Partly or Wholly Manufactured," is included under the general title of manufactures, in order to make the import and export figures comparable with the census figures of production.

Turning to the individual articles forming the great mass of manufactures produced or exported, the percentage of the product exported varies greatly with the various articles or groups of articles. Comparing the Bureau of Statistics' figures of exports for the fiscal year 1905 with the census figures of production in the calendar year 1904, the percentage which the export figures bear to those of production are, in the case of agricultural implements 18.5 per cent, bicycles and tricycles 26.8 per cent, cash registers 20.6 per cent, sewing machines 29.3 per cent, and typewriters 44.6 per cent; while in a large proportion of articles the percentage is very much less—boots and shoes 2.5 per cent, carriages and wagons 2.7 per cent, structural iron 4 per cent, furniture of wood 2.6 per cent, flour and gristmill products 5.6 per cent, and automobiles 8.3 per cent.

IX. STATISTICS OF MANUFACTURING.

Approximate Annual Value of Manufactures Produced in the Principal Manufacturing Countries at dates named, 1780 to 1900.

Countries.	1780.	1800.	1820.	1840.
	Millions of Dollars.			
United Kingdom	861	1,119	1,411	1,883
Germany	243	292	414	730
France	715	925	1,071	1,285
Austria-Hungary	146	243	389	691
Russia	49	73	97	195
Italy	49	73	122	195
Belgium	....	....	....	292
Spain	49	97	146	219
United States	73	122	268	467
Various	151	219	292	438
Total	2,336	3,163	4,210	6,395

Countries.	1860.	1888.	1896.	1900.
	Millions of Dollars.			
United Kingdom	2,808	3,991	4,263	5,000
Germany	1,509	2,837	3,358	4,601
France	1,849	2,360	2,900	3,450
Austria-Hungary	973	1,231	1,596	2,000
Russia	754	1,767	1,849	1,980
Italy	389	589	925	1,700
Belgium	438	496	574	750
Spain	292	414	589	615
United States	1,908	7,022	9,636	13,004
Various	779	1,767	2,097	2,317
Total	11,699	22,474	27,787	35,417

Note.—The figures (Mulhall's estimates prior to 1900) here given for the United States are those of gross values. The relation of "gross" to "net" value of the manufactures of the United States is explained at page 211.

Approximate Annual Value of Manufactures Produced In the Principal Manufacturing Countries at dates named, 1780 to 1900.

Countries.	1780.	1800.	1820.	1840.
	Millions of Dollars.			
United Kingdom	861	1,119	1,411	1,883
Germany	213	292	414	730
France	715	925	1,071	1,285
Austria-Hungary	146	243	389	691
Russia	49	73	97	195
Italy	49	73	122	195
Belgium	....	....	....	292
Spain	49	97	146	219
United States	48	81	179	311
Various	151	219	292	438
Total	2,311	3,122	4,121	6,239

Countries.	1860.	1888.	1896.	1900.
	Millions of Dollars.			
United Kingdom	2,808	3,991	4,263	5,000
Germany	1,509	2,837	3,358	4,601
France	1,849	2,360	2,900	3,450
Austria-Hungary	973	1,231	1,596	2,000
Russia	754	1,767	1,849	1,980
Italy	389	589	925	1,700
Belgium	438	496	574	750
Spain	292	414	589	615
United States	1,272	4,681	6,426	8,371
Various	779	1,767	2,097	2,317
Total	10,063	20,133	24,577	30,784

Note.—Figures are those of Mulhall, except for 1900, the figures of gross manufactures for the United States having been reduced to net on the basis of net equal to 66⅔ per cent of gross; figures for 1900, estimate of Wm. J. Clark, in Engineering Magazine, May, 1904.

Importation of Manufactures into United Kingdom and United States, respectively, at quinquennial years, 1870 to 1908.

[From official statistics of the respective governments.]

Year[D]	Into the United Kingdom. Millions dollars.	Into the United States. Millions dollars.
1870	277	229
1875	354	241
1880	405	307
1885	406	261
1890	478	348
1895	483	296
1900	630	337
1905	707	430
1907	754	638
1908	696	528

[D] For United States, fiscal years; for United Kingdom, calendar years.

Commerce of the United States, the United Kingdom and Germany, from 1875 to 1908. Showing exports of domestic merchandise, and exports of domestic manufacture from each country named.

	Imports of merchandise.		
Year.	United Kingdom.	Germany.[E]	United States.[F]
	Dollars.	Dollars.	Dollars.
1875	1,819,779,000	839,590,000	533,005,000
1880	2,001,251,000	670,945,000	667,955,000
1885	1,805,316,000	699,067,000	577,527,000
1890	2,047,298,000	990,023,000	789,310,000
1895	2,027,822,000	980,719,000	731,970,000
1900	2,545,544,000	1,372,216,000	849,941,000
1901	2,540,264,000	1,290,254,000	823,172,000
1902	2,571,416,000	1,340,178,000	903,321,000
1903	2,642,054,050	1,424,080,000	1,025,719,000
1904	2,681,629,000	1,514,660,000	991,087,000
1905	2,749,669,000	1,696,660,000	1,117,513,000
1906	2,958,289,000	1,909,210,000	1,226,562,000
1907	3,143,293,000	2,046,187,000	1,434,421,000
1908			1,194,342,000

	Exports of domestic merchandise.		
Year.	United Kingdom.	Germany.	United States.[F]
	Dollars.	Dollars.	Dollars.
1875	1,087,497,000	593,052,000	499,284,100
1880	1,085,521,000	688,500,000	823,946,353
1885	1,037,124,000	680,551,000	726,682,946
1890	1,282,472,000	791,717,000	845,293,828
1895	1,100,453,000	789,660,000	793,392,599
1900	1,417,086,000	1,097,509,000	1,370,763,571
1901	1,362,729,000	1,054,685,000	1,460,462,806
1902	1,379,283,000	1,111,008,000	1,355,481,861
1903	1,415,179,000	1,113,313,000	1,392,231,302
1904	1,463,412,000	1,242,987,000	1,435,179,000
1905	1,605,053,000	1,364,131,000	1,491,745,000
1906	1,827,737,000	1,513,449,000	1,171,953,000
1907	2,074,125,000	1,634,803,000	1,853,718,000
1908			1,834,786,000

	Exports of domestic manufactures.		
Year.	United Kingdom.	Germany.	United States.[F]
	Dollars.	Dollars.	Dollars.
1875	978,886,000	....	101,962,000
1880	970,681,000	460,279,000	121,818,000
1885	913,353,000	504,623,000	150,256,000
1890	1,118,657,000	511,096,000	178,982,000
1895	953,800,000	518,723,000	205,058,000
1900	1,142,603,000	709,806,000	484,846,000
1901	1,110,131,000	688,409,000	465,778,000
1902	1,127,606,000	735,182,000	453,865,000
1903	1,163,812,000	780,925,000	467,898,000
1904	1,204,359,000	819,196,000	523,320,000
1905	1,322,851,000	910,017,000	611,426,000
1906	1,523,699,000	1,046,938,000	686,023,000
1907	1,690,038,000	No data.	740,123,000
1908			750,576,000

[E] Imports for consumption.

[F] Years ending June 30.

Exportation of Manufactures from United Kingdom and United States, respectively, at quinquennial years, 1870 to 1908.

[From official statistics of the respective governments.]

Year[G]	From the United Kingdom. Millions dollars.	From the United States. Millions dollars.
1870	888	70
1875	979	102
1880	965	122
1885	915	150
1890	1,112	179
1895	941	205
1900	1,126	485
1905	1,329	611
1907	1,694	740
1908	1,445	751

[G] For United States, fiscal years; for United Kingdom, calendar years.

Coal Production of the World by Principal Countries, at quinquennial periods from 1870 to 1895 and annually since that date.

[From reports of the United States Geological Survey.]

Year.	United States.	Great Britain.	Germany.
	Short tons.	Short tons.	Short tons.
1870	33,035,580	123,682,935	37,488,312
1875	52,348,320	149,303,263	52,703,970
1880	71,481,570	164,605,738	65,177,634
1885	111,160,295	178,473,588	81,227,255
1890	157,770,963	203,408,003	98,398,500
1895	193,117,530	212,320,725	114,561,318
1896	191,986,357	218,804,611	123,943,159
1897	200,229,199	226,385,523	132,762,882
1898	219,976,267	226,301,058	144,283,196
1899	253,741,192	246,506,155	149,719,766
1900	269,684,027	252,203,056	164,805,202
1901	293,299,816	245,332,578	168,217,082
1902	301,590,439	254,346,447	165,826,496
1903	357,356,416	257,974,605	179,076,630
1904	351,816,398	260,319,665	186,785,378
1905	392,722,635	264,464,408	191,576,074
1906	414,157,278	281,195,743	222,350,526

Year.	France.	Total production of the world.	Per cent of U. S.
	Short tons.	Short tons.	
1870	14,530,716	34,850,088	14.07
1875	18,694,916	308,479,177	16.97
1880	21,346,124	369,413,780	20.62
1885	21,510,359	447,783,802	24.82
1890	28,756,638	563,693,232	27.99
1895	30,877,922	644,177,076	29.98
1896	32,167,270	664,001,718	28.92
1897	33,938,987	697,213,515	28.72
1898	35,656,426	738,129,608	29.80
1899	36,215,026	801,976,021	31.63
1900	36,811,536	846,041,848	31.88
1901	35,596,536	870,711,044	33.69
1902	33,286,146	888,453,950	33.95
1903	38,466,873	972,195,531	36.76
1904	37,663,349	983,527,562	35.78
1905	38,951,360	1,034,156,604	37.98
1906	37,828,931	[H]1,106,478,707	37.43

[H] Latest available figures are used in making up totals for 1906.

Note. The use of coal for the production of power for use in manufacturing has such an important relation to that industry that the presentation of this table in this study seems justifiable.

World's Production of Cotton.

[From Latham, Alexander & Co.'s "Cotton Movement & Fluctuation," 1902-7.]

Countries.	1902-3.	1903-4.
	Bales.	Bales.
United States	10,511,020	9,841,671
East Indies[I]	2,737,577	2,734,400
Egypt	1,148,700	1,275,754
Brazil[J]	329,390	307,516
Total	14,726,687	14,159,341

Countries.	1904-5.	1905-6.	1906-7.
	Bales.	Bales.	Bales.
United States	13,420,440	11,048,000	13,346,000
East Indies[I]	2,952,720	2,983,370	3,482,000
Egypt	1,244,968	1,152,516	1,350,000
Brazil[J]	325,928	476,667	400,000
Total	17,944,056	15,660,553	18,578,000

[I] Includes India’s exports to Europe, America and Japan, and mill consumption in India increased or decreased by excess or loss of stock at Bombay.

[J] Receipts into Europe from Brazil, Smyrna, Peru, West Indies, etc., and Japan and China cotton used in Japanese mills.

Estimated Number of Cotton Spindles at Work on the Continent of Europe, Sept. 30, 1907.

[From Alfred B. Shepperson's "Cotton Facts," December, 1907.]

Russia and Poland	7,000,000
Germany	9,000,000
Austria	3,700,000
France	6,200,000
Spain	2,800,000
Switzerland	1,550,000
Italy	3,000,000
Belgium	1,300,000
Sweden, Norway, etc.	550,000
Holland	420,000
Portugal	210,000
Greece	70,000
Total	35,800,000

Annual Consumption of Cotton in Cotton Mills.

[From Alfred B. Shepperson's "Cotton Facts," December, 1907.]

Season of	Great Britain.	Continent Europe.	Northern States of U. S.
	In bales of 500 pounds net.		
1896-7	3,224,000	4,368,000	1,771,000
1897-8	3,432,000	4,628,000	1,771,000
1898-9	3,519,000	4,784,000	2,218,000
1899-	3,334,000	4,576,000	2,163,000
1900-1	3,269,000	4,576,000	1,909,000
1901-2	3,253,000	4,836,000	1,996,000
1902-3	3,185,000	5,148,000	1,980,000
1903-4	2,977,000	5,148,000	1,980,000
1904-5	3,572,000	5,148,000	2,112,000
1905-6	3,766,000	5,244,000	2,364,000
1906-7	3,915,000	5,444,000	2,460,000

Season of	Southern States of U. S.	Total of United States.	India.
	In bales of 500 pounds net.		
1896-7	946,000	2,717,000	1,041,000
1897-8	1,151,000	2,922,000	1,185,000
1898-9	1,364,000	3,582,000	1,340,000
1899-	1,524,000	3,687,000	1,162,000
1900-1	1,526,000	3,435,000	1,087,000
1901-2	1,912,000	3,908,000	1,384,000
1902-3	1,910,000	3,890,000	1,362,000
1903-4	1,795,000	3,775,000	1,368,000
1904-5	2,063,000	4,175,000	1,473,000
1905-6	2,239,000	4,603,000	1,587,000
1906-7	2,362,000	4,822,000	1,562,000

World's Supply and Distribution of Cotton.

[From Latham, Alexander & Co.'s "Cotton Movement & Fluctuation," 1902-7.]

Year.	Visible and Invisible Supply at beginning of year.
	Bales of 500 pounds each.
1884-5	1,550,000
1885-6	1,343,000
1886-7	1,441,000
1887-8	1,473,000
1888-9	1,291,000
1889-90	1,119,000
1890-1	1,077,000
1891-2	1,742,000
1892-3	2,818,000
1893-4	2,258,000
1894-5	2,128,000
1895-6	3,203,000
1896-7	1,931,000
1897-8	1,923,636
1898-9	3,241,158
1899-1900	3,999,364
1900-1	2,456,489
1901-2	2,673,027
1902-3	2,672,068
1903-4	2,921,061
1904-5	2,770,244
1905-6	5,172,638
1906-7	4,504,382

Year.	Crops.		
	United States	All Others.	Total.
	Bales of 500 pounds each.		
1884-5	5,136,000	2,101,000	7,237,000
1885-6	5,984,000	2,234,000	8,218,000
1886-7	5,960,000	2,577,000	8,537,000
1887-8	6,400,000	2,309,000	8,709,000
1888-9	6,463,000	2,632,000	9,095,000
1889-90	6,820,000	2,933,000	9,753,000
1890-1	8,137,000	3,039,000	11,176,000
1891-2	8,640,000	3,001,000	11,641,000
1892-3	6,435,000	3,296,000	9,731,000
1893-4	7,136,000	3,314,000	10,450,000
1894-5	9,640,000	2,978,000	12,618,000
1895-6	6,912,000	3,421,000	10,333,000
1896-7	8,435,868	3,438,000	11,873,868
1897-8	10,890,000	3,316,290	14,206,290
1898-9	11,078,000	3,694,934	14,772,934
1899-1900	9,137,000	3,092,897	12,229,897
1900-1	10,218,000	3,414,454	13,632,454
1901-2	10,380,380	4,038,569	14,413,949
1902-3	10,511,020	4,215,661	14,726,687
1903-4	9,841,671	4,317,670	14,159,341
1904-5	13,420,440	4,524,000	17,944,056
1905-6	11,048,000	4,612,553	15,660,553
1906-7	13,346,000	5,232,000	18,578,000

Year.	Total Actual Consumption.	Balance of Supply End of year.	
		Visible.	Invisible.
	Bales of 500 pounds each.		
1884-5	7,444,000	984,000	359,000
1885-6	8,120,000	968,000	473,000
1886-7	8,505,000	999,000	474,000
1887-8	8,891,000	772,000	519,000
1888-9	9,267,000	682,000	437,000
1889-90	9,795,000	846,000	231,000
1890-1	10,511,000	1,315,000	427,000
1891-2	10,565,000	2,310,000	508,000
1892-3	10,291,000	1,903,000	355,000
1893-4	10,580,000	1,792,000	336,000
1894-5	11,543,000	2,185,000	1,018,000
1895-6	11,605,000	1,231,000	700,000
1896-7	11,880,332	1,295,636	628,000
1897-8	12,888,768	1,905,158	1,336,000
1898-9	14,014,728	2,371,364	1,628,000
1899-1900	13,772,772	1,071,489	1,385,000
1900-1	13,415,916	1,549,027	1,124,000
1901-2	14,414,908	1,306,068	1,366,000
1902-3	14,477,694	1,177,677	1,743,384
1903-4	14,310,158	1,085,237	1,735,007
1904-5	15,541,667	2,501,469	2,671,164
1905-6	16,328,804	1,702,485	2,801,897
1906-7	17,005,640	2,215,497	3,861,245

Stocks of Money in Thirteen Principal Countries of the World in 1873, 1896 and 1906.

Relative increase in use of gold, silver and paper money illustrated.

Countries.	Stock of Gold.		
	1873.	1896.	1906.
United States	$135,000,000	$696,300,000	$1,593,300,000
Great Britain	160,000,000	584,000,000	486,700,000
France	450,000,000	772,000,000	926,400,000
Germany	160,200,000	654,500,000	1,030,300,000
Russia	149,100,000	586,900,000	939,400,000
Italy	20,000,000	96,900,000	215,500,000
Belgium	25,000,000	35,000,000	31,100,000
Netherlands	12,000,000	21,900,000	45,900,000
Austria-Hungary	35,000,000	178,500,000	306,400,000
Australasia	50,000,000	132,100,000	125,000,000
Denmark	4,100,000	15,400,000	22,600,000
Sweden	1,800,000	10,600,000	22,600,000
Norway	7,600,000	7,500,000	8,300,000
Total	1,209,800,000	2,791,600,000	5,753,500,000

Countries.	Stock of Silver.		
	1873.	1896.	1906.
United States	$ 6,150,000	$364,500,000	$698,700,000
Great Britain	95,000,000	121,700,000	116,800,000
France	500,000,000	443,900,000	411,100,000
Germany	306,235,000	212,800,000	219,700,000
Russia	18,600,000	74,200,000	77,900,000
Italy	23,000,000	45,400,000	31,700,000
Belgium	15,000,000	57,000,000	24,700,000
Netherlands	37,300,000	56,100,000	52,600,000
Austria-Hungary	40,000,000	63,700,000	105,300,000
Australasia	3,000,000	7,000,000	10,000,000
Denmark	7,500,000	5,400,000	6,100,000
Sweden	4,300,000	4,900,000	7,700,000
Norway	1,600,000	2,000,000	3,100,000
Total	1,057,685,000	1,728,600,000	1,765,400,000

Countries.	Uncovered paper.		
	1873.	1896.	1906.
United States	$749,445,000	$397,000,000	$610,800,000
Great Britain	59,800,000	112,100,000	116,800,000
France	385,300,000	119,200,000	269,200,000
Germany	90,800,000	123,800,000	267,100,000
Russia	618,400,000	467,200,000	No data.
Italy	87,800,000	161,000,000	150,600,000
Belgium	35,100,000	72,500,000	125,800,000
Netherlands	15,300,000	37,900,000	57,800,000
Austria-Hungary	265,800,000	177,600,000	119,300,000
Australasia	....	22,500,000	No data.
Denmark	6,500,000	6,400,000	10,700,000
Sweden	6,000,000	19,000,000	34,800,000
Norway	2,300,000	3,800,000	7,000,000
Total	2,322,545,000	1,720,000,000	1,769,900,000

Countries.	Total money in countries named.		
	1873.	1896.	1906.
United States	$890,595,000	$1,727,800,000	$2,902,800,000
Great Britain	314,800,000	817,800,000	720,300,000
France	1,335,300,000	1,335,100,000	1,606,700,000
Germany	557,235,000	991,100,000	1,517,100,000
Russia	786,100,000	1,128,300,000	[K]1,017,300,000
Italy	130,800,000	303,300,000	397,800,000
Belgium	75,100,000	164,500,000	181,600,000
Netherlands	64,600,000	115,900,000	156,300,000
Austria-Hungary	340,800,000	419,800,000	531,000,000
Australasia	[K]53,000,000	161,600,000	[K]135,000,000
Denmark	18,100,000	27,200,000	39,400,000
Sweden	12,100,000	34,500,000	65,100,000
Norway	11,500,000	13,300,000	18,400,000
Total	4,590,030,000	7,240,200,000	9,288,800,000

[K] Exclusive of uncovered paper, for which no data is available.

Note.—The great increase in the use of capital in the manufacturing industries in recent years seems to justify the presentation of this table showing the general growth of money in the manufacturing

countries.

Annual Average Gold Production of the World.

Period.	Gold—million dollars.
1493 to 1700	5.4
1701 to 1850	13.1
1851 to 1890	120.2
1891 to 1900	210.1
1901 to 1905	322.1
1906	400.3
1907	410.0
(estim.) 1908	444.0

The World's Production of Pig Iron from 1800 to 1907.

[In gross tons of 2240 lbs.]

Year.	United States.	Great Britain.	Germany.
	Tons.	Tons.	Tons.
1800	40,000	190,000	40,000
1810	55,000	250,000	46,000
1820	20,000	400,000	90,000
1830	165,000	680,000	120,000
1840	287,000	1,390,000	170,000
1850	564,000	2,250,000	402,000
1860	820,000	3,830,000	530,000
1870	1,665,000	5,960,000	1,390,000
1880	3,835,000	7,750,000	2,730,000
1885	4,050,000	7,420,000	2,690,000
1889	7,603,000	8,250,000	4,530,000
1895	9,446,000	7,703,000	5,465,000
1896	8,623,000	8,660,000	6,271,000
1897	9,652,000	8,796,000	6,771,000
1898	11,773,000	8,610,000	7,196,000
1899	13,620,000	9,421,000	8,013,000
1900	13,789,000	8,960,000	8,384,000
1901	15,878,000	7,929,000	7,754,000
1902	17,821,000	8,680,000	8,395,000
1903	18,009,000	8,935,000	9,860.000
1904	16,497,000	8,694,000	9,899,000
1905	22,992,000	9,608,000	10,703,000
1906	25,307,000	10,109,000	12,099,000
1907	25,781,000	9,924,000	12,672,000

Year.	France.	Various.	Total.
	Tons.	Tons.	Tons.
1800	60,000	130,000	460,000
1810	85,000	180,000	616,000
1820	140,000	385,000	1,570,000
1830	220,000	480,000	2,677,000
1840	350,000	640,000	4,426,000
1850	570,000	270,000	920,000
1860	900,000	1,100,000	7,180,000
1870	1,180,000	1,710,000	11,905,000
1880	1,730,000	2,090,000	18,135,000
1885	1,630,000	2,310,000	18,100,000
1889	1,720,000	3,060,000	25,163,000
1895	2,006,000	4,247,000	28,867,000

1896	2,302,000	5,001,000	30,857,000
1897	2,444,000	5,267,000	32,930,000
1898	2,485,000	5,808,000	35,872,000
1899	2,537,000	6,464,000	40,055,000
1900	2,671,000	6,686,000	40,490,000
1901	2,351,000	6,886,000	40,798,000
1902	2,367,000	6,876,000	44,139,000
1903	2,796,000	6,677,000	46,277,000
1904	2,927,000	7,322,000	45,339,000
1905	3,028,000	7,569,000	53,900,000
1906	3,267,000	7,360,000	58,142,000
1907	3,532,000	7,591,000	[L] 59,500,000

[L] Preliminary estimate.

Note.—Official figures of the respective national statistical offices of the United States, the United Kingdom, Germany and France. Figures for all other countries taken from the French and Swedish Mineral Statistics.

Commerce of the World since 1830.

[Aggregate of imports for consumption and domestic exports in millions of dollars.—Mulhall's figures prior to 1890.]

Country.	1830.	1840.	1850.	1860.	1870.
United Kingdom	422	547	811	1,800	2,625
France	197	317	456	801	1,089
Germany	220	249	336	624	1,017
Russia	134	158	192	230	494
Austria-Hungary	72	105	139	225	398
Italy	96	144	182	249	317
Spain	33	48	53	120	197
Portugal	14	19	24	38	48
Holland and Belgium	144	216	293	413	653
United States	105	197	297	653	702
Spanish America	168	230	336	451	648
India	48	96	144	249	408
British colonies, other	43	101	211	494	614
Other countries	264	323	326	853	1,200
The world	1,960	2,750	3,800	7,200	10,500

Country.	1880.	1890.	1897.	1903.	1907.
United Kingdom	3,350	3,552	3,389	4,056	5,217
France	1,627	1,493	1,450	1,747	2,237
Germany	1,411	1,761	1,996	2,621	3,681
Russia	629	566	618	867	[M][N]834
Austria-Hungary	513	441	609	813	949
Italy	437	451	438	652	[M]821
Spain	240	283	301	257	[M]325
Portugal	67	86	73	97	[O]100
Holland and Belgium	1,137	1,488	1,915	2,614	[M]3,010
United States	1,478	1,536	1,815	2,453	3,318
Spanish America	768	797	826	965	1,802
India	518	629	440	761	[M]913
British colonies, other	974	1,430	1,550	2,292	[O]2,169
Other countries	1,351	2,287	3,020	2,866	[P]3,733

The world	14,500	16,800	18,500	23,061	29,109

[M] 1906.

[N] Trade over the European frontier only.

[O] 1904.

[P] Various years, 1904 to 1906.

Imports and Exports of Manufactures into and from the Principal Countries of the World and the Share Which Manufactures Formed of their Total Commerce.

The Bureau of Statistics of the Department of Commerce and Labor published in 1903 a series of tables showing the imports and exports of manufactures of the principal countries of the world and the share which manufactures formed, respectively, of the imports and exports of each of the countries named. The following is a summarization of that table:

Countries.	Iron and Steel.	
	Import.	Export.
Austria-Hungary (1901)	$13,942,000	$ 10,667,000
Belgium (1902)	19,083,000	46,144,000
Denmark (1901)	9,415,000	1,711,000
France (1902)	31,336,000	42,238,000
Germany (1901)	42,186,000	207,951,000
Italy (1901)	31,318,000	1,523,000
Netherlands (1901)	92,446,000	58,045,000
Portugal (1902)	6,431,000	249,000
Russia-European frontier (1901)	48,538,000	818,000
Spain (1902)	19,448,000	955,000
Sweden (1902)	11,916,000	15,402,000
Norway (1901)	11,672,000	963,000
Switzerland (1902)	17,366,000	10,704,000
United Kingdom (1902)	74,685,000	298,945,000
United States (1903)	51,617,000	96,642,000
Canada (1902)	34,727,000	…
Mexico (1901)	18,457,000	…
Argentina (1902)	18,343,000	…
Brazil (1901)	7,034,000	…
China (1902)	4,721,000	…
Japan (1902)	13,878,000	…
India (1902)	54,302,000	…
Australia (1901)	36,066,000	…
New Zealand (1900)	12,088,000	…

Countries.	Textiles.	
	Import.	Export.
Austria-Hungary (1901)	$ 34,696,000	$ 27,659,000
Belgium (1902)	21,652,000	41,722,000
Denmark (1901)	12,699,000	245,000
France (1902)	44,611,000	188,338,000
Germany (1901)	65,290,000	204,789,000
Italy (1901)	17,116,000	36,399,000
Netherlands (1901)	41,172,000	29,668,000
Portugal (1902)	7,253,000	1,171,000
Russia-European frontier (1901)	23,728,000	9,942,000
Spain (1902)	11,032,000	6,977,000
Sweden (1902)	13,306,000	796,000
Norway (1901)	8,886,000	257,000
Switzerland (1902)	27,205,000	76,447,000
United Kingdom (1902)	175,194,000	547,325,000
United States (1903)	146,202,000	39,641,000
Canada (1902)	10,060,000	…
Mexico (1901)	10,294,000	…
Argentina (1902)	28,700,000	…
Brazil (1901)	14,032,000	…
China (1902)	79,580,000	…
Japan (1902)	15,380,000	31,729,000
India (1902)	125,356,000	…
Australia (1901)	54,540,000	…
New Zealand (1900)	12,821,000	…

Countries.	Other Manufactures.	
	Import.	Export.
Austria-Hungary (1901)	$ 5,350,000	$149,038,000
Belgium (1902)	63,475,000	90,974,000
Denmark (1901)	17,741,000	1,926,000
France (1902)	136,645,000	278,227,000
Germany (1901)	259,193,000	411,311,000
Italy (1901)	53,305,000	37,451,000
Netherlands (1901)	108,121,000	143,797,000
Portugal (1902)	10,302,000	1,946,000
Russia-European frontier (1901)	85,900,000	45,309,000
Spain (1902)	27,463,000	33,398,000
Sweden (1902)	26,613,000	23,221,000
Norway (1901)	13,037,000	10,863,000
Switzerland (1902)	48,478,000	47,960,000
United Kingdom (1902)	478,821,000	294,861,000
United States (1903)	369,310,000	654,860,000
Canada (1902)	67,719,000	18,076,000
Mexico (1901)	18,170,000	9,178,000
Argentina (1902)	20,674,000	704,000
Brazil (1901)	21,954,000	43,000
China (1902)	56,239,000	…
Japan (1902)	39,637,000	28,173,000
India (1902)	74,123,000	…
Australia (1901)	65,598.000	13,754,000
New Zealand (1900)	16,732,000	970,000

Countries.	Total Manufactures.	
	Import.	Export.
Austria-Hungary (1901)	$113,988,000	$ 187,364,000
Belgium (1902)	104,210,000	178,840,000
Denmark (1901)	39,855,000	3,882,000
France (1902)	212,592,000	508,803,000
Germany (1901)	366,669,000	824,051,000
Italy (1901)	101,739,000	75,373,000
Netherlands (1901)	241,739,000	231,510,000
Portugal (1902)	23,986,000	3,366,000
Russia-European frontier (1901)	158,166,000	56,069,000
Spain (1902)	57,943,000	41,330,000
Sweden (1902)	51,835,000	39,419,000
Norway (1901)	33,595,000	12,083,000
Switzerland (1902)	93,049,000	135,111,000
United Kingdom (1902)	728,700,000	1141,131,000
United States (1903)	570,129,000	791,143,000
Canada (1902)	112,506,000	18,076,000
Mexico (1901)	46,921,000	9,178,000
Argentina (1902)	67,717,000	704,000
Brazil (1901)	43,020,000	43,000
China (1902)	140,540,000	…
Japan (1902)	69,895,000	59,902,000
India (1902)	253,781,000	…
Australia (1901)	156,204,000	13,754,000
New Zealand (1900)	41,641,000	970,000

Countries.	Percent which manufactures form of total.	
	Import.	Export.
Austria-Hungary (1901)	32.63	48.35
Belgium (1902)	23.72	49.89
Denmark (1901)	37.47	4.96
France (1902)	24.95	62.22
Germany (1901)	28.42	78.13
Italy (1901)	30.68	28.50
Netherlands (1901)	29.54	33.27
Portugal (1902)	39.96	10.96
Russia-European frontier (1901)	56.37	14.45
Spain (1902)	37.60	29.04
Sweden (1902)	42.08	41.61
Norway (1901)	43.46	28.78
Switzerland (1902)	42.72	80.07
United Kingdom (1902)	27.92	82.70
United States (1903)	55.58	56.83
Canada (1902)	57.26	10.47
Mexico (1901)	75.11	27.78
Argentina (1902)	68.13	.41
Brazil (1901)	44.87	…
China (1902)	71.36	…
Japan (1902)	51.73	47.05
India (1902)	88.15	…
Australia (1901)	76.35	10.23
New Zealand (1900)	83.82	1.72

The Manufacturing Industry of the United States, 1850 to 1905, showing Value of Product, Capital Invested, Wage-Earners Employed, Wages Paid, and Number of Establishments in each census year in the period under consideration.

[From official records of the United States Census Office.]

	Date of Census.	
	1850	1860
Number of establishments	123,025	140,433
Capital	$533,245,351	$1,009,855,715
Salaried officials, clerks, etc., Number	[S]	[S]
Salaries	[S]	[S]
Wage-earners, average number	957,059	1,311,246
Total wages	$236,755,464	$378,878,966
Men, 16 years and over	731,137	1,040,349
Wages	[S]	[S]
Women, 16 years and over	2,225,922	270,897
Wages	[S]	[S]
Children, under 16 years	[S]	[S]
Wages	[S]	[S]
Miscellaneous expenses	[U]	[U]
Cost of materials used	$555,123,822	$1,031,605,092
Value of products, including custom work and repairing.	$1,019,106,616	$1,885,861,676

	Date of Census.	
	1870	1880
Number of establishments	252,148	253,852
Capital	$2,118,208,769	$2,790,272,606
Salaried officials, clerks, etc., Number	[S]	[S]
Salaries	[S]	[S]
Wage-earners, average number	2,053,996	2,732,595
Total wages	$775,584,343	$947,953,795
Men, 16 years and over	1,615,598	2,019,035
Wages	[S]	[S]
Women, 16 years and over	323,770	531,639
Wages	[S]	[S]
Children, under 16 years	114,628	181,921
Wages	[S]	[S]
Miscellaneous expenses	[U]	[U]
Cost of materials used	$2,488,427,242	$3,396,823,549
Value of products, including custom work and repairing.	$4,232,325,442	$5,369,579,191

	Date of Census.	
	1890	1900.[Q]
Number of establishments	355,475	512,254
Capital	$6,525,156,486	$9,817,434,799
Salaried officials, clerks, etc., Number	461,609[R]	396,759
Salaries	$391,988,208[R]	$403,711,233
Wage-earners, average number	4,251,613	5,308,406
Total wages	$1,891,228,321	$2,322,333,877
Men, 16 years and over	3,327,042	4,110,527
Wages	$1,659,234,483	$2,016,677,789
Women, 16 years and over	803,686	1,029,296
Wages	$215,367,976	$279,994,396
Children, under 16 years	120,885	168,583
Wages	$16,625,862	$25,661,692
Miscellaneous expenses	$631,225,035	$1,027,775,778
Cost of materials used	$5,162,044,076	$7,345,413,651
Value of products, including custom work and repairing.	$9,372,437,283	$13,004,400,143

	Date of Census.
	1905.
Number of establishments	588,769
Capital	$13,872,035,371
Salaried officials, clerks, etc., Number	566,175
Salaries	$609,200,251
Wage-earners, average number	6,152,443
Total wages	$3,014,389,372
Men, 16 years and over	4,792,874
Wages	$2,629,747,837
Women, 16 years and over	1,194,083
Wages	$356,992,855
Children, under 16 years	167,066
Wages	$29,228,667
Miscellaneous expenses	$1,651,603,535
Cost of materials used	$9,497,619,851
Value of products, including custom work and repairing.	$16,866,706,985

	Per cent of Increase.		
	1850 to 1860	1860 to 1870	1870 to 1880
Number of establishments	14.1	79.6	0.7
Capital	89.4	109.3	31.7
Salaried officials, clerks, etc., Number	…	…	…
Salaries	…	…	…
Wage-earners, average number	37.0	56.6	33.0
Total wages	60.0	104.7	22.2
Men, 16 years and over	42.3	55.3	25.0
Wages	…	…	…
Women, 16 years and over	19.9	19.5	64.2
Wages	…	…	…
Children, under 16 years	…	…	58.7
Wages	…	…	…
Miscellaneous expenses	…	…	…
Cost of materials used	85.8	141.2	36.5
Value of products, including custom work and repairing.	85.1	124.4	26.9

	Per cent of Increase.		
	1880 to 1890	1890 to 1900	1900 to 1905
Number of establishments	40.0	44.1	4.2
Capital	133.9	50.5	41.3
Salaried officials, clerks, etc., Number	…	13.9[T]	42.7
Salaries	…	3.0	50.9
Wage-earners, average number	55.6	24.9	15.9
Total wages	99.5	22.8	29.8
Men, 16 years and over	64.8	23.5	16.6
Wages	…	21.5	30.4
Women, 16 years and over	51.2	28.1	16.0
Wages	…	30.0	27.5
Children, under 16 years	33.6[T]	39.5	0.9
Wages	…	54.3	13.9
Miscellaneous expenses	…	62.8	60.7
Cost of materials used	52.0	42.3	29.3
Value of products, including custom work and repairing.	74.5	38.8	29.7

[Q] Includes, for comparative purposes, 85 governmental establishments in the District of Columbia having products valued at $9,887,355, the statistics of such establishments for 1890 not being separable. Totals for 1900 and 1905 are exclusive of statistics for governmental establishments and for Hawaii.

[R] Includes proprietors and firm members, with their salaries; number only reported in 1900, but not included in this table.

[S] Not reported separately.

[T] Decrease.

[U] Not reported.

Manufactures in the U. S.: Gross and Net Values of Products, Census Years 1900 and 1905, by Industry Groups.

The gross value of manufactures as reported by the census contains many duplications because the finished products of some factories frequently become the material for other factories. In this way not only one but several duplications of the cost of materials often occur. The net value of productions eliminates these duplications by deducting from the gross value the cost of all materials which have undergone any process of manufacture covered by the census reports on manufactures. For further explanation of the relation of “gross” and “net” values, see page 211.

[From reports of the Bureau of the Census, Department of Commerce and Labor.]

Group.	1900.[V]	
	Gross.	
	Value. Dollars.	Rank.
Food and kindred products	2,273,880,874	1
Textiles	1,637,484,484	3
Iron and steel and their products	1,793,490,908	2
Lumber and its remanufactures	1,030,695,350	5
Leather and its finished products	583,731,046	9
Paper and printing	606,317,768	8
Liquors and beverages	425,504,167	12
Chemicals and allied products	552,797,877	10
Clay, glass, and stone products	293,564,235	13
Metals and metal products, other than iron & steel	748,795,464	7
Tobacco	283,076,546	14
Vehicles for land transportation	508,524,510	11
Shipbuilding	74,578,158	15
Miscellaneous industries	1,004,092,294	6
Hand trades	1,183,615,478	4
Total	13,000,149,159	…

Group.	1900.[V]	
	Net.	
	Value. Dollars.	Rank.
Food and kindred products	1,750,811,817	1
Textiles	1,081,961,248	2
Iron and steel and their products	983,821,918	3
Lumber and its remanufactures	547,227,860	6
Leather and its finished products	329,614,996	11
Paper and printing	419,798,101	7
Liquors and beverages	349,157,618	10
Chemicals and allied products	372,538,857	8
Clay, glass, and stone products	245,447,118	14
Metals and metal products, other than iron & steel	371,154,446	9
Tobacco	264,052,573	12
Vehicles for land transportation	250,622,377	13
Shipbuilding	42,492,518	15
Miscellaneous industries	638,191,538	5
Hand trades	721,104,859	4
Total	8,367,997,844	…

Group.	1905.	
	Gross.	
	Value. Dollars.	Rank.
Food and kindred products	2,845,234,900	1
Textiles	2,147,441,418	3
Iron and steel and their products	2,176,739,726	2
Lumber and its remanufactures	1,223,730,336	4
Leather and its finished products	705,747,470	9
Paper and printing	857,112,256	8
Liquors and beverages	501,266,605	11
Chemicals and allied products	1,031,965,263	5
Clay, glass, and stone products	391,230,422	12
Metals and metal products, other than iron & steel	922,262,456	7
Tobacco	331,117,681	13
Vehicles for land transportation	643,924,442	10
Shipbuilding	82,769,239	14
Miscellaneous industries	941,604,873	6
Hand trades	[W]	[W]
Total	14,802,147,087	…

Group.	1905.	
	Net.	
	Value. Dollars.	Rank.
Food and kindred products	2,176,489,626	1
Textiles	1,397,009,940	2
Iron and steel and their products	1,239,490,273	3
Lumber and its remanufactures	805,315,333	4
Leather and its finished products	401,011,414	10
Paper and printing	596,872,350	7
Liquors and beverages	431,735,208	9
Chemicals and allied products	714,489,549	5
Clay, glass, and stone products	334,971,057	11
Metals and metal products, other than iron & steel	442,912,699	8
Tobacco	307,100,175	13
Vehicles for land transportation	324,109,901	12
Shipbuilding	46,707,258	14
Miscellaneous industries	4,715,023	624
Hand trades	[W]	[W]
Total	9,821,205,387	…

[V] The figures of production for 1900 exclude 10 lumber establishments reported for Alaska with products valued at $4,250,984.

[W] “Hand trades” not included in the Census of 1905.

Manufactures: Percentage Distribution, by Groups of States, Census Years 1850 to 1905.

[From reports of the Bureau of the Census, Department of Commerce and Labor.]

Group of States and census years.[X]	Establish-ments	Capital.	Wage-earners	
			Average number.	Wages.
	Per cent.	Per cent.	Per cent.	Per cent.
New England States:				
1850	18.3	31.1	32.7	31.8
1860	14.7	25.5	29.9	27.5
1870	12.8	23.1	25.7	27.2
1880	12.4	22.4	23.7	23.9
1890	13.6	18.0	19.3	19.0
1900	10.9	16.8	18.1	18.3
1905	10.3	14.7	17.2	16.8
Middle States:				
1850	43.9	44.2	43.9	44.3
1860	37.9	43.1	41.6	40.2
1870	34.7	42.7	39.2	41.4
1880	35.3	42.1	41.7	42.8
1890	35.2	39.2	38.5	40.8
1900	34.1	40.7	36.6	38.4
1905	33.6	39.5	36.7	37.3
Southern States:				
1850	16.7	12.6	11.5	9.5
1860	17.2	11.5	10.1	9.2
1870	15.4	6.6	9.1	5.8
1880	14.6	6.9	8.2	5.6
1890	13.1	7.8	9.7	7.1
1900	15.1	9.0	13.3	9.2
1905	15.3	11.0	14.0	10.7
Central States:				
1850	20.2	11.8	11.5	12.7
1860	23.4	17.1	14.2	14.9
1870	33.5	24.4	23.8	22.6
1880	32.3	25.1	23.6	24.1
1890	31.8	29.7	28.2	27.6
	32.0	27.8	27.4	28.3

1900				
1905	31.3	28.2	27.0	28.4
Western States:				
1850	[Y]	[Y]	[Y]	[Y]
1860	.5	.4	.3	.4
1870	1.5	1.0	.8	1.1
1880	2.6	1.0	1.0	1.1
1890	3.2	2.0	1.8	2.2
1900	3.9	2.9	2.0	2.5
1905	4.2	3.2	2.1	2.7
Pacific States:				
1850	.9	.3	.4	1.7
1860	6.3	2.4	3.9	7.8
1870	2.1	2.2	1.4	1.9
1880	2.8	2.5	1.8	2.5
1890	3.1	3.3	2.5	3.3
1900	4.0	2.1	2.6	3.2
1905	5.2	3.3	3.0	4.1
Alaska:				
1890	[Y]	[Y]	[Y]	[Y]
1900	[Y]	.1	[Y]	.1
1905	.1	.1	[Y]	[Y]

Group of States and census years.[X]	Miscel-laneous expenses.	Cost of materials used.	Value of products.
	Per cent.	Per cent.	Per cent.
New England States:			
1850	…	27.6	27.8
1860	…	23.8	24.8
1870	…	24.3	23.8
1880	…	19.4	20.6
1890	15.7	15.3	16.0
1900	12.2	13.8	14.6
1905	11.5	13.1	13.7
Middle States:			
1850	…	47.9	46.4
1860	…	43.1	42.5
1870	…	41.7	41.8
1880	…	41.1	41.3
1890	36.3	38.1	38.9
1900	39.1	37.6	38.1
1905	38.7	37.0	37.3
Southern States:			
1850	…	9.5	9.9
1860	…	10.6	10.3
1870	…	6.5	6.6
1880	…	6.3	6.3
1890	8.2	7.4	7.5
1900	9.1	8.6	8.9
1905	10.1	10.2	10.5
Central States:			
1850	…	14.5	14.3
1860	…	19.5	18.1
1870	…	24.9	24.9
1880	…	29.4	28.0
1890	34.7	32.5	31.4
1900	35.6	31.4	30.9
1905	34.3	30.7	30.5
Western States:			

1850	…	.1	.1
1860	…	.2	.4
1870	…	1.0	1.1
1880	…	1.4	1.4
1890	2.4	3.6	3.0
1900	1.9	5.2	4.3
1905	2.4	5.3	4.3
Pacific States:			
1850	…	.4	1.5
1860	…	2.8	3.9
1870	…	1.6	1.8
1880	…	2.4	2.4
1890	2.7	3.1	3.2
1900	2.1	3.4	3.2
1905	2.9	3.7	3.7
Alaska:			
1890	[Y]	[Y]	[Y]
1900	[Y]	[Y]	[Y]
1905	.1	[Y]	[Y]

[X] New England States: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut. Middle States: New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia. Southern States: Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Indian Territory, Oklahoma, Texas. Central States: Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri. Western States: Montana, Idaho, Wyoming, North Dakota, South Dakota, Nebraska, Nevada, Utah, Colorado, Kansas, Arizona, New Mexico. Pacific States: Washington, Oregon, California.

[Y] Less than one-tenth of 1 per cent.

Summary of Manufactures in the U. S., by States and Territories, Census Years 1900 and 1905.

[From reports of the Bureau of the Census, Department of Commerce and Labor.]

State or Territory.	Census year.	Number of establish-ments.	Capital.
			Dollars.
United States	1900	207,562	8,978,825,200
	1905	216,262	12,686,265,673
Alabama	1900	2,000	60,165,904
	1905	1,882	105,382,859
Alaska	1900	48	3,568,704
	1905	82	10,684,799
Arizona	1900	154	9,517,578
	1905	169	14,395,654
Arkansas	1900	1,746	25,384,636
	1905	1,907	46,306,116
California	1900	4,997	175,467,806
	1905	6,839	282,647,201
Colorado	1900	1,323	58,172,865
	1905	1,606	107,663,500
Connecticut	1900	3,382	299,206,925
	1905	3,477	373,283,580
Delaware	1900	633	38,791,402
	1905	631	50,925,630
Dist. of Columbia	1900	491	17,960,498
	1905	482	20,199,783
Florida	1900	1,275	25,682,171
	1905	1,413	32,971,982
Georgia	1900	3,015	79,303,316
	1905	3,219	135,211,551
Idaho	1900	287	2,130,112
	1905	364	9,689,445
Illinois	1900	14,374	732,829,771
	1905	14,921	975,844,799
Indian Territory	1900	179	1,591,953
	1905	466	5,016,654
Indiana	1900	7,128	219,321,080
	1905	7,044	312,071,234
Iowa	1900	4,828	85,667,334

	1905	4,785	111,427,429
Kansas	1900	2,299	59,458,256
	1905	2,475	88,680,117
Kentucky	1900	3,648	87,995,822
	1905	3,734	147,282,478
Louisiana	1900	1,826	100,874,729
	1905	2,091	150,810,608
Maine	1900	2,878	114,007,715
	1905	3,145	143,707,750
Maryland	1900	3,886	149,155,313
	1905	3,852	201,877,966
Massachusetts	1900	10,929	781,867,715
	1905	10,723	965,948,887
Michigan	1900	7,310	246,996,529
	1905	7,446	337,894,102
Minnesota	1900	4,096	133,076,669
	1905	4,756	184,903,271
Mississippi	1900	1,294	22,712,186
	1905	1,520	50,256,309
Missouri	1900	6,853	223,781,088
	1905	6,464	379,368,827
Montana	1900	395	38,224,915
	1905	382	52,589,810
Nebraska	1900	1,695	65,906,052
	1905	1,819	80,235,310
Nevada	1900	99	1,251,208
	1905	115	2,891,997
New Hampshire	1900	1,771	92,146,025
	1905	1,618	109,495,072
New Jersey	1900	6,415	477,301,565
	1905	7,010	715,060,174
New Mexico	1900	174	2,160,718
	1905	199	4,638,248
New York	1900	35,957	1,523,502,651
	1905	37,194	2,031,459,515
North Carolina	1900	3,465	68,283,005
	1905	3,272	141,000,639

North Dakota	1900	337	3,511,968
	1905	507	5,703,837
Ohio	1900	13,868	570,908,968
	1905	13,785	856,988,830
Oklahoma	1900	316	2,462,438
	1905	657	11,107,763
Oregon	1900	1,406	28,359,089
	1905	1,602	44,023,548
Pennsylvania	1900	23,462	1,449,814,740
	1905	23,495	1,995,836,988
Rhode Island	1900	1,678	176,901,606
	1905	1,617	215,901,375
South Carolina	1900	1,369	62,750,027
	1905	1,399	113,422,224
South Dakota	1900	624	6,051,288
	1905	686	7,585,142
Tennessee	1900	3,116	63,140,657
	1905	3,175	102,439,481
Texas	1900	3,107	63,655,616
	1905	3,158	115,664,871
Utah	1900	575	13,219,039
	1905	606	26,004,011
Vermont	1900	1,938	43,499,633
	1905	1,699	62,658,741
Virginia	1900	3,186	92,299,589
	1905	3,187	147,989,182
Washington	1900	1,926	41,574,744
	1905	2,751	96,952,621
West Virginia	1900	1,824	49,103,138
	1905	2,109	86,820,823
Wisconsin	1900	7,841	286,060,566
	1905	8,558	412,647,051
Wyoming	1900	139	2,047,883
	1905	169	2,695,889

State or Territory.	Census year.	Wage-earners.	
		Average number.	Total wages.
			Dollars.
United States	1900	4,715,023	2,009,735,799
	1905	5,470,321	2,611,540,532
Alabama	1900	52,711	14,911,683
	1905	62,173	21,878,451
Alaska	1900	2,260	1,374,680
	1905	1,938	1,095,579
Arizona	1900	3,126	2,287,352
	1905	4,793	3,969,248
Arkansas	1900	31,525	10,184,154
	1905	33,089	14,543,635
California	1900	77,224	39,889,997
	1905	100,355	64,656,686
Colorado	1900	19,498	11,707,566
	1905	21,813	15,100,365
Connecticut	1900	159,733	73,394,062
	1905	181,605	87,942,628
Delaware	1900	20,562	8,457,003
	1905	18,475	8,158,203
Dist. of Columbia	1900	6,155	3,022,906
	1905	6,299	3,658,370
Florida	1900	35,471	10,916,443
	1905	42,091	15,767,182
Georgia	1900	83,336	19,958,153
	1905	92,749	27,392,442
Idaho	1900	1,552	818,239
	1905	3,061	2,059,391
Illinois	1900	332,871	159,104,179
	1905	379,436	208,405,468
Indian Territory	1900	1,087	379,188
	1905	2,257	1,144,078
Indiana	1900	139,017	59,280,131
	1905	154,174	72,058,099
Iowa	1900	44,420	18,020,653

	1905	49,481	22,997,053
Kansas	1900	27,119	12,802,096
	1905	35,570	18,883,071
Kentucky	1900	51,735	18,454,252
	1905	59,794	24,438,684
Louisiana	1900	40,878	14,725,437
	1905	55,859	25,315,750
Maine	1900	69,914	25,730,735
	1905	74,958	32,691,759
Maryland	1900	94,170	32,414,429
	1905	94,174	36,144,244
Massachusetts	1900	438,234	195,278,276
	1905	488,399	232,388,946
Michigan	1900	155,800	62,531,812
	1905	175,229	81,278,837
Minnesota	1900	64,557	29,029,190
	1905	69,636	35,843,145
Mississippi	1900	26,799	7,909,607
	1905	38,690	14,819,034
Missouri	1900	107,704	46,713,734
	1905	133,167	66,644,126
Montana	1900	9,854	7,376,822
	1905	8,957	8,652,217
Nebraska	1900	18,669	8,842,429
	1905	20,260	11,022,149
Nevada	1900	504	352,606
	1905	802	693,407
New Hampshire	1900	67,646	25,849,631
	1905	65,366	27,693,203
New Jersey	1900	213,975	95,164,913
	1905	266,336	128,168,801
New Mexico	1900	2,490	1,199,496
	1905	3,478	2,153,068
New York	1900	726,909	337,323,585
	1905	856,947	430,014,851
North Carolina	1900	72,322	14,051,784
	1905	85,339	21,375,294

North Dakota	1900	1,358	671,321
	1905	1,755	1,031,307
Ohio	1900	308,109	136,427,579
	1905	364,298	182,429,425
Oklahoma	1900	1,294	514,879
	1905	3,199	1,655,324
Oregon	1900	14,459	6,822,011
	1905	18,523	11,443,512
Pennsylvania	1900	663,960	296,875,548
	1905	763,282	367,960,890
Rhode Island	1900	88,197	35,995,101
	1905	97,318	43,112,637
South Carolina	1900	47,025	9,130,269
	1905	59,441	13,868,950
South Dakota	1900	2,224	1,129,787
	1905	2,492	1,421,680
Tennessee	1900	45,963	14,727,506
	1905	60,572	22,805,628
Texas	1900	38,604	16,911,681
	1905	49,066	24,468,942
Utah	1900	5,413	2,762,522
	1905	8,052	5,157,400
Vermont	1900	28,179	11,426,548
	1905	33,106	15,221,059
Virginia	1900	66,223	20,273,889
	1905	80,285	27,943,058
Washington	1900	31,523	17,065,140
	1905	45,199	30,087,287
West Virginia	1900	33,080	12,639,856
	1905	43,758	21,153,042
Wisconsin	1900	137,525	55,695,816
	1905	151,391	71,471,805
Wyoming	1900	2,060	1,209,123
	1905	1,834	1,261,122

State or Territory.	Census year.	Cost of materials used.
		Dollars.
United States	1900	6,577,614,074
	1905	8,503,949,756
Alabama	1900	37,998,233
	1905	60,458,368
Alaska	1900	1,762,583
	1905	3,741,946
Arizona	1900	7,876,542
	1905	14,595,057
Arkansas	1900	18,288,045
	1905	21,799,346
California	1900	164,894,269
	1905	215,726,414
Colorado	1900	60,750,784
	1905	63,114,397
Connecticut	1900	169,671,648
	1905	191,801,881
Delaware	1900	24,725,317
	1905	24,883,806
Dist. of Columbia	1900	7,475,216
	1905	7,731,971
Florida	1900	12,847,187
	1905	16,532,439
Georgia	1900	49,356,296
	1905	83,624,504
Idaho	1900	1,438,868
	1905	4,068,523
Illinois	1900	681,450,122
	1905	840,057,316
Indian Territory	1900	1,697,829
	1905	4,848,646
Indiana	1900	195,162,566
	1905	220,507,007
Iowa	1900	85,778,867
		102,843,892

	1905	
Kansas	1900	120,737,677
	1905	156,509,949
Kentucky	1900	67,406,202
	1905	86,545,464
Louisiana	1900	75,403,937
	1905	117,035,305
Maine	1900	61,210,327
	1905	80,042,090
Maryland	1900	129,354,412
	1905	150,024,066
Massachusetts	1900	498,655,033
	1905	626,410,431
Michigan	1900	175,966,128
	1905	230,080,931
Minnesota	1900	150,299,277
	1905	210,553,949
Mississippi	1900	16,543,029
	1905	25,800,885
Missouri	1900	184,189,030
	1905	252,258,417
Montana	1900	30,068,101
	1905	40,930,060
Nebraska	1900	95,925,178
	1905	124,051,628
Nevada	1900	662,284
	1905	1,627,776
New Hampshire	1900	60,163,380
	1905	73,216,387
New Jersey	1900	334,726,094
	1905	470,449,176
New Mexico	1900	1,998,593
	1905	2,235,934
New York	1900	1,018,377,186
	1905	1,348,603,286
North Carolina	1900	44,854,224
	1905	79,268,004

North Dakota	1900	4,150,860
	1905	7,095,986
Ohio	1900	409,302,501
	1905	527,636,585
Oklahoma	1900	3,732,618
	1905	11,545,306
Oregon	1900	20,788,833
	1905	30,596,763
Pennsylvania	1900	958,301,272
	1905	1,142,942,707
Rhode Island	1900	87,951,780
	1905	112,872,261
South Carolina	1900	30,485,861
	1905	49,968,626
South Dakota	1900	6,483,677
	1905	8,696,831
Tennessee	1900	54,559,039
	1905	79,351,746
Texas	1900	54,388,303
	1905	91,603,630
Utah	1900	11,440,250
	1905	24,939,827
Vermont	1900	26,384,812
	1905	32,429,852
Virginia	1900	59,359,484
	1905	83,649,149
Washington	1900	38,276,944
	1905	66,166,165
West Virginia	1900	37,228,253
	1905	54,419,206
Wisconsin	1900	185,695,393
	1905	227,255,092
Wyoming	1900	1,369,730
	1905	1,300,773

State or Territory.	Census year.	Value of products, including custom work and repairing.
		Dollars.
United States	1900	11,411,121,122
	1905	14,802,147,087
Alabama	1900	72,109,929
	1905	109,169,922
Alaska	1900	4,194,421
	1905	8,244,524
Arizona	1900	20,438,987
	1905	28,083,192
Arkansas	1900	39,887,578
	1905	53,864,394
California	1900	257,385,521
	1905	367,218,494
Colorado	1900	89,067,879
	1905	100,143,999
Connecticut	1900	315,106,150
	1905	369,082,091
Delaware	1900	41,321,061
	1905	41,160,276
Dist. of Columbia	1900	16,426,408
	1905	18,359,159
Florida	1900	34,183,509
	1905	50,298,290
Georgia	1900	94,532,368
	1905	151,040,455
Idaho	1900	3,001,442
	1905	8,768,743
Illinois	1900	1,120,868,308
	1905	1,410,342,129
Indian Territory	1900	2,629,067
	1905	7,909,451
Indiana	1900	337,071,630
	1905	393,954,405

Iowa	1900	132,870,865
	1905	160,572,313
Kansas	1900	154,008,544
	1905	198,244,992
Kentucky	1900	126,508,660
	1905	159,753,968
Louisiana	1900	111,397,919
	1905	186,379,592
Maine	1900	112,959,098
	1905	144,020,197
Maryland	1900	211,076,143
	1905	243,375,996
Massachusetts	1900	907,626,439
	1905	1,124,092,051
Michigan	1900	319,691,856
	1905	429,120,060
Minnesota	1900	223,692,922
	1905	307,858,073
Mississippi	1900	33,718,517
	1905	57,451,445
Missouri	1900	316,304,095
	1905	439,548,957
Montana	1900	52,744,997
	1905	66,415,452
Nebraska	1900	130,302,453
	1905	154,918,220
Nevada	1900	1,261,005
	1905	3,096,274
New Hampshire	1900	107,590,803
	1905	123,610,904
New Jersey	1900	553,005,684
	1905	774,369,025
New Mexico	1900	4,060,924
	1905	5,705,880
New York	1900	1,871,830,872
	1905	2,488,345,579
North Carolina	1900	85,274,083

	1905	142,520,776
North Dakota	1900	6,259,840
	1905	10,217,914
Ohio	1900	748,670,855
	1905	960,811,857
Oklahoma	1900	5,504,869
	1905	16,549,656
Oregon	1900	36,592,714
	1905	55,525,123
Pennsylvania	1900	1,649,882,380
	1905	1,955,551,332
Rhode Island	1900	165,550,382
	1905	202,109,583
South Carolina	1900	53,335,811
	1905	79,376,262
South Dakota	1900	9,529,946
	1905	13,085,333
Tennessee	1900	92,749,129
	1905	137,960,476
Texas	1900	92,894,433
	1905	150,528,389
Utah	1900	17,981,648
	1905	38,926,464
Vermont	1900	51,515,228
	1905	63,083,611
Virginia	1900	108,644,150
	1905	148,856,525
Washington	1900	70,831,345
	1905	128,821,667
West Virginia	1900	67,006,822
	1905	99,040,676
Wisconsin	1900	326,752,878
	1905	411,139,681
Wyoming	1900	3,268,555
	1905	3,523,260

Chief Manufacturing Industries of the United States, Showing Sums Paid in Wages, Number of Employes, Capital Invested and Value of Product, 1880 to 1905.

[From reports of the Bureau of the Census, Department of Commerce and Labor.]

Industry.	Census year.	Number of establish-ments.	Capital.
			Dollars.
Agricultural implements	1880	1,943	62,109,668
	1890	910	145,313,997
	1900	715	157,707,951
	1905	648	196,740,700
Boots and shoes	1880	1,959	42,994,028
	1890	2,082	95,282,311
	1900	1,599	99,819,233
	1905	1,316	122,526,093
Bread and other bakery products	1880	6,396	19,155,286
	1890	10,484	45,758,489
	1900	14,836	80,901,926
	1905	18,227	122,363,327
Carriages and wagons	1880	3,841	37,973,493
	1890	4,572	93,455,257
	1900	6,204	109,875,885
	1905	4,956	126,320,604
Cars, shop construction and repairs	1890	716	76,192,477
by steam railroad companies	1900	1,293	119,580,273
	1905	1,141	146,943,729
Cars, shop construction and repairs	1890	78	2,351,162
by street railway companies	1900	108	10,781,939
	1905	86	12,905,853
Cars, steam and street railroad, not	1880	130	9,272,680
including operations of railway	1890	88	46,109,625
companies	1900	85	95,939,249
	1905	87	101,154,750
Cheese, butter and condensed milk	1880	3,932	9,604,803
	1890	4,552	16,016,573
	1900	9,242	36,303,164
	1905	8,926	47,255,556
Chemicals	1880	595	28,983,458
	1890	563	55,032,452

	1900	433	89,069,450
	1905	448	119,890,193
Clothing, men’s	1880	6,166	79,861,696
	1890	4,867	128,253,547
	1900	5,729	120,547,851
	1905	4,504	153,177,500
Clothing, women’s	1880	562	8,207,273
	1890	1,224	21,259,528
	1900	2,701	48,431,544
	1905	3,351	73,947,823
Confectionery	1880	1,450	8,486,874
	1890	2,921	23,326,799
	1900	962	26,319,195
	1905	1,348	43,125,408
Cooperage	1880	3,898	12,178,726
	1890	2,652	17,806,554
	1900	1,694	21,777,636
	1905	1,517	29,532,614
Cordage and twine	1880	165	7,140,475
	1890	150	23,351,883
	1900	105	29,275,470
	1905	102	37,110,521
Cotton goods	1880	1,005	219,504,794
	1890	905	354,020,843
	1900	1,055	467,240,157
	1905	1,154	613,110,655
Electrical machinery, apparatus	1880	76	1,509,758
and supplies	1890	189	18,997,337
	1900	581	83,659,924
	1905	784	174,066,026
Flour and gristmill products	1880	24,338	177,361,878
	1890	18,470	208,473,500
	1900	9,476	189,281,330
	1905	10,051	265,117,434
Foundry and machine shop products	1880	4,984	155,021,734
	1890	6,500	383,257,473
	1900	9,316	663,414,323

	1905	9,428	936,416,978
Furnishing goods, men’s	1880	161	3,724,664
	1890	586	12,299,011
	1900	457	20,575,961
	1905	547	28,043,584
Furniture	1880	5,227	44,946,128
	1890	1,919	80,780,939
	1900	1,814	104,484,394
	1905	2,482	152,712,732
Glass	1880	169	18,804,599
	1890	294	40,966,850
	1900	355	61,423,903
	1905	399	89,389,151
Hardware	1880	492	15,363,551
	1890	350	26,271,840
	1900	381	39,311,745
	1905	445	52,884,078
Jewelry	1880	739	11,431,164
	1890	783	22,246,508
	1900	851	27,871,924
	1905	1,023	39,678,956
Leather, tanned, curried,	1880	5,628	73,383,911
and finished	1890	1,787	98,088,698
	1900	1,306	173,977,421
	1905	1,049	242,584,254
Liquors, malt	1880	2,191	91,208,224
	1890	1,248	232,471,290
	1900	1,507	413,767,233
	1905	1,531	515,636,792
Lumber and timber products	1880	25,758	181,465,392
	1890	22,617	557,881,054
	1900	23,053	400,857,337
	1905	19,127	517,224,128
Lumber, planing-mill products,	1880	2,491	38,070,593
including sash, doors, and blinds	1890	3,670	120,271,440
	1900	4,198	118,948,556
	1905	5,009	177,145,734

Marble and stone work	1880	2,846	16,498,221
	1890	1,321	24,041,961
	1900	1,655	39,559,146
	1905	1,642	66,526,724
Paper and wood pulp	1880	742	48,139,652
	1890	649	89,829,548
	1900	763	167,507,713
	1905	761	277,444,471
Petroleum, refining	1890	94	77,416,296
	1900	67	95,327,892
	1905	98	136,280,541
Silk and silk goods	1880	382	19,125,300
	1890	472	51,007,537
	1900	483	81,082,201
	1905	624	109,556,621
Slaughtering and meat packing, wholesale	1880	872	49,419,213
	1890	611	98,190,766
	1900	557	173,866,377
	1905	559	219,818,627
Slaughtering, wholesale, not including meat packing	1890	507	18,696,738
	1900	325	14,933,804
	1905	370	17,896,063
Smelting and refining, copper	1900	47	53,063,395
	1905	40	76,824,640
Smelting and refining, lead	1900	39	72,148,933
	1905	32	63,822,810
Structural ironwork	1880	220	1,400,197
	1890	724	21,968,172
	1900	697	43,442,877
	1905	775	76,598,507
Sugar and molasses, refining	1880	49	27,432,500
	1890	393	24,013,008
	1900	657	184,033,304
	1905	344	165,468,320
Tinware, copper-smithing, and sheet iron working	1880	7,693	23,167,392
	1890	7,002	38,434,900
	1900	1,846	35,724,739

	1905	2,366	124,500,133
Tobacco, chewing and smoking,	1880	477	17,207,401
and snuff	1890	395	30,841,316
	1900	437	43,856,570
	1905	433	178,847,556
Tobacco, cigars and cigarettes	1880	7,145	21,698,549
	1890	10,956	59,517,827
	1900	14,522	67,660,748
	1905	16,395	145,135,945
Woolen goods	1880	1,990	96,095,564
	1890	1,811	130,989,940
	1900	1,035	124,386,262
	1905	792	140,302,488
Worsted goods	1880	76	20,374,043
	1890	143	68,085,116
	1900	186	132,168,110
	1905	226	162,464,929

Industry.	Census year.	Wage-earners.	
		Average number.	Total wages.
			Dollars.
Agricultural implements	1880	39,580	15,359,610
	1890	38,827	18,107,094
	1900	46,582	22,450,880
	1905	47,394	25,002,650
Boots and shoes	1880	111,152	43,001,438
	1890	133,690	60,667,145
	1900	141,830	58,440,883
	1905	149,924	69,059,680
Bread and other	1880	22,488	9,411,328
bakery products	1890	38,841	19,120,529
	1900	60,192	27,864,024
	1905	81,284	43,179,822
Carriages and wagons	1880	45,394	18,988,615
	1890	56,525	28,972,401
	1900	58,425	27,578,046
	1905	60,722	30,878,229
Cars, shop construction	1890	106,632	60,213,433
and repairs by steam	1900	173,652	96,062,329
railroad companies	1905	236,900	142,188,336
Cars, shop construction	1890	2,009	1,411,205
and repairs by street	1900	7,025	4,404,593
railway companies	1905	11,052	7,012,798
Cars, steam and street	1880	14,232	6,507,753
railroad, not including	1890	33,139	17,168,099
operations of	1900	37,038	18,938,170
railway companies	1905	38,788	23,087,400
Cheese, butter	1880	7,903	1,548,495
and condensed milk	1890	12,219	4,248,854
	1900	12,799	6,145,561
	1905	15,557	8,412,937
Chemicals	1880	9,724	4,222,663
	1890	15,038	7,308,411
	1900	19,020	9,393,236

	1905	24,525	13,361,972
Clothing, men’s	1880	160,813	45,940,353
	1890	144,926	51,075,837
	1900	120,927	45,496,728
	1905	137,190	57,225,506
Clothing, women’s	1880	25,192	6,661,005
	1890	39,149	15,428,272
	1900	83,739	32,586,101
	1905	115,705	51,180,193
Confectionery	1880	9,801	3,242,852
	1890	21,724	7,783,007
	1900	26,866	8,020,453
	1905	36,239	11,699,257
Cooperage	1880	25,973	8,992,603
	1890	22,555	10,056,249
	1900	22,117	8,786,428
	1905	21,149	9,485,455
Cordage and twine	1880	5,435	1,558,676
	1890	12,385	3,976,232
	1900	13,114	4,113,112
	1905	14,614	5,338,178
Cotton goods	1880	185,472	45,614,419
	1890	218,876	66,024,538
	1900	302,861	86,689,752
	1905	315,874	96,205,796
Electrical machinery,	1880	1,271	683,164
apparatus and supplies	1890	8,802	4,517,050
	1900	42,013	20,579,194
	1905	60,466	31,841,521
Flour and gristmill	1880	58,407	17,422,316
products	1890	47,403	18,138,402
	1900	32,226	16,285,163
	1905	39,110	19,822,196
Foundry and machine	1880	145,650	66,093,920
shop products	1890	231,331	129,282,263
	1900	350,103	182,096,007
	1905	402,914	229,869,297

Furnishing goods, men's	1880	11,174	2,644,155
	1890	20,773	6,078,036
	1900	30,322	9,730,066
	1905	27,185	8,760,108
Furniture	1880	59,304	23,695,080
	1890	72,869	35,068,979
	1900	87,262	35,632,523
	1905	110,133	49,883,235
Glass	1880	24,177	9,144,100
	1890	44,892	20,885,961
	1900	52,818	27,084,710
	1905	63,969	37,288,148
Hardware	1880	16,801	6,846,913
	1890	18,495	8,656,067
	1900	26,463	11,422,758
	1905	31,713	14,580,589
Jewelry	1880	12,697	6,441,688
	1890	13,880	8,038,327
	1900	20,468	10,643,887
	1905	22,080	12,592,846
Leather, tanned,	1880	40,282	16,503,828
curried, and finished	1890	42,392	21,249,989
	1900	52,109	22,591,091
	1905	57,239	27,049,152
Liquors, malt	1880	26,220	12,198,053
	1890	30,257	20,713,383
	1900	39,459	25,776,468
	1905	48,139	34,542,897
Lumber and	1880	148,290	31,893,098
timber products	1890	311,964	87,934,284
	1900	413,335	148,007,845
	1905	404,626	183,021,519
Lumber, planing-	1880	37,187	14,431,654
mill products,	1890	79,923	42,221,856
including sash,	1900	73,510	32,621,704
doors, and blinds	1905	97,674	50,713,607
Marble and stone work	1880	21,471	10,238,885

	1890	21,950	15,314,598
	1900	30,641	16,328,174
	1905	40,905	25,032,725
Paper and wood pulp	1880	25,631	8,970,133
	1890	31,050	13,204,828
	1900	49,646	20,746,426
	1905	65,964	32,019,212
Petroleum, refining	1890	11,403	5,872,467
	1900	12,199	6,717,087
	1905	16,770	9,989,367
Silk and silk goods	1880	31,337	9,146,705
	1890	49,382	17,762,441
	1900	65,416	20,982,194
	1905	79,601	26,767,943
Slaughtering and	1880	27,297	10,508,530
meat packing,	1890	37,502	20,304,029
wholesale	1900	64,681	31,033,850
	1905	69,593	37,090,399
Slaughtering, wholesale,	1890	6,473	4,000,947
not including	1900	3,705	2,358,403
meat packing	1905	4,541	3,236,573
Smelting and	1900	11,324	8,529,021
refining, copper	1905	12,752	10,827,043
Smelting and	1900	8,319	5,088,684
refining, lead	1905	7,573	5,374,691
Structural ironwork	1880	1,934	844,614
	1890	17,158	10,235,701
	1900	24,903	13,588,779
	1905	34,276	19,760,210
Sugar and molasses,	1880	5,857	2,875,032
refining	1890	7,043	2,385,654
	1900	14,129	6,917,829
	1905	13,549	7,575,650
Tinware,	1880	27,116	11,243,276
copper-smithing,	1890	31,377	15,610,265
and sheet	1900	28,315	13,193,307
iron working	1905	39,475	20,608,179

Tobacco, chewing	1880	32,756	6,419,024
and smoking,	1890	29,790	6,947,158
and snuff	1900	29,161	7,109,821
	1905	23,990	6,775,325
Tobacco, cigars	1880	63,297	18,464,562
and cigarettes	1890	87,000	36,475,060
	1900	103,365	40,865,510
	1905	135,418	55,864,978
Woolen goods	1880	86,504	25,836,392
	1890	76,915	26,139,194
	1900	68,893	24,757,006
	1905	72,747	28,827,556
Worsted goods	1880	18,803	5,683,027
	1890	42,978	14,944,966
	1900	57,008	20,092,738
	1905	69,251	26,269,787

Industry.	Census year.	Value of products, including custom work and repairing.
		Dollars.
Agricultural implements	1880	68,640,486
	1890	81,271,651
	1900	101,207,428
	1905	112,007,344
Boots and shoes	1880	166,050,354
	1890	220,649,358
	1900	258,969,580
	1905	320,107,458
Bread and other	1880	65,824,806
bakery products	1890	128,421,535
	1900	175,368,682
	1905	269,609,061
Carriages and wagons	1880	64,951,617
	1890	102,680,341
	1900	113,234,590
	1905	125,332,976
Cars, shop construction	1890	129,461,698
and repairs by steam	1900	218,238,277
railroad companies	1905	309,863,499
Cars, shop construction	1890	2,966,347
and repairs by street	1900	9,370,811
railway companies	1905	13,437,121
Cars, steam and street	1880	27,997,591
railroad, not including	1890	73,385,852
operations of	1900	97,815,648
railway companies	1905	122,019,506
Cheese, butter	1880	25,742,510
and condensed milk	1890	60,635,705
	1900	130,783,349
	1905	168,182,789
Chemicals	1880	38,640,458

	1890	59,352,548
	1900	62,637,008
	1905	92,088,378
Clothing, men’s	1880	209,548,460
	1890	251,019,609
	1900	276,717,357
	1905	355,796,571
Clothing, women’s	1880	32,004,794
	1890	68,164,019
	1900	159,339,539
	1905	247,661,560
Confectionery	1880	25,637,033
	1890	55,997,101
	1900	60,643,946
	1905	87,087,253
Cooperage	1880	33,714,770
	1890	38,617,956
	1900	38,439,745
	1905	49,424,394
Cordage and twine	1880	12,492,171
	1890	38,812,559
	1900	37,849,651
	1905	48,017,139
Cotton goods	1880	210,950,383
	1890	267,981,724
	1900	339,200,820
	1905	450,467,704
Electrical machinery,	1880	2,655,036
apparatus and supplies	1890	19,114,714
	1900	92,434,435
	1905	140,809,369
Flour and gristmill	1880	505,185,712
products	1890	513,971,474
	1900	501,896,304
	1905	713,033,395
Foundry and machine	1880	215,442,011
shop products	1890	413,197,118

	1900	644,456,216
	1905	799,862,588
Furnishing goods, men’s	1880	11,506,357
	1890	29,870,946
	1900	44,346,482
	1905	49,031,582
Furniture	1880	77,845,725
	1890	111,743,080
	1900	125,315,986
	1905	170,446,825
Glass	1880	21,154,571
	1890	41,051,004
	1900	56,539,712
	1905	79,607,998
Hardware	1880	22,653,693
	1890	26,726,463
	1900	35,846,656
	1905	45,770,171
Jewelry	1880	22,201,621
	1890	34,761,458
	1900	46,128,659
	1905	53,225,681
Leather, tanned,	1880	200,264,944
curried, and finished	1890	172,136,092
	1900	204,038,127
	1905	252,620,986
Liquors, malt	1880	101,058,385
	1890	182,731,622
	1900	236,914,914
	1905	298,358,732
Lumber and	1880	233,608,886
timber products	1890	437,957,382
	1900	555,197,271
	1905	580,022,690
Lumber, planing-	1880	73,424,681
mill products,	1890	183,681,552
including sash,	1900	167,786,122

doors, and blinds	1905	247,441,956
Marble and stone work	1880	31,415,150
	1890	41,924,264
	1900	42,230,457
	1905	63,059,842
Paper and wood pulp	1880	57,366,860
	1890	78,937,184
	1900	127,326,162
	1905	188,715,189
Petroleum, refining	1890	85,001,198
	1900	123,929,384
	1905	175,005,320
Silk and silk goods	1880	41,033,045
	1890	87,298,454
	1900	107,256,258
	1905	133,288,072
Slaughtering and	1880	303,562,413
meat packing,	1890	433,252,315
wholesale	1900	697,056,065
	1905	801,757,137
Slaughtering, wholesale,	1890	128,359,353
not including	1900	86,723,126
meat packing	1905	112,157,487
Smelting and	1900	165,131,670
refining, copper	1905	240,780,216
Smelting and	1900	175,466,304
refining, lead	1905	185,826,839
Structural ironwork	1880	3,410,086
	1890	37,745,294
	1900	66,927,305
	1905	90,944,697
Sugar and molasses,	1880	155,484,915
refining	1890	123,118,259
	1900	239,711,011
	1905	277,285,449
Tinware,	1880	50,183,811
copper-smithing,	1890	66,653,746

and sheet	1900	63,812,787
iron working	1905	97,974,838
Tobacco, chewing	1880	52,793,056
and smoking,	1890	65,843,587
and snuff	1900	103,754,362
	1905	116,767,630
Tobacco, cigars	1880	63,979,575
and cigarettes	1890	129,693,275
	1900	159,958,811
	1905	214,350,051
Woolen goods	1880	160,606,721
	1890	133,577,977
	1900	118,430,158
	1905	142,196,658
Worsted goods	1880	33,549,942
	1890	79,194,652
	1900	120,314,344
	1905	165,745,052

The Textile Industries of the United States at Decennial Periods, 1850 to 1900.

[Compiled from Census Reports.]

	Year.	Number of establish-ments.	Capital.
Wool manu-facture[Z]	1850	1,760	$ 32,516,366
	1860	1,673	42,849,932
	1870	3,456	132,382
	1880	2,689	159,091
	1890	2,489	296,494
	1900	2,335	392,040
	1905	2,292	477,525
Cotton manu-facture[AA]	1850	1,094	74,500,931
	1860	1,091	98,585,269
	1870	956	140,706
	1880	756	208,280
	1890	905	354,020
	1900	1,055	467,240
	1905	1,154	613,110
Silk manu--facture	1850	67	678,300
	1860	139	2,926,980
	1870	86	6,231,130
	1880	382	19,125,300
	1890	472	51,007,537
	1900	483	81,082,201
	1905	624	109,556
Dyeing and finishing textiles	1850	104	4,818,350
	1860	124	5,718,671
	1870	292	18,374,503
	1880	191	26,223,981
	1890	248	38,450,800
	1900	298	60,643,104
	1905	360	88,708,576
Flax, hemp and jute	1890	162	27,731,649
	1900	141	41,991,762
	1905	133	54,423,531
Combined textiles	1850	3,025	112,513
	1860	3,027	150,080

	1870	4,790	297,694
	1880	4,018	412,721
	1890	4,276	767,705
	1900	4,312	1,042,997,577
	1905	4,563	1,343,324,605

	Year.	Number of wage-earners.	Wages.
Wool	1850	47,763	…
manu-	1860	59,522	$ 13,361,602
facture[Z]	1870	119,859	40,357
	1880	161,557	47,389
	1890	213,859	70,917
	1900	242,495	82,292
	1905	283,691	102,333,548
Cotton	1850	92,286	…
manu-	1860	122,028	23,940
facture[AA]	1870	135,369	39,044
	1880	174,659	42,040
	1890	218,876	66,024
	1900	802,861	86,689
	1905	315,874	96,205
Silk	1850	1,743	…
manufacture	1860	5,435	1,050
	1870	6,649	1,942
	1880	31,337	9,146
	1890	49,382	17,762
	1900	65,416	20,982
	1905	79,601	26,767
Dyeing and	1850	5,105	…
finishing	1860	7,097	2,001
textiles	1870	13,066	5,221
	1880	16,698	6,474
	1890	19,601	8,911
	1900	29,776	12,726
	1905	35,563	15,469
Flax, hemp	1890	15,519	4,872
and jute	1900	20,903	6,331
	1905	24,508	8,580
Combined	1850	146,877	…
textiles	1860	194,082	40,353

	1870	274,943	86,565
	1880	384,251	105,050,666
	1890	517,237	168,488,982
	1900	661,451	209,022,447
	1905	739,239	249,357,277

	Year.	Cost of materials.	Value of products.
Wool manu-facture[Z]	1850	$29,246,696	$ 49,636,881
	1860	46,649,365	80,734,606
	1870	134,154,615	217,668,826
	1880	164,371,551	267,252,913
	1890	203,095,572	337,768,524
	1900	232,230,986	392,473,050
	1905	319,154,878	517,492,142
Cotton manu-facture[AA]	1850	34,835,056	61,869,184
	1860	57,285,534	115,681,774
	1870	111,736,936	177,489,789
	1880	102,206,347	192,090,110
	1890	154,912,979	267,981,724
	1900	176,551,527	339,200,320
	1905	286,255,303	450,467,704
Silk manufacture	1850	1,093,866	1,809,476
	1860	3,901,777	6,607,771
	1870	7,817,559	12,210,662
	1880	22,467,701	41,033,045
	1890	51,004,425	87,298,454
	1900	62,406,665	107,256,258
	1905	75,861,188	188,288,072
Dyeing and finishing textiles	1850	11,540,347	15,454,430
	1860	5,005,435	11,716,463
	1870	99,539,992	113,017,537
	1880	13,664,295	32,297,420
	1890	12,385,220	28,900,460
	1900	17,958,137	44,963,331
	1905	19,621,253	50,849,545
Flax, hemp and jute	1890	26,148,344	37,313,021
	1900	32,197,885	47,601,607
	1905	44,890,546	62,939,329
Combined textiles	1850	76,715,959	128,769,971
	1860	112,842,111	214,740,614
	1870	353,249,102	520,386,764

	1880	302,709,894	532,673,488
	1890	447,546,540	759,262,283
	1900	521,345,200	931,494,566
	1905	745,783,168	1,215,036,792

[Z] Includes hosiery and knit goods.

[AA] Includes cotton small wares.

Cotton Manufactures in the United States, 1870 to 1905.

[From official reports of the United States Census Office.]

	1870.	1880.
Number of establishments	956	756
Capital	$140,706,291	$208,280,346
Wage-earners, average number	135,369	174,659
Total wages	$39,044,132	$42,040,510
Cost of materials used	$111,736,936	$102,206,347
Value of products	$177,489,739	$192,090,110
Active spindles, number	7,132,415	10,653,435
Looms, number	157,310	225,759
Cotton consumed, bales	…	1,570,344
Cotton consumed, pounds	398,308,257	759,343,981

	1890.
Number of establishments	905
Capital	$354,020,843
Wage-earners, average number	218,876
Total wages	$66,024,538
Cost of materials used	$154,912,979
Value of products	$267,981,724
Active spindles, number	14,188,103
Looms, number	324,866
Cotton consumed, bales	2,261,600
Cotton consumed, pounds	1,117,945,776

	1900.	1905.
Number of establishments	973	1,077
Capital	$460,842,772	$605,100,164
Wage-earners, average number	297,929	310,458
Total wages	$85,126,310	$94,377,696
Cost of materials used	$178,441,390	$282,047,648
Value of products	$332,806,156	$442,451,218
Active spindles, number	19,008,352	23,155,613
Looms, number	450,682	640,910
Cotton consumed, bales	3,639,495	3,743,089
Cotton consumed, pounds	1,814,002,512	1,873,074,716

Silk Manufactures in the United States, 1870 to 1905.

[From official reports of the United States Census Office.]

	1870.	1880.
Number of establishments	86	382
Capital	$6,231,180	$19,125,300
Wage-earners, average number	6,649	31,337
Total wages	$1,942,286	$9,146,705
Cost of materials used	$7,817,559	$22,467,701
Value of products	$12,210,662	$41,033,045
Raw silk used, pounds	684,488	2,690,482

	1890.
Number of establishments	472
Capital	$51,007,537
Wage-earners, average number	49,382
Total wages	$17,762,441
Cost of materials used	$51,004,425
Value of products	$87,298,454
Raw silk used, pounds	6,376,881

	1900.	1905.
Number of establishments	483	624
Capital	$81,082,201	$109,556,621
Wage-earners, average number	65,416	79,601
Total wages	$20,982,194	$26,767,943
Cost of materials used	$62,406,665	$75,861,188
Value of products	$107,256,258	$133,288,072
Raw silk used, pounds	9,760,770	11,572,783

Cotton Production and Manufacturing in the United States, also Imports and Exports of Cotton Manufactures.

[From the Statistical Abstract of the United States.]

	Total commercial crop.	Taken for home consumption.		
		By North-ern mills.	By South-ern mills.	Total.
	In thousands of bales.			
1884	5,713	1,537	340	1,877
1885	5,706	1,437	316	1,753
1886	6,575	1,781	381	2,162
1887	6,499	1,687	401	2,088
1888	7,047	1,805	456	2,261
1889	6,939	1,790	480	2,270
1890	7,297	1,780	545	2,325
1891	8,674	2,027	613	2,640
1892	9,018	2,172	684	2,856
1893	6,664	1,652	723	2,375
1894	7,532	1,580	711	2,291
1895	9,837	2,019	852	2,871
1896	7,147	1,605	900	2,605
1897	8,706	1,793	999	2,792
1898	11,216	2,211	1,254	3,465
1899	11,256	2,217	1,415	3,632
1900	9,422	2,047	1,597	3,644
1901	10,839	1,964	1,583	3,647
1902	10,768	2,066	2,017	4,083
1903	10,674	1,966	1,958	3,924
1904	10,002	2,046	1,889	3,935
1905	13,654	2,292	2,270	4,562
1906	11,234	2,335	2,292	4,627
1907	13,540	2,510	2,495	5,005

	Raw cotton imported.	Exports of manufactures of cotton.	Imports of manufactures of cotton.
	Pounds.	Dollars.	Dollars.
1884	7,019,492	11,885,211	29,074,626
1885	5,115,680	11,836,591	27,197,241
1886	5,072,334	13,959,934	29,709,266
1887	3,924,531	14,929,342	28,940,353
1888	5,497,592	13,013,189	28,917,799
1889	7,973,039	10,212,644	26,805,942
1890	8,606,049	9,999,277	29,918,055
1891	20,908,817	13,604,857	29,712,624
1892	28,663,769	13,226,277	28,323,841
1893	43,367,952	11,809,355	33,560,293
1894	27,705,949	14,340,886	22,346,547
1895	49,332,022	13,789,810	33,196,625
1896	55,350,520	16,837,396	32,437,504
1897	51,898,926	21,037,678	34,429,363
1898	52,660,363	17,024,092	27,267,300
1899	50,158,158	23,566,914	32,054,434
1900	67,398,521	24,003,087	41,296,239
1901	46,631,283	20,272,418	40,246,935
1902	98,715,680	32,108,362	44,460,126
1903	74,874,426	32,216,304	52,462,755
1904	48,840,590	22,403,718	49,524,246
1905	60,508,548	49,668,080	48,919,986
1906	70,963,633	52,944,038	63,043,322
1907	104,791,784	32,305,412	73,704,636

Iron and Steel Manufacturing in the U. S.: Comparative Summary, 1870 to 1905, with per cent of increase for each decade.[BB]

[From the United States Census.]

	Date of census.	
	1870.[CC]	1880.[CC]
Number of establishments	808	792
Capital	$121,722,704	$209,904,965
Salaried officials, clerks, etc., number	[EE]	[EE]
Salaries	[EE]	[EE]
Wage-earners, average number	77,555	140,798
Total wages	$40,514,981	$55,451,510
Men, 16 years and over	75,037	133,023
Wages	[EE]	[EE]
Women, 16 years and over	82	45
Wages	[EE]	[EE]
Children, under 16 years	2,436	7,730
Wages	[EE]	[EE]
Miscellaneous expenses	[FF]	[FF]
Cost of materials used	$135,526,132	$191,271,150
Value of products	$207,208,696	$296,557,685
Tons of products (2,240 pounds each)	3,263,585	6,486,733

	Date of census.
	1890.
Number of establishments	719
Capital	[DD] $414,044,844
Salaried officials, clerks, etc., number	4,325
Salaries	$6,462,236
Wage-earners, average number	171,181
Total wages	$89,273,956
Men, 16 years and over	168,943
Wages	$88,840,642
Women, 16 years and over	58
Wages	$17,106
Children, under 16 years	2,180
Wages	$416,208
Miscellaneous expenses	$18,214,948
Cost of materials used	$327,272,845
Value of products	$478,687,519
Tons of products (2,240 pounds each)	16,264,478

	Date of census.	
	1900.	1905.
Number of establishments	669	606
Capital	$590,530,484	$948,689,840
Salaried officials, clerks, etc., number	9,217	16,566
Salaries	$11,741,788	$20,758,412
Wage-earners, average number	222,607	242,740
Total wages	$120,836,338	$141,439,906
Men, 16 years and over	219,635	239,383
Wages	$120,157,007	$140,545,610
Women, 16 years and over	1,071	1,455
Wages	$266,888	$441,967
Children, under 16 years	1,901	1,902
Wages	$412,443	$452,329
Miscellaneous expenses	$32,274,100	$47,164,970
Cost of materials used	$522,431,701	$620,171,881
Value of products	$804,034,918	$905,854,152
Tons of products (2,240 pounds each)	29,507,860	34,844,933

	Per cent of increase.	
	1870 to 1880.	1880 to 1890.
Number of establishments	[DD] 2.0	[DD] 9.2
Capital	72.4	97.3
Salaried officials, clerks, etc., number	…	…
Salaries	…	…
Wage-earners, average number	81.5	21.6
Total wages	36.9	61.0
Men, 16 years and over	77.3	27.0
Wages	…	…
Women, 16 years and over	[DD] 45.1	28.9
Wages	…	…
Children, under 16 years	217.3	[DD] 71.8
Wages	…	…
Miscellaneous expenses	…	…
Cost of materials used	41.1	71.1
Value of products	43.1	61.4
Tons of products (2,240 pounds each)	98.8	150.7

	Per cent of increase.	
	1890 to 1900.	1900 to 1905.
Number of establishments	[DD] 7.0	9.4
Capital	42.6	60.7
Salaried officials, clerks, etc., number	113.1	79.7
Salaries	81.7	76.8
Wage-earners, average number	30.0	9.0
Total wages	35.4	17.1
Men, 16 years and over	30.0	9.0
Wages	35.3	17.0
Women, 16 years and over	1,746.6	35.9
Wages	1,460.2	65.6
Children, under 16 years	[DD] 12.8	0.1
Wages	[DD] 0.9	9.7
Miscellaneous expenses	77.2	46.1
Cost of materials used	59.6	18.7
Value of products	68.0	12.7
Tons of products (2,240 pounds each)	81.4	18.1

[BB] This summary includes only active establishments for 1880, 1890, and 1900; such establishments were not reported separately in 1870. The 669 establishments in 1900 and the 606 establishments in 1905 include in each case 1 penal institution, the figures for which are not included in Parts I and II of the Report on Manufactures.

[CC] For explanation of the apparent discrepancies in the data for 1870 and 1880, see remarks, page 2, Part I, Manufacturing Industries, 1890, in regard to the depreciated currency in 1870; and in regard to the inclusion of capital, employes, and wages relating to mining and other operations in the figures for 1880, see page 745, Statistics of Manufactures, 1880.

[DD] Decrease.

[EE] Not reported separately.

[FF] Not reported.

Production of Pig Iron and of Crude Steel in the United States, 1880 to 1907, and relation of same to Imports and Exports of Iron and Steel Manufactures; also Prices of Representative Iron and Steel Products during the period named.

[From official reports of Bureau of Statistics.]

Year.	Pig iron produced in United States.	Crude steel produced in United States.	Per cent of domestic iron used in home industries (fiscal year).
	Tons.	Tons.	
1880	3,835,191	1,247,335	78.44
1881	4,144,254	1,588,314	90.23
1882	4,623,323	1,736,692	89.36
1883	4,595,510	1,673,535	91.44
1884	4,097,868	1,550,879	94.20
1885	4,044,526	1,711,920	96.43
1886	5,683,329	2,562,503	93.92
1887	6,417,148	3,339,071	93.13
1888	6,489,738	2,899,440	95.17
1889	7,603,642	3,385,732	97.35
1890	9,202,703	4,277,071	98.10
1891	8,279,870	3,904,240	99.12
1892	9,157,000	4,927,581	99.01
1893[HH]	7,124,502	4,019,995	99.39
1894[HH]	6,657,388	4,412,032	99.64
1895[HH]	9,446,308	6,114,834	99.79
1896[HH]	8,623,127	5,281,689	99.07
1897	9,652,680	7,156,957	99.77
1898	11,773,934	8,932,857	99.79
1899	13,620,703	10,639,857	99.80
1900	13,789,242	10,188,329	98.55
1901	15,878,354	13,473,595	99.71
1902	17,821,307	14,947,250	99.01
1903	18,009,252	14,534,978	94.92
1904	16,497,033	13,859,887	98.95
1905	22,992,380	20,023,947	99.27
1906	25,307,191	23,398,136	98.94
1907	25,781,361	[II]23,360,000	97.83

Year.	Price per ton of pig iron, No. 1 foundry.[GG]	Price of steel rails per ton.	Wire nails, price per keg of 100 lbs.
1880	$28.48	$67.52	…
1881	25.17	61.08	…
1882	25.77	48.50	…
1883	22.42	37.75	…
1884	19.81	30.75	…
1885	17.99	28.52	…
1886	18.71	34.52	$3.51
1887	20.93	37.08	3.15
1888	18.88	29.83	2.55
1889	17.76	29.25	2.49
1890	18.41	31.78	2.51
1891	17.52	29.92	2.04
1892	15.75	30.00	1.70
1893[HH]	14.52	28.12	1.49
1894[HH]	12.66	24.00	1.11
1895[HH]	13.10	24.33	1.69
1896[HH]	12.95	28.00	2.54
1897	12.10	18.75	1.46
1898	11.66	17.62	1.45
1899	19.36	28.12	2.60
1900	19.98	32.29	2.76
1901	15.87	27.33	2.41
1902	22.19	28.00	2.15
1903	19.92	28.00	2.13
1904	15.57	28.00	1.96
1905	17.88	28.00	1.93
1906	20.98	28.00	1.98
1907	23.89	28.00	2.18

Year.	Imports of manufactures of iron and steel.	Exports of domestic manufactures of iron and steel.
1880	$71,266,699	$14,716,524
1881	60,604,477	16,604,767
1882	67,976,897	20,748,206
1883	58,495,246	22,826,528
1884	40,147,053	21,909,881
1885	33,610,093	16,592,155
1886	37,534,078	15,745,569
1887	49,203,164	15,958,502
1888	48,992,757	17,763,034
1889	42,377,793	21,156,077
1890	41,679,591	25,542,208
1891	53,544,372	28,909,614
1892	28,928,103	28,800,930
1893[HH]	34,937,974	30,106,482
1894[HH]	20,925,769	29,220,264
1895[HH]	23,048,515	32,000,989
1896[HH]	25,338,103	41,160,877
1897	16,094,557	57,497,872
1898	12,626,431	70,406,885
1899	12,100,440	93,716,031
1900	20,478,728	121,913,548
1901	17,874,789	117,319,320
1902	27,180,247	98,552,562
1903	51,617,312	96,642,467
1904	27,028,312	111,948,586
1905	23,510,164	134,728,363
1906	29,053,987	160,984,985
1907	40,587,865	181,530,871

[GG] Not made in commercial quantities in the United States before 1887.

[HH] Democratic and low-tariff years.

[II] Preliminary figures.

Annual Production of Bessemer Steel Rails in the United States from 1867 to 1907, and their Average Annual Price at the Works in Pennsylvania.

Years.	Gross tons.	Price.
1867	2,277	$166.00
1868	6,451	158.46
1869	8,616	132.19
1870	30,357	106.79
1871	34,152	102.52
1872	83,991	111.94
1873	115,192	120.58
1874	129,414	94.28
1875	259,699	68.75
1876	368,269	59.25
1877	385,865	45.58
1878	491,427	42.21
1879	610,682	48.21
1880	852,196	67.52
1881	1,187,770	61.08
1882	1,284,067	48.50
1883	1,148,709	87.75
1884	996,983	30.75
1885	959,471	28.52
1886	1,574,703	34.52
1887	2,101,904	37.08
1888	1,386,277	29.83
1889	1,510,057	29.25
1890	1,867,837	31.78
1891	1,293,053	29.92
1892	1,537,588	30.00
1893	1,129,400	28.12
1894	1,016,013	24.00
1895	1,299,628	24.33
1896	1,116,958	28.00
1897	1,644,520	18.75
1898	1,976,702	17.62
1899	2,270,585	28.12
	2,383,654	32.29

1900		
1901	2,870,816	27.33
1902	2,985,892	28.00
1903	2,946,756	28.00
1904	2,137,957	28.00
1905	3,192,347	28.00
1906	3,791,459	28.00
1907	3,380,025	28.00

Production of Tin Plates in and Importation of Tin Plates into the United States, 1891 to 1908, in long tons.

Calendar Year.	Production, Long tons.	Importation, Long tons.
1891	552	327,882
1892	18,803	268,472
1893	55,182	253,155
1894	74,260	215,068
1895	113,666	219,545
1896	160,862	119,171
1897	256,598	83,851
1898	326,915	67,222
1899	397,767	58,915
1900	302,665	60,386
1901	399,291	77,395
1902	366,000	60,115
1903	480,000	47,360
1904	458,000	70,652
1905	493,500	65,740
1906	577,562	56,983
1907	514,777	57,773
1908	…	58,490

Commerce of the United States by Great Groups and Share which Manufactures and Raw Material Formed of the Total, 1820 to 1909.

Imports.

Year ending June 30—	Foodstuffs in crude condition and food animals.	
	Dollars.	Percent of Total
1820	6,081,641	11.15
1830	7,382,274	11.77
1840	15,273,321	15.54
1850	18,011,659	10.38
1860	35,743,826	10.11
1870	53,981,838	12.38
1875	90,018,885	16.89
1880	100,297,040	15.01
1881	102,486,852	15.95
1882	104,947,672	14.49
1883	93,091,358	12.87
1884	103,010,830	15.43
1885	93,345,583	16.16
1886	91,588,644	14.41
1887	106,362,234	15.36
1888	116,087,107	16.03
1889	123,130,984	16.53
1890	128,480,142	16.28
1891	150,639,399	17.83
1892	175,558,861	21.22
1893	131,663,968	15.19
1894	133,309,989	20.35
1895	141,377,238	19.31
1896	130,002,310	16.67
1897	128,379,785	16.79
1898	103,984,608	16.88
1899	98,933,256	14.19
1900	97,916,293	11.52
1901	110,385,208	13.43
1902	120,280,302	13.31
1903	119,202,674	11.62
1904	132,223,895	13.34
1905	146,130,903	13.08

1906	134,315,448	10.95
1907	149,747,693	10.44
1908	145,577,427	12.19
1909	163,921,598	12.49

Year ending June 30—	Foodstuffs partly or wholly manufactured.	
	Dollars.	Percent of Total
1820	10,820,814	19.85
1830	9,653,971	15.39
1840	15,188,845	15.46
1850	21,465,776	12.37
1860	53,771,067	15.21
1870	96,253,561	22.08
1875	113,145,852	21.23
1880	118,125,216	17.69
1881	123,380,388	19.20
1882	139,438,506	19.24
1883	142,127,926	19.65
1884	130,778,286	19.59
1885	102,937,933	17.82
1886	112,771,436	17.75
1887	111,714,382	16.14
1888	111,048,075	15.34
1889	122,254,266	16.41
1890	133,332,031	16.89
1891	147,721,884	17.48
1892	139,794,773	16.89
1893	153,739,181	17.75
1894	155,348,824	23.72
1895	107,026,180	14.63
1896	118,805,703	15.24
1897	129,244,951	16.90
1898	86,091,010	13.97
1899	123,448,135	17.71
1900	133,027,374	15.65
1901	125,540,654	15.25
1902	95,350,256	10.56
1903	116,620,623	11.37
1904	118,222,862	11.93
1905	145,355,839	13.01

1906	140,358,114	11.44
1907	158,656,263	11.06
1908	147,008,870	12.31
1909	165,028,764	12.58

Year ending June 30—	Crude materials for use in manufacturing.	
	Dollars.	Percent of Total
1820	1,983,706	3.64
1830	4,214,825	6.72
1840	11,510,245	11.71
1850	11,711,266	6.75
1860	37,073,022	10.49
1870	53,118,022	12.18
1875	78,891,769	14.80
1880	131,861,617	19.74
1881	114,244,631	17.77
1882	131,356,113	18.13
1883	133,612,450	18.48
1884	119,150,641	17.84
1885	106,774,553	18.49
1886	128,434,759	20.22
1887	143,361,050	20.71
1888	155,057,432	21.42
1889	163,548,106	21.94
1890	170,637,250	21.62
1891	184,175,197	21.80
1892	188,317,595	22.76
1893	209,277,112	24.16
1894	130,086,011	19.86
1895	180,939,902	24.72
1896	197,646,852	25.35
1897	196,159,371	25.66
1898	189,322,244	30.73
1899	208,565,691	29.91
1900	276,241,152	32.50
1901	248,006,751	30.13
1902	303,001,868	33.55
1903	330,491,084	32.22
1904	389,160,658	34.82
1906	414,687,999	33.81

1907	477,027,174	33.25
1908	363,482,258	30.43
1909	453,319,751	34.55

Year ending June 30—	Manufactures for further use in manufacturing.	
	Dollars.	Percent of Total
1820	4,079,064	7.48
1830	5,152,486	8.22
1840	11,356,196	11.56
1850	26,163,152	15.08
1860	23,613,395	6.67
1870	54,545,306	12.51
1875	63,411,606	11.89
1880	110,779,516	16.59
1881	87,790,890	13.66
1882	98,623,766	13.61
1883	98,755,423	13.66
1884	94,698,249	14.18
1885	78,254,677	13.55
1886	91,539,244	14.40
1887	120,079,754	17.34
1888	121,605,094	16.80
1889	115,079,918	15.44
1890	116,924,080	14.81
1891	136,446,309	16.15
1892	112,729,303	13.63
1893	135,608,418	15.65
1894	82,894,732	12.65
1895	96,486,622	13.18
1896	101,070,937	12.96
1897	88,490,406	11.57
1898	79,288,417	12.88
1899	91,953,914	13.19
1900	134,222,045	15.79
1901	127,576,924	15.49
1902	147,656,292	16.34
1903	195,750,847	19.08
1904	177,827,960	15.91
1906	220,298,751	17.96

1907	274,096,464	19.11
1908	196,248,409	16.43
1909	222,580,277	16.97

Year ending June 30—	Manufactures ready for consumption.	
	Dollars.	Percent of Total
1820	30,998,900	56.86
1830	35,734,837	56.97
1840	44,300,005	45.09
1850	95,312,499	54.93
1860	199,878,690	56.52
1870	173,034,847	39.69
1875	177,891,440	33.38
1880	196,587,405	29.43
1881	203,725,925	31.70
1882	238,716,691	32.94
1883	242,945,562	33.59
1884	207,771,072	31.12
1885	182,543,076	31.61
1886	194,791,568	30.65
1887	202,800,073	29.29
1888	211,218,652	29.17
1889	212,482,518	28.52
1890	230,685,581	29.23
1891	217,577,775	25.75
1892	204,543,857	24.72
1893	228,764,866	26.40
1894	148,798,021	22.72
1895	199,543,108	27.26
1896	226,639,759	29.07
1897	217,843,918	28.48
1898	153,025,210	24.84
1899	169,516,630	24.32
1900	203,126,341	23.90
1901	205,505,580	24.96
1902	231,420,820	25.62
1903	257,757,184	25.13
1904	252,857,673	25.51

1905	252,372,650	22.58
1906	307,801,154	25.10
1907	364,192,884	25.39
1908	331,617,926	27.77
1909	297,617,739	22.69

Year ending June 30—	Miscellaneous.		Total.
	Dollars.	Percent of Total	Dollars.
1820	556,709	1.02	54,520,834
1830	582,563	.93	62,720,956
1840	630,094	.64	98,258,706
1850	845,174	.49	173,509,526
1860	3,536,119	1.00	353,616,119
1870	5,024,834	1.16	435,958,408
1875	9,645,884	1.81	533,005,436
1880	10,303,952	1.54	667,954,746
1881	11,035,942	1.72	642,664,628
1882	11,556,826	1.59	724,639,574
1883	12,648,195	1.75	723,180,924
1884	12,288,615	1.84	667,697,693
1885	13,671,507	2.37	577,527,329
1886	16,310,485	2.57	635,436,136
1887	8,002,275	1.16	692,319,768
1888	8,940,754	1.24	723,957,114
1889	8,635,860	1.16	745,131,652
1890	9,251,325	1.17	789,310,409
1891	8,355,632	.99	844,916,196
1892	6,458,073	.78	827,402,462
1893	7,347,377	.85	866,400,922
1894	4,557,045	.70	654,994,622
1895	6,596,915	.90	731,969,965
1896	5,559,113	.71	779,724,674
1897	4,611,981	.60	764,730,412
1898	4,338,165	.70	616,049,654
1899	4,730,863	.68	697,148,489
1900	5,407,979	.64	849,941,184
1901	6,157,048	.74	823,172,165
1902	5,611,410	.62	903,320,948
1903	5,896,825	.58	1,025,719,237
1904	6,754,620	.68	991,087,371
1905	6,665,061	.60	1,117,513,071

1906	9,100,980	.74	1,226,562,446
1907	10,700,947	.75	1,434,421,425
1908	10,406,902	.87	1,194,341,792
1909	9,452,095	.72	1,311,920,224

Commerce of the United States by Great Groups, 1820 to 1909.

Exports (domestic).

Year ending June 30—	Foodstuffs in crude condition and food animals.	
	Dollars.	Percent of Total
1820	2,474,822	4.79
1830	2,724,181	4.65
1840	4,564,532	4.09
1850	7,535,764	5.59
1860	12,166,447	3.85
1870	41,852,630	11.12
1875	79,077,679	15.84
1880	266,108,950	32.30
1881	241,641,847	27.34
1882	155,008,497	21.14
1883	163,196,443	20.29
1884	130,395,872	17.99
1885	123,326,867	16.97
1886	100,799,692	15.13
1887	125,453,686	17.85
1888	86,368,408	12.63
1889	98,847,455	13.54
1890	132,073,183	15.62
1891	106,155,721	12.17
1892	262,455,846	25.84
1893	153,277,859	18.43
1894	133,196,928	15.30
1895	99,051,108	12.49
1896	128,550,669	14.90
1897	181,420,814	17.58
1898	305,108,915	25.21
1899	232,903,066	19.35
1900	227,347,193	16.59
1901	246,394,140	16.88
1902	184,786,389	13.63
1903	185,308,064	13.31
1904	135,747,224	9.46
1905	118,185,098	7.92

1906	177,216,467	10.32
1907	167,348,227	9.03
1908	189,051,824	10.30
1909	135,663,625	8.28

Year ending June 30—	Foodstuffs partly or wholly prepared.	
	Dollars.	Percent of Total
1820	10,085,366	19.51
1830	9,556,992	16.32
1840	15,936,108	14.27
1850	20,017,162	14.84
1860	38,624,949	12.21
1870	50,919,666	13.53
1875	110,292,780	22.09
1880	193,352,723	23.47
1881	226,386,821	25.62
1882	178,002,738	24.28
1883	186,392,822	23.18
1884	194,703,245	26.86
1885	201,800,801	27.77
1886	162,689,021	24.43
1887	175,784,781	25.00
1888	169,872,314	24.84
1889	174,504,227	23.90
1890	224,756,580	26.59
1891	226,448,303	25.96
1892	250,438,545	24.66
1893	247,075,061	29.73
1894	249,846,142	28.77
1895	219,125,531	27.62
1896	219,413,574	25.41
1897	235,051,930	22.79
1898	284,879,827	23.54
1899	304,754,736	25.31
1900	318,126,502	23.28
1901	336,605,378	23.05
1902	328,831,350	24.27
1903	323,244,251	23.22
1904	308,835,694	21.52
1905	283,064,680	18.98

1906	347,385,462	20.22
1907	345,706,609	18.65
1908	331,961,663	18.10
1909	302,457,444	18.46

Year ending June 30—	Crude materials for use in manufacturing.	
	Dollars.	Percent of Total
1820	31,246,382	60.46
1830	36,482,266	62.34
1840	75,488,421	67.61
1850	83,984,707	62.26
1860	216,009,648	68.31
1870	213,439,991	56.64
1875	206,271,795	41.31
1880	238,787,934	28.98
1881	278,918,722	31.55
1882	233,294,072	31.82
1883	288,841,684	35.92
1884	239,510,224	33.04
1885	248,611,181	34.22
1886	254,409,407	38.21
1887	250,236,436	35.60
1888	271,275,629	39.67
1889	286,235,227	39.19
1890	304,566,922	36.03
1891	346,848,321	39.77
1892	315,096,548	31.02
1893	247,289,240	29.75
1894	276,068,989	31.70
1895	264,194,679	33.30
1896	251,817,571	29.17
1897	296,834,858	28.76
1898	286,311,334	23.66
1899	277,723,374	23.07
1900	325,589,000	23.75
1901	397,767,463	27.24
1902	373,595,243	27.56
1903	408,679,699	29.35
1904	461,716,328	32.17
1905	472,665,309	31.69

1906	500,536,700	29.13
1907	593,145,135	32.00
1908	556,681,462	30.33
1909	520,768,631	31.78

Year ending June 30—	Manufactures for further use in manufacturing.	
	Dollars.	Percent of Total
1820	4,867,379	9.42
1830	4,117,606	7.04
1840	4,841,101	4.34
1850	6,060,900	4.49
1860	12,641,625	3.99
1870	13,711,708	3.66
1875	27,458,054	5.50
1880	29,044,159	3.52
1881	32,820,713	3.71
1882	37,164,800	5.07
1883	37,996,198	4.72
1884	37,800,437	5.21
1885	39,437,313	5.42
1886	34,037,715	5.11
1887	36,732,490	5.22
1888	40,176,023	5.88
1889	42,712,932	5.85
1890	46,454,992	5.50
1891	47,961,372	5.49
1892	50,284,241	4.95
1893	49,070,703	5.94
1894	67,145,189	7.72
1895	61,812,896	7.78
1896	76,219,728	8.85
1897	98,284,243	9.52
1898	101,990,563	8.43
1899	117,730,260	9.78
1900	152,890,591	11.15
1901	148,013,625	10.12
1902	131,918,311	9.73
1903	140,415,620	10.09
1904	174,574,136	12.17
1905	209,361,544	14.03

1906	226,210,513	13.17
1907	259,414,784	13.99
1908	261,105,883	14.23
1909	229,937,155	14.04

Year ending June 30—	Manufactures ready for consumption.	
	Dollars.	Percent of Total
1820	2,925,165	5.66
1830	5,461,589	9.34
1840	10,584,079	9.47
1850	17,162,206	12.72
1860	35,811,383	11.33
1870	56,329,137	14.96
1875	74,503,493	14.92
1880	92,774,139	11.26
1881	102,458,449	11.59
1882	124,835,385	17.02
1883	122,448,549	15.23
1884	118,172,882	16.30
1885	110,818,865	15.25
1886	111,627,312	16.76
1887	112,417,839	15.99
1888	113,892,689	16.65
1889	123,183,883	16.87
1890	132,527,050	15.68
1891	140,349,741	16.09
1892	132,792,441	13.07
1893	129,938,284	15.63
1894	135,659,274	15.61
1895	143,244,969	18.06
1896	181,789,157	21.04
1897	212,959,122	20.63
1898	222,537,358	18.38
1899	262,656,583	21.81
1900	331,955,684	24.15
1901	317,764,367	21.76
1902	321,946,540	23.75
1903	327,489,757	23.52
1904	348,745,843	24.30

1905	402,064,030	26.95
1906	459,812,656	26.76
1907	480,708,667	25.93
1908	489,469,958	26.68
1909	441,820,754	26.97

Year ending June 30—	Miscellaneous.		Total.
	Dollars.	Percent of Total	Dollars.
1820	84,526	0.16	51,683,640
1830	182,244	.31	58,524,878
1840	246,320	.22	111,660,561
1850	139,494	.10	134,900,233
1860	988,371	.31	316,242,423
1870	363,341	.09	376,616,473
1875	1,680,299	.34	499,284,100
1880	3,878,448	.47	823,946,353
1881	1,699,395	.19	883,925,947
1882	4,934,240	.67	733,239,732
1883	5,347,936	.66	804,223,632
1884	4,382,192	.60	724,964,852
1885	2,687,919	.37	726,682,946
1886	2,401,382	.36	665,964,529
1887	2,397,691	.34	703,022,923
1888	2,277,041	.33	683,862,104
1889	4,798,885	.65	730,282,609
1890	4,915,101	.58	845,293,828
1891	4,506,825	.52	872,270,283
1892	4,664,390	.46	1,015,732,011
1893	4,379,638	.52	831,030,785
1894	7,288,415	.84	869,204,937
1895	5,963,407	.75	793,392,590
1896	5,409,788	.63	863,200,487
1897	7,456,636	.72	1,032,007,603
1898	9,463,916	.78	1,210,291,913
1899	8,163,203	.68	1,203,931,222
1900	14,854,601	1.08	1,370,763,571
1901	13,917,833	.95	1,460,462,806
1902	14,404,028	1.06	1,355,481,861
1903	7,100,911	.51	1,392,231,302
1904	5,559,792	.38	1,435,179,017
1905	6,403,980	.43	1,491,744,641

1906	6,791,584	.40	1,717,953,382
1907	7,394,612	.40	1,853,718,034
1908	6,515,567	.36	1,834,786,357
1909	7,707,984	.47	1,638,355,593

Population of the United States 10 Years of Age and Upward, Engaged in Manufacturing and Other Gainful Occupations, Census Year 1900, by Sex.

[From reports of the Bureau of the Census, Department of Commerce and Labor.]

OCCUPATION.	1900.	
	Male.	Female.
AGRICULTURAL PURSUITS	9,404,429	977,336
PROFESSIONAL SERVICE	827,941	430,597
DOMESTIC AND PERSONAL SERVICE	3,485,208	2,095,449
TRADE AND TRANSPORTATION	4,263,617	503,347
MANUFACTURING AND MECHANICAL PURSUITS	5,772,641	1,312,668
Building trades.		
Carpenters and joiners	599,707	545
Masons (brick and stone)	160,638	167
Painters, glaziers, and varnishers	275,782	1,759
Paper hangers	21,749	241
Plasterers	35,649	45
Plumbers and gas and steam fitters	97,659	126
Roofers and slaters	9,065	2
Mechanics (not otherwise specified)	9,351	27
Chemicals and allied products.		
Oil well and oil works employes	24,573	53
Other chemical workers	12,035	2,688
Clay, glass, and stone products.		
Brick and tile makers, etc.	49,455	478
Glassworkers	47,377	2,621
Marble and stone cutters	54,317	143
Potters	13,200	2,940
Fishing and mining.		
Fishermen and oystermen	68,478	462
Miners and quarrymen	562,417	989
Food and kindred products.		
Bakers	74,860	4,328
Butchers	112,815	378
Butter and cheese makers	18,593	648
Confectioners	21,980	9,214

Millers	40,362	186
Other food preparers	23,640	5,142
Iron and steel and their products.		
Blacksmiths	226,284	193
Iron and steel workers	287,241	3,297
Machinists	282,574	571
Steam boiler makers	33,038	8
Stove, furnace, and grate makers	12,430	43
Tool and cutlery makers	27,376	746
Wheelwrights	13,495	10
Wireworkers	16,701	1,786
Leather and its finished products.		
Boot and shoe makers and repairers	169,393	39,510
Harness and saddle makers and repairers	39,506	595
Leather curriers and tanners	40,917	1,754
Trunk and leather-case makers, etc.	5,472	1,579
Liquors and beverages.		
Bottlers and soda water makers, etc.	9,725	794
Brewers and maltsters	20,687	275
Distillers and rectifiers	3,114	30
Lumber and its remanufactures.		
Cabinetmakers	35,552	67
Coopers	37,087	113
Saw and planing mill employes	161,251	373
Other woodworkers	104,791	6,805
Metals and metal products other than iron and steel.		
Brassworkers	25,870	890
Clock and watch makers and repairers	19,305	4,815
Gold and silver workers	19,732	6,380
Tin plate and tinware makers	68,730	1,775
Other metal workers	54,282	2,320
Paper and printing.		
Bookbinders	14,646	15,632

Box makers (paper)	3,796	17,302
Engravers	10,698	453
Paper and pulp mill operatives	26,904	9,424
Printers, lithographers, and pressmen	139,166	15,981
Textiles.		
Bleachery and dye works operatives	20,493	1,785
Carpet factory operatives	10,371	9,001
Cotton mill operatives	125,788	120,603
Hosiery and knitting mill operatives	12,630	34,490
Silk mill operatives	22,023	32,437
Woolen mill operatives	42,566	30,630
Other textile mill operatives	53,437	51,182
Dressmakers	2,090	344,794
Hat and cap makers	15,110	7,623
Milliners	1,739	86,120
Seamstresses	4,837	146,105
Shirt, collar, and cuff makers	8,491	30,941
Tailors and tailoresses	160,714	68,935
Other textile workers	8,862	20,671
Miscellaneous industries.		
Broom and brush makers	8,643	1,577
Charcoal, coke, and lime burners	14,405	31
Engineers and firemen (not locomotive)	223,318	177
Glovemakers	4,503	7,768
Manufacturers and officials, etc.	239,649	3,360
Model and pattern makers	14,869	204
Photographers	23,361	3,580
Rubber factory operatives	14,492	7,374
Tobacco and cigar factory operatives	87,955	43,497
Upholsterers	28,663	2,158
Other miscellaneous industries	380,167	90,922
Total manufacturing and mechanical pursuits	5,772,641	1,312,668
Grand total	23,753,836	5,319,397

OCCUPATION.	1900.
	Total.
AGRICULTURAL PURSUITS	10,381,765
PROFESSIONAL SERVICE	1,258,538
DOMESTIC AND PERSONAL SERVICE	5,580,657
TRADE AND TRANSPORTATION	4,766,964
MANUFACTURING AND MECHANICAL PURSUITS	7,085,309
Building trades.	
Carpenters and joiners	600,252
Masons (brick and stone)	160,805
Painters, glaziers, and varnishers	277,541
Paper hangers	21,990
Plasterers	35,694
Plumbers and gas and steam fitters	97,785
Roofers and slaters	9,067
Mechanics (not otherwise specified)	9,378
Chemicals and allied products.	
Oil well and oil works employes	24,626
Other chemical workers	14,723
Clay, glass, and stone products.	
Brick and tile makers, etc.	49,933
Glassworkers	49,998
Marble and stone cutters	54,460
Potters	16,140
Fishing and mining.	
Fishermen and oystermen	68,940
Miners and quarrymen	563,406
Food and kindred products.	
Bakers	79,188
Butchers	113,193
Butter and cheese makers	19,241
Confectioners	31,194

Millers	40,548
Other food preparers	28,782
Iron and steel and their products.	
Blacksmiths	226,477
Iron and steel workers	290,538
Machinists	283,145
Steam boiler makers	33,046
Stove, furnace, and grate makers	12,473
Tool and cutlery makers	28,122
Wheelwrights	13,505
Wireworkers	18,487
Leather and its finished products.	
Boot and shoe makers and repairers	208,903
Harness and saddle makers and repairers	40,101
Leather curriers and tanners	42,671
Trunk and leather-case makers, etc.	7,051
Liquors and beverages.	
Bottlers and soda water makers, etc.	10,519
Brewers and maltsters	20,962
Distillers and rectifiers	3,144
Lumber and its remanufactures.	
Cabinetmakers	35,619
Coopers	37,200
Saw and planing mill employes	161,624
Other woodworkers	111,596
Metals and metal products other than iron and steel.	
Brassworkers	26,760
Clock and watch makers and repairers	24,120
Gold and silver workers	26,112
Tin plate and tinware makers	70,505
Other metal workers	56,602
Paper and printing.	
Bookbinders	30,278

Box makers (paper)	21,098
Engravers	11,151
Paper and pulp mill operatives	36,328
Printers, lithographers, and pressmen	155,147
Textiles.	
Bleachery and dye works operatives	22,278
Carpet factory operatives	19,372
Cotton mill operatives	246,391
Hosiery and knitting mill operatives	47,120
Silk mill operatives	54,460
Woolen mill operatives	73,196
Other textile mill operatives	104,619
Dressmakers	346,884
Hat and cap makers	22,733
Milliners	87,859
Seamstresses	150,942
Shirt, collar, and cuff makers	39,432
Tailors and tailoresses	229,649
Other textile workers	29,533
Miscellaneous industries.	
Broom and brush makers	10,220
Charcoal, coke, and lime burners	14,436
Engineers and firemen (not locomotive)	223,495
Glovemakers	12,271
Manufacturers and officials, etc.	243,009
Model and pattern makers	15,073
Photographers	26,941
Rubber factory operatives	21,866
Tobacco and cigar factory operatives	131,452
Upholsterers	30,821
Other miscellaneous industries	471,089
Total manufacturing and mechanical pursuits	7,085,309
Grand total	29,073,233

World's Development of Carrying Power, Production, and Commerce, 1800-1907.

[From "Transportation Systems of the World," issued by the Bureau of Statistics, Department of Commerce and Labor.]

Year.	Population.	Commerce.	
		Total.	Per capita.
	Millions.	Millions of dollars.	Dollars.
1800[MM]	640	1,479	2.31
1820[NN]	780	1,659	2.13
1830[NN]	847	1,981	2.34
1840[OO]	950	2,789	2.93
1850[OO]	1,075	4,049	3.76
1860[OO]	1,205	7,246	6.01
1870[PP]	1,310	10,663	8.14
1880[QQ]	1,439	14,761	10.26
1890[RR]	1,488	17,519	11.80
1900	1,543	20,105	13.02
1906	1,600	26,500	16.50
1907	…	…	…

Year.	Carrying Power.		
	Sail.	Steam.	Total.
	Thousand tons.[JJ]	Thousand tons.[JJ]	Thousand tons.[JJ][KK]
1800[MM]	4,026	…	4,026
1820[NN]	5,814	0.023	5,894
1830[NN]	7,100	.111	7,528
1840[OO]	9,012	.372	10,482
1850[OO]	11,470	.864	14,902
1860[OO]	14,890	1.723	21,730
1870[PP]	12,900	3.012	25,100
1880[QQ]	14,400	5.901	37,900
1890[RR]	12,640	8.295	47,800
1900	8,119	13.856	63,543
1906	5,469	21.094	89,845
1907	5,200	22.140	93,760

Year.	Railways.	Telegraphs.	Cables.
	Thousand miles.[JJ]	Thousand miles.	Thousand miles.
1800[MM]	…	…	…
1820[NN]	…	…	…
1830[NN]	0.2	…	…
1840[OO]	5.4	…	…
1850[OO]	24.0	5	1⁄40
1860[OO]	67.4	100	1½
1870[PP]	139.9	281	15
1880[QQ]	224.9	440	49
1890[RR]	390.0	768	132
1900	500.0	1,180	200
1906	[SS]562.8	1,200	200
1907	595.8	…	…

Year.	Production of Cotton, Coal, and Pig iron.		
	Cotton.	Coal.	Pig iron.
	Million pounds.[JJ]	Million tons.	Million tons.[JJ]
1800[MM]	520	11.6	0.5
1820[NN]	630	17.2	1.0
1830[NN]	820	25.1	1.6
1840[OO]	1,310	44.8	2.7
1850[OO]	1,435	81.4	4.4
1860[OO]	2,551	142.3	7.2
1870[PP]	2,775	213.4	11.9
1880[QQ]	3,601	340.0	18.1
1890[RR]	5,600	466.0	25.2
1900	6,247	800.0	41.4
1906	[TT]9,971	[12]987.9	[13]58.1
1907	[TT]8,256	[UU]1,079.6	[VV]59.7

Year.	Area cultivated.	Gold production, decade ending year named.
	Million acres.[JJ]	Million dollars.[LL]
1800[MM]	360	128.5
1820[NN]	402	76.1
1830[NN]	…	94.5
1840[OO]	492	134.8
1850[OO]	…	363.9
1860[OO]	583	1,334.0
1870[PP]	…	1,263.0
1880[QQ]	749	1,150.8
1890[RR]	807	1,060.1
1900	875	2,100.0
1906	900	3,095.0
1907	…	3,259.5

[JJ] Mulhall’s estimate, except 1830, 1890, 1900, 1906, and 1907.

[KK] Steam tonnage reduced to sail by multiplying by 4.

[LL] Soetbeer’s estimates prior to 1860.

[MM] Malte-Brun’s estimate for 1804.

[NN] Based on Balbi’s estimate for 1828.

[OO] Based on Michelet’s estimate for 1845.

[PP] Based on Behm-Wagner estimate for 1874.

[QQ] Levasseur’s estimate for 1878.

[RR] Royal Geographic Society estimate.

[SS] Estimates of the Archiv für Eisenbahnwesen.

[TT] Estimates of the United States Census Office.

[UU] Estimates of the United States Geological Survey.

[VV] Estimates of the “Mineral Industry.”

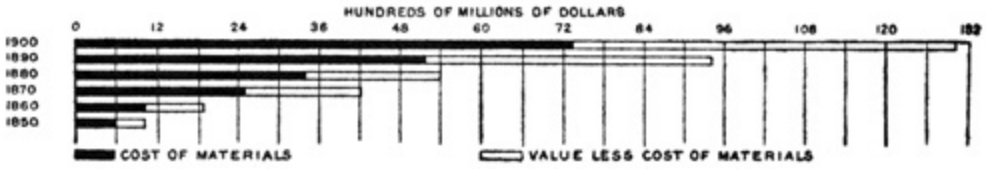
1. CAPITAL INVESTED IN MANUFACTURING AT EACH CENSUS: 1850 TO 1900



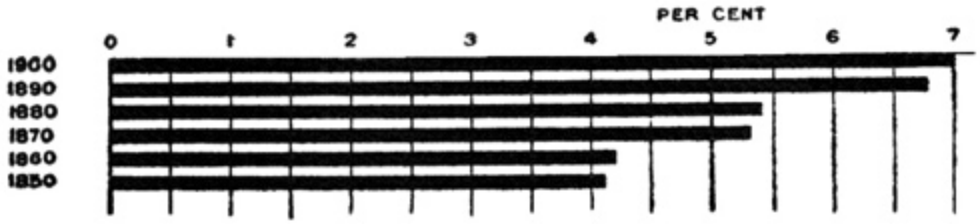
2. AVERAGE NUMBER OF WAGE-EARNERS EMPLOYED IN MANUFACTURES AT EACH CENSUS: 1850 TO 1900



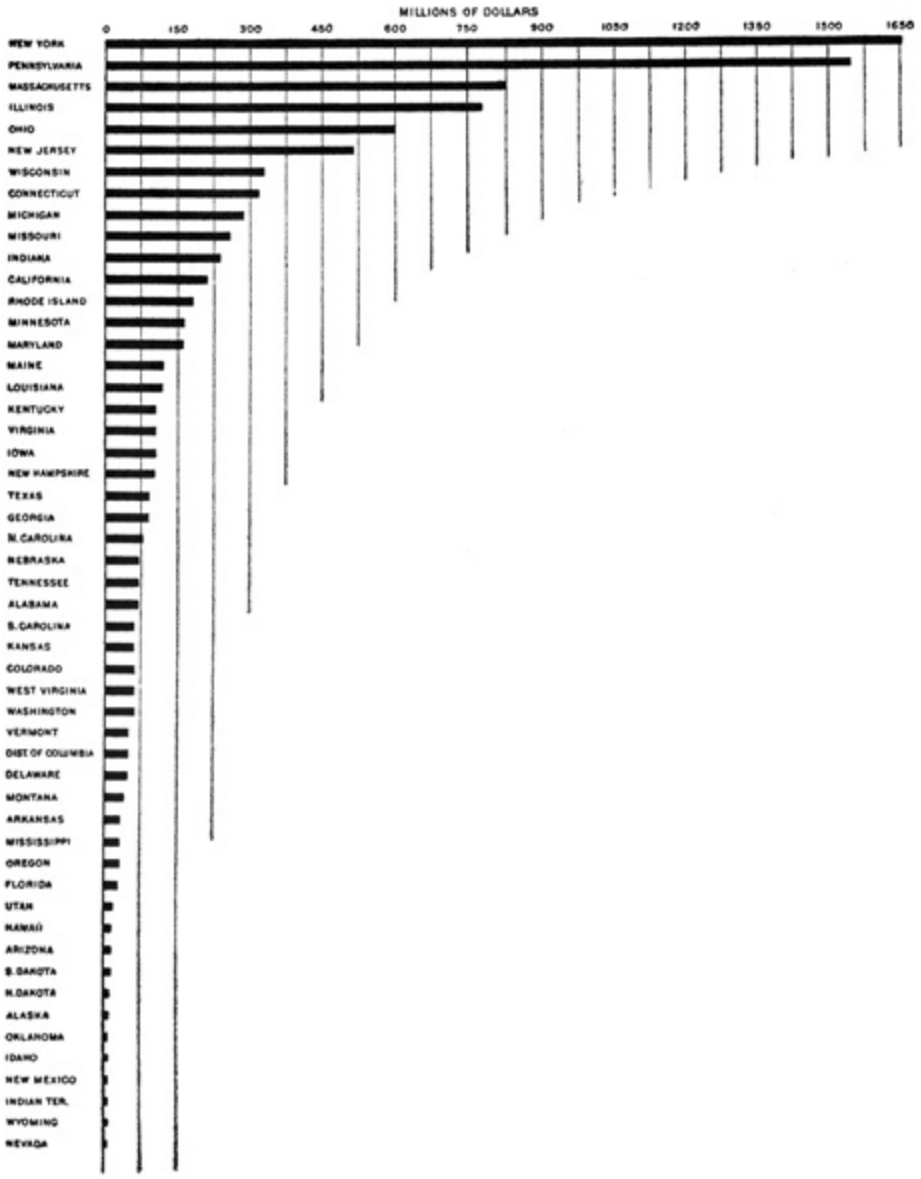
3. VALUE OF PRODUCTS AT EACH CENSUS: 1850 TO 1900



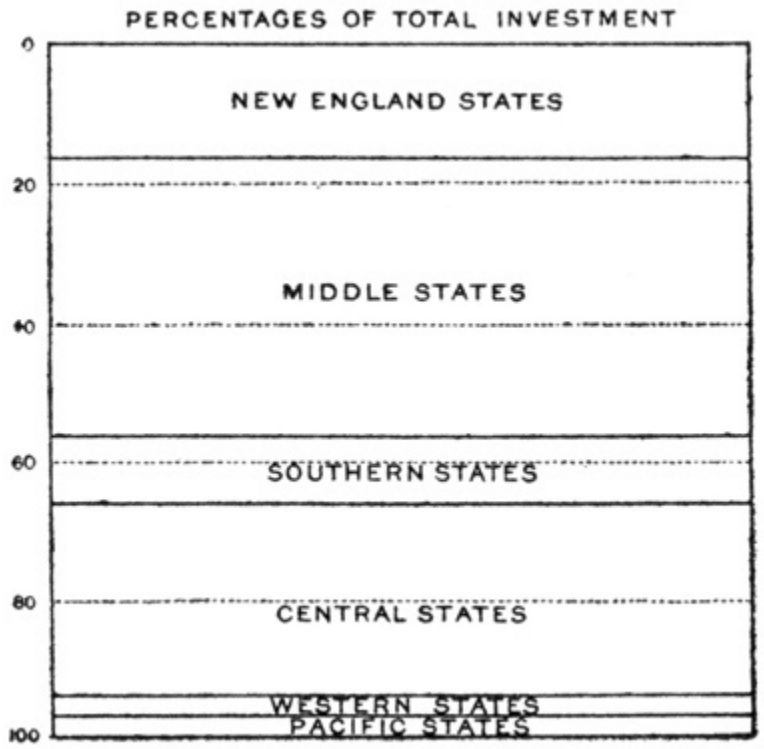
4. PROPORTION WHICH AVERAGE NUMBER OF WAGE-EARNERS EMPLOYED IN MANUFACTURES BEAR TO POPULATION AT EACH CENSUS: 1850 TO 1900



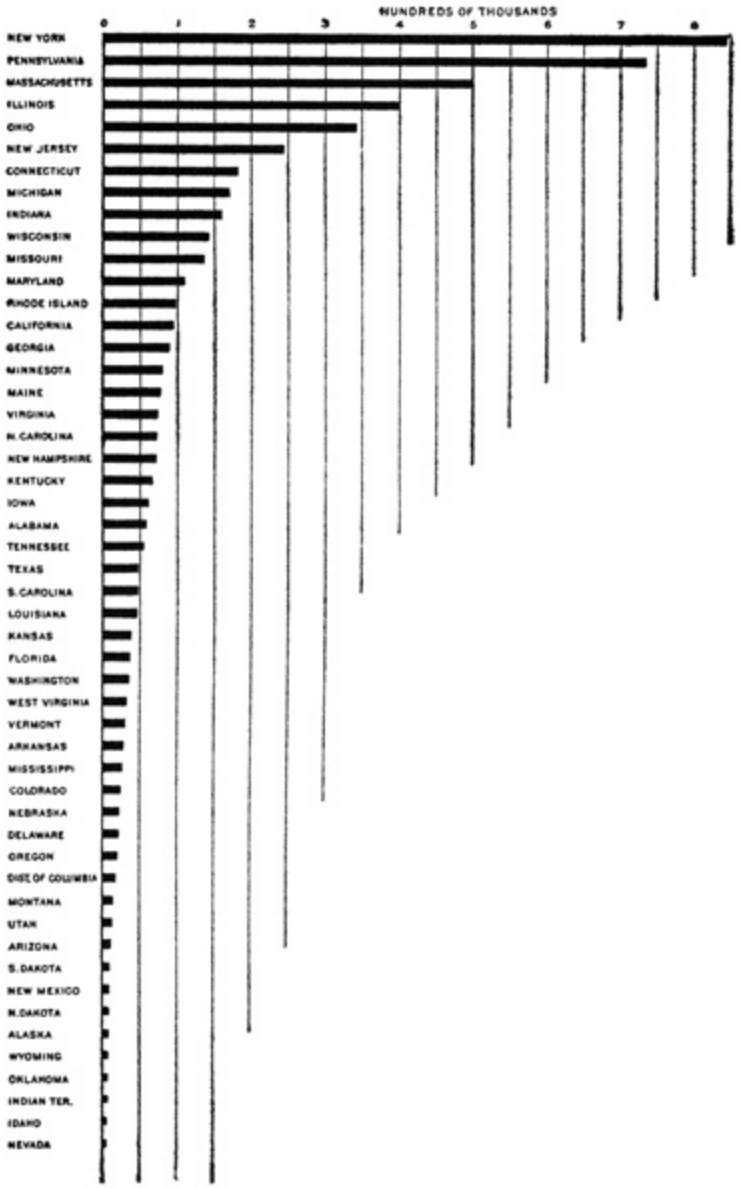
1. CAPITAL INVESTED IN MANUFACTURING IN EACH STATE AND TERRITORY: 1900



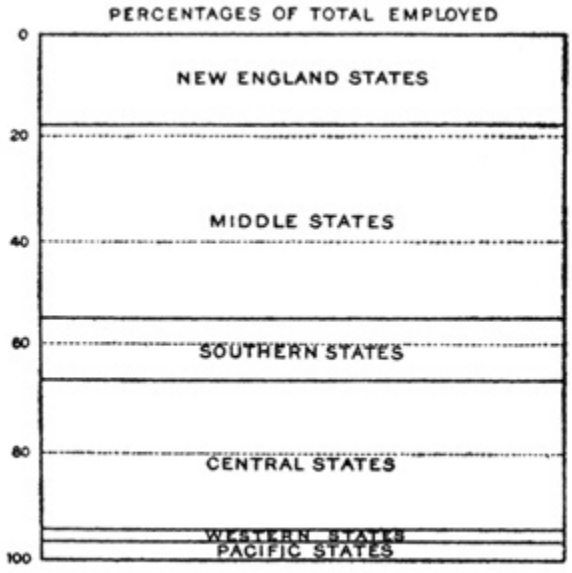
2. CAPITAL INVESTED BY STATE GROUPS


PERCENTAGES OF TOTAL INVESTMENT
0
NEW ENGLAND STATES
20
MIDDLE STATES
40
60
SOUTHERN STATES
80
CENTRAL STATES
WESTERN STATES
PACIFIC STATES
100

1. AVERAGE NUMBER OF WAGE-EARNERS EMPLOYED IN MANUFACTURES: 1900.

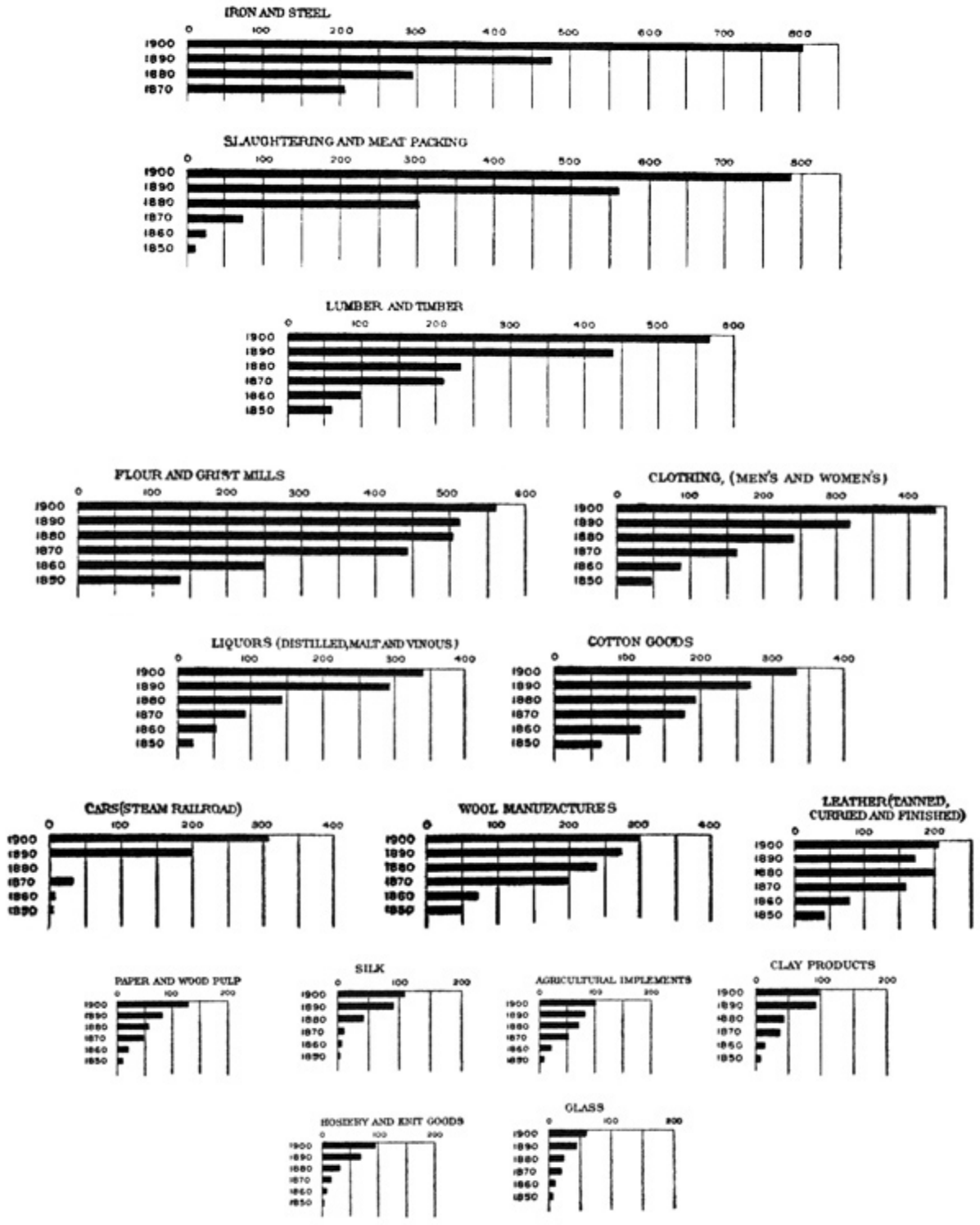


2. AVERAGE NUMBER OF WAGE EARNERS EMPLOYED IN MANUFACTURES BY STATE GROUPS

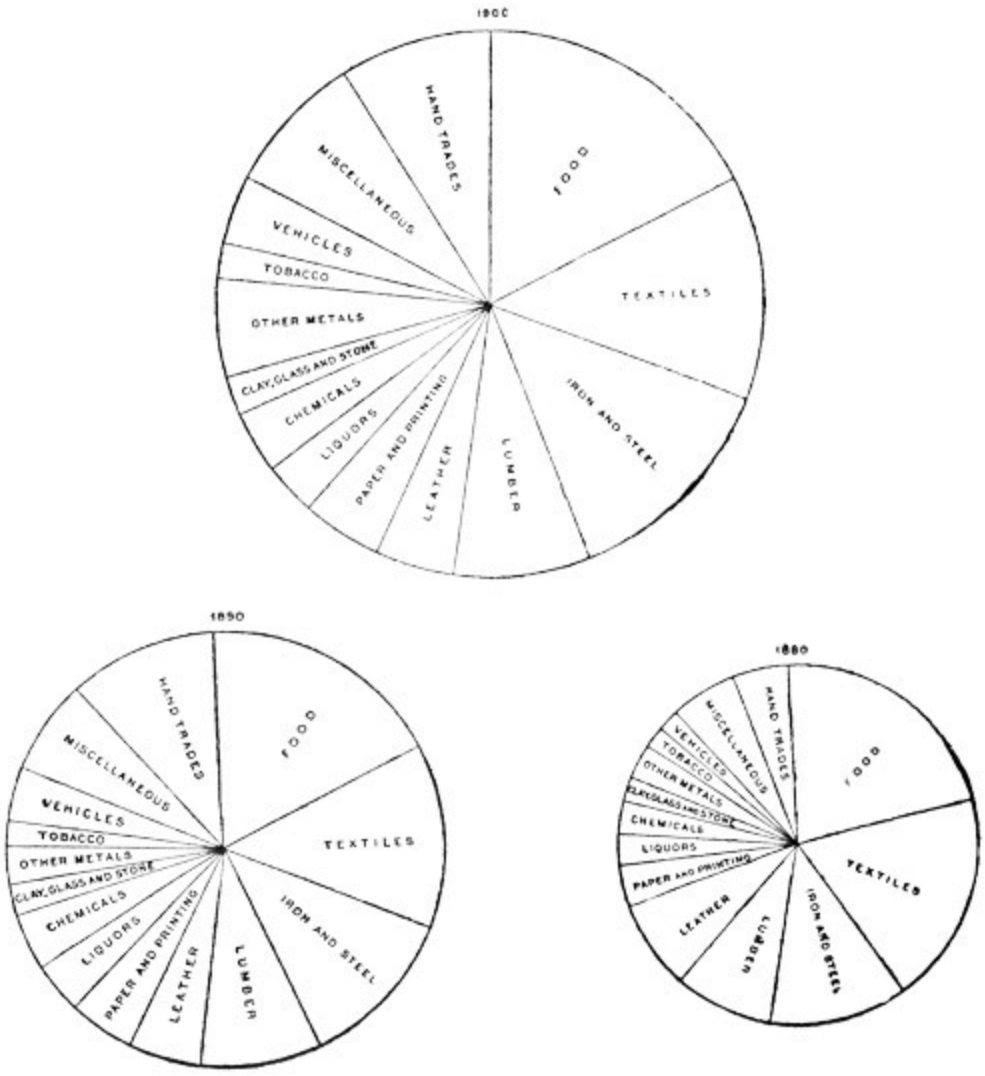

PERCENTAGES OF TOTAL EMPLOYED
0
NEW ENGLAND STATES
20
MIDDLE STATES
40
60
SOUTHERN STATES
80
CENTRAL STATES
WESTERN STATES
PACIFIC STATES
100

VALUE OF PRODUCTS OF CERTAIN MANUFACTURING INDUSTRIES: 1850 TO 1900

MILLIONS OF DOLLARS



VALUE OF ALL MANUFACTURED PRODUCTS IN THE U. S., AND PROPORTIONAL VALUE OF EACH GROUP: 1880 TO 1900



VALUE OF PRODUCTS OF MANUFACTURES PER SQUARE MILE: 1900

1. FLOUR AND GRIST MILL



2. CHEESE, BUTTER AND CONDENSED MILK



3. SLAUGHTERING AND MEAT PACKING



4. LIQUORS (DISTILLED, MALT AND VINOUS)



5. CLAY PRODUCTS (BRICK AND TILE, POTTERY ETC.)



6. GLASS



1. TEXTILES



2. COTTON GOODS



3. WOOL



4. SILK AND SILK GOODS



5. HOSIERY AND KNIT GOODS



6. MEN'S AND WOMEN'S CLOTHING, (FACTORY PRODUCT)



1. PETROLEUM REFINING



2. CHEMICALS AND ALLIED PRODUCTS



3. PAPER AND WOOD PULP



4. PRINTING AND PUBLISHING



5. LEATHER (TANNED, CURRIED AND FINISHED)



6. BOOTS AND SHOES (FACTORY PRODUCT



1. IRON AND STEEL (BLAST FURNACES AND ROLLING MILLS)



2. COKE



3. LUMBER AND TIMBER PRODUCTS



4. AGRICULTURAL IMPLEMENTS



5 CARRIAGES AND WAGONS



6. CARS, (CONSTRUCTION AND REPAIRS)



Less than $10 to a square mile | $10 to 100 to a square mile | $100 to 1000 to a square mile | $1000 and over

CONCRETE AND STEEL.

BY J. F. SPRINGER.

[New York author of articles in Applied Science.]

The life of properly made concrete is not known. However, specimens from the times of the Romans are yet in good condition. This material has very considerable ability to resist compression; it is practically fireproof and teredo proof; when properly protected it is probably but little deteriorated by weather changes; and, if properly made, it is probably inappreciably subject to chemical disintegration when submerged. But there is one palpable fault—it is weak when subjected to tensile stresses. On the other hand—steel has great tensile resistivity and is strong under transverse stress. These two materials—concrete and steel—supplement each other in valuable qualities. The possibility of using them in combination depends largely upon the fact that their co-efficients of expansion are practically the same for moderate thermal fluctuations. Steel is easily corroded. Nor is it strictly fireproof, as temperatures which are not excessive will induce bending and buckling. When it is surrounded by concrete, steel is protected against both fire and corrosion.

In many situations, steel would not alone supply the best material of construction. And the same remark applies to concrete. A striking instance is the case of the six new docks in Baltimore. Three of these had already been constructed of wood and stone, when it became evident that the building of the remaining three and of the long bulkhead which was part of the scheme along the same lines would entail a larger expense than the use of reinforced concrete construction. Steel by itself would have been impossible of consideration because of its susceptibility to corrosion. Concrete alone could not be used because of the excessive cost of the increased amount of Portland cement. It is said, that a retaining wall of all concrete would have cost about $600 per linear foot. Reinforced concrete costs about $58 per foot.

Steel is used, not merely as a reinforcement, but as the material of forms. Used thus, it may, at times, not only retain the concrete in position but also prevent the action of the surrounding soil or water. The possibility of using steel for forms depends largely upon the fact that many applications of concrete are becoming standardized rapidly. Thus is permitted a re-use of the steel form that justifies the expense. But the employment of steel forms sometimes involves the use of steel in the handling of them. A further use, although perhaps more remote, is in connection with the arrangements for the handling of the mixed concrete and of the raw materials. Still more remote, but still a necessary application, is the use of steel and iron in the crushing mills and the like. When we look at the question and inform ourselves of the ramifications, it is not difficult to see that concrete and steel are materials whose engineering applications are mutually involved. Concrete is certainly replacing steel in some applications. But, notwithstanding this, these two are to be regarded as unopposed to each other on the whole.

When concrete is cast about steel, an adhesive bond ensues. But this is scarcely to be regarded as sufficient to enable the two to act as one under tensile stresses. A mechanical bond should be employed. This is the explanation of the somewhat complicated forms of standard reinforcement bars.

Concrete properly reinforced is an admirable material for factory construction. It permits of rapid erection, is fireproof, has a long life, is adapted to weather conditions, and is economical. The floors of concrete buildings are easily cleaned and do not develop splinters.

One of the large automobile factories—that of the Geo. N. Pierce Company at Buffalo, N. Y.—is a good instance of the rapidity with which reinforced concrete buildings may be erected. Within seven months of the date of signing the contract with the Trussed Concrete Steel Company, Detroit, Mich., which employs the Kahn system of reinforcement, certain large structures were ready for use. The floor space here is 325,000 square feet. It was necessary to provide a number of large areas unbroken by supports. It was found possible to use girders having spans of 55 and 61 feet. When subjected to a load, a girder develops compressive strains above and tensile ones below. The concrete is well adapted to withstand the one, but not the

other. In an ordinary bridge truss, there may be diagonals that are also under tensile stress. In the Kahn system of reinforcement, a horizontal bar from which rigidly attached diagonals extend upward and outward is provided with a view of enabling the girder to withstand the tensile stress. In accordance with this design the long girders were constructed. Girders providing runways for 3-ton cranes were also constructed. A load of 14 tons placed upon one of the reinforced concrete girders having a span of 25 feet induced a deflection of only $^{1}/_{16}$ inch. This girder is 12 inches wide and 22 inches deep and its reinforcement consists of three 1 x 3 in. Kahn bars. Hollow tile was largely employed here in connection with the concrete.

What is known in the trade as the corrugated bar, supplied by the Corrugated Steel Bar Company is a steel reinforcing rod which provides shoulders by means of which the concrete is mechanically engaged. This general type of reinforcement is, however, not confined to this concern. By means of this style of bar, the engineer is able to secure the desired mechanical interlock. As the concrete and steel expand and contract they do so together—unless the temperature change is excessive—and so the relation between the two is maintained. Such standard types of reinforcing bars are applicable to multitudes of construction. An interesting example is the railroad bridge over the Vermilion River near Danville, Illinois. There are three arches, the central one of which has a span of 100 feet. About 130 tons of corrugated bars were employed in the construction of this beautiful bridge.

Another good example of bridge construction is the bridge over the Maumee River near Waterville, Ohio. This structure follows the designs of the National Bridge Company. It has a width of 16 feet between copings and crosses the river at a point where it is 1,000 feet wide. It is said that this reinforced bridge will carry a load of 5 tons per linear foot. The arches are 12 in number, the longest having a span of 90 feet, and the shortest, one of 75 feet. The loading of a bridge arch produces a lateral thrust upon the piers. If the next arch is not loaded, then this thrust is unbalanced and must be cared for. This was done in this case by employing part of the 100 tons of reinforcement in a vertical position. This bridge having a very long expectation of life was built at a cost of $77,000. The total amount of concrete was about 9,200 cubic yards.

The city of Philadelphia has gone into the construction of city bridges of concrete in rather an extensive way. Among a total of 30 or more is the reinforced bridge across Poquessing Creek, having a span of 71 feet. This bridge is rather flat, having a rise of but 9½ feet. The reinforcement employed here consisted in part of angle bars placed in pairs to form a kind of T-bar. The principal reinforcement here was the arch ribs. These were each composed of two of the T-bars arranged one above the other in such manner that their points of nearest approach were at the crown. These were latticed together. Such ribs were placed 4 feet apart. Transversely disposed steel rods held the whole together. The mechanical interlock here depended upon was due, no doubt, to the mutual disposition of the various rods, etc.

A railway viaduct, one-half mile or more in length is another example of the Kahn methods. This structure belongs to the Richmond & Chesapeake Railway and is located at Richmond, Va. There is a span of 70 feet which has girders nearly 6 feet deep. At another span the girders, probably of about the same depth, sagged but ⅛ inch upon removal of the falsework.

A style of reinforcement much used consists of a net-like fabric of metal. This is employed largely in floors to bind the whole mass together. In the manufacture of this netting, a Canadian company has found it desirable to repair the inevitable breakages of strands in manufacture by the use of the Davis-Bournonville Company's oxyacetylene torch. It is said that welds can be made on the average of one in two minutes in the case of an ordinary weight of the fabric. This netting is made by expanding sheets of perforated metal from a narrow to a considerable width. It is during this expansion that the strands sometimes break.

Another style of floor reinforcement is the fabric made from wire. That floors properly reinforced are quite substantial may be judged from the case of the United States Fidelity & Guarantee Company. Their building in Baltimore was exposed to intense heat in the great fire of 1904. In fact, a considerable part of the side walls and the front fell, leaving floors of concrete. A load of brick giving a pressure of 300 pounds per square foot was arranged on one of the floors to a distance of 5 feet to each side of one of the girders. The deflection amounted to ⅛ inch. This was about 1⁄20 of 1 per cent of the span. This is an example of Hennibique construction.

Reference has already been made to the Kahn truss reinforcement. With the same general object in view, the Hennibique truss has been designed. There are two horizontal bars, one above the other. The upper is, however, not perfectly horizontal except near the center. Towards either side, this bar rises as it recedes from the center. These two bars are enveloped by loose stirrups arranged vertically and at intervals. These are open at the top and closed below.

There are two varieties of piles—the bearing pile and the sheet pile. Their duties are quite different. One sustains a compressive load, the other withstands a transverse thrust. But concrete has been used for both kinds. In the case of the bearing pile, its own intrinsic qualities are eminently suitable. It has good compressive resistance; it is teredo proof, and has the prospect of long life whether conditions are wet, dry or a mixture of the two. Wood makes an admirable bearing pile, if constantly submerged, but it is a prey to the teredo. The necessity for constant submergence limits the usefulness of the wood pile. It must be cut off below the hydraulic level, and this necessitates carrying the foundation footings to a lower level than would otherwise ordinarily be the case. With the concrete bearing pile, on the contrary, the footings may be constructed at any level desired as the pile itself may be partly submerged and partly in the dry. However, the concrete pile may be subjected to other than compressive stresses, especially during its placement. And so, some reinforce it. Some, no doubt, have in view a possible buckling when in the ground, particularly if the surrounding soil is yielding. Reinforcement both longitudinal and transverse is employed. Longitudinal bars are arranged at intervals around and within the periphery. These may be bound together by separate hoops disposed along the length or by wire wound about the longitudinals in spirals. In the case of concrete sheet piling, the concrete supplies a surface and forms a protective covering to the imbedded reinforcement which is here a vital matter and consequently indispensable. In the dock improvements at Baltimore, to which reference has already been made, reinforced concrete sheet piling was largely used. The steel sheet pile could not well have been used here because of its susceptibility to corrosion. The concrete slabs, 12 × 18 inches in cross-section perform the duty of retaining masses of earth in place both above and below the water line. There were certain other concrete

constructional elements of an auxiliary character. The total reinforcement amounted to about 1,200 tons.

With regard to its fireproof qualities, an eloquent testimonial arises from the fact that the immense Marlborough-Blenheim Hotel at Atlantic City, a concrete and tile structure, is said to enjoy a saving of $18,000 per year in fire insurance premiums. The insurance is based on $600,000. This structure is 560 feet in length and has a width varying from 60 to 200 feet.

Reference has been made to the close identity of the co-efficients of expansion for steel and concrete for moderate intervals of temperature. While this is so, if the thermal range is considerable, the concrete and the steel cannot be expected to expand and contract together. In most engineering construction, the range is small, say 150 degrees F., but there are exceptions. One of these relates to the material used in tall chimneys. The hot gases which pass up these give rise to rather high temperatures. In fact, it is well-recognized practice to build a large part of such chimneys double, one shell enveloping another, with an air space between. Some four or five years ago what is, perhaps, the very tallest concrete chimney in the United States was built for the Colusa Parrot Mining & Smelting Company, Butte, Montana. It is 352½ feet high and has a flue 18 feet in diameter. A solid wall 1½ feet thick constitutes the base of 21 feet in height. Above this level, an air space 4 inches wide radially is arranged between two shells of 5 and 9 inches thick. The inner one is the thinner. The steel reinforcements used were T-bars. The footing is of reinforced concrete and rests upon a fill 18 feet deep. A further important factor which has to be considered is the serious effect of repeated stresses. Partly because of this, it is recommended that a large factor of safety be adopted. Further, the best practice would seem to be in the direction of a complete divorce between the inner and outer shells all the way up and of a uniformity in wall thickness from bottom to top. Vertical cracks have been noted in some chimneys. This would indicate the advisability of strong circular reinforcement. It is thought that a tone concrete following the formula 1:2:2 is better for the outer shell than a cement mortar. It is said to be stronger, denser and more impervious to water than a mortar following the formula 1:3. In order to secure adhesion between layers, the fresh concrete should be applied wet and the old should perhaps be resurfaced by tooling.

The compressive resistivity of the usual concretes is considerable. However, in certain bridge construction in New York City, a need was felt for a concrete which should have a very high compressive resistance. And so experiments were made with a concrete formed by substituting wire nails for the crushed stone. About 60 tests were made with concrete following the formula 1:2:2⅔. The resulting material was quite heavy. A cubic foot weighed 196 pounds as compared with 130 to 160 pounds for ordinary concretes. Eighty-eight pounds of nails were used in one cubic foot bringing the cost to about $2.30. This was certainly very expensive material. But where extraordinary qualities are desired, we have to spend money. Cubes were cast measuring 6 inches on a side. These were tested to destruction at different stages of maturity. After the lapse of one week, the lowest crushing resistance obtained was 2,770 pounds per square inch and the highest 3,330 pounds. After one month, the minimum crushing strength was 3,050 pounds, the maximum 8,340 pounds, while the average was 5,645 pounds. When a year had gone by, it was found that four cubes gave an average of 10,410 pounds. However, the average resistance of 17,235 pounds was obtained in the case of cubes 15 months old.

Since concrete is but little affected by water and by fluctuations between wet and dry conditions, it is not at all remarkable that it has been employed for sewer and water tower construction. In the United States a high standpipe has been constructed at Attleboro, Massachusetts. This is 118 feet high and has an internal diameter of 50 feet. The wall varies from 18 inches in thickness at the bottom to 8 inches at the top. The concrete was made according to the formula 1:2:4. There is another tower 110 feet high and having an external diameter of about 35 feet. At Anaheim, California, a large tank together with its substructure has been constructed entirely of reinforced concrete. The floor of the tank is about 60 feet above the surface. The tank itself is 38 feet in height and 30 feet in diameter and has a wall varying in thickness from 5 to 3 inches. The reinforcement employed was the twisted steel bar.

In order to prevent corrosion of the reinforcement, it is thought necessary to guard against water entering and dissolving away the caustic lime contacting with the steel. One way would be to give the concrete itself a very dense character. Another is to fill the external pores with a bituminous or oleo-resinous paint. Or, an insoluble substance suited to fill the pores

may be one of the ingredients when the concrete is mixed. Finally a flexible waterproof coating may be employed where conditions permit. As to the steel itself—it is desirable to have it uniform, as then reliance may be placed upon calculations. For this reason, one of the great concrete construction companies recommends mild steel as opposed to high carbon steel.

One of the great recommendations of concrete is that it permits wonderful rapidity of construction. We had an example of this in the case of the Geo. N. Pierce automobile factory. Another was in connection with the construction of junction caissons for certain subsurface tubes of the tunnel of the Hudson Companies. These caissons were three in number and were located on the Jersey shore opposite New York City. These structures were quite large, being about 100 feet in length and having a width of about 45 feet. These caissons, one or two of which were put under air pressure, were constructed of concrete with steel reinforcement. The use of concrete in the tunnel system and in the Terminal Building has been very extensive. To complete the concrete construction, about half a million barrels of Portland cement, so it is thought, must be consumed. The Gatun Locks at Panama will require only about four times this amount. The twisted steel bars of the reinforcement have been used in large quantity.

The work on the water front at Baltimore to which reference has already been made involved a considerable variety of reinforced concrete construction. For retaining walls sheet piles were employed. These ordinarily had a face of 18 inches and a thickness of 12 inches and a length of 27 feet. As it was not necessary to retain the soil by an impervious bulkhead, these piles did not interlock. However, they had to resist a horizontal thrust, and so wales were strung along the outside at the top. These wales were themselves of concrete reinforced by means of imbedded lattice girders of steel. In position, the girders lay flat and thus gave their chief strength to the horizontal thrust. The wales were supported, in part, by concrete piers. These were placed by means of steel caissons. These cofferdams were of sheet steel 27 feet deep and were sunk by open air methods. When in place, the concrete was put in and the pier thus formed. An upward surface of the pier provides a means of absorbing the horizontal thrust of the wales. The piers themselves are, some of them, mutually tied together across the dock; others are tied to reinforced concrete piles sunk in

the body of the dock. The ties are themselves of reinforced concrete. The steel of the caissons served only as a mold. It is now a matter apparently of but little importance how soon it corrodes. The extensive concrete work at Baltimore was done by the Raymond Concrete Pile Company.

While the question of the teredo seems to have been a factor at Baltimore because of the probability of its presence in the harbor when certain sewerage improvements are carried out, this matter was really an insistent thing in connection with a wharf constructed by the United Fruit Company at Bocas del Toro in the Republic of Panama. This wharf is itself of reinforced concrete. But the bearing piles are what interest us. The native wooden piling, so it seems, would at this general location become seriously damaged by the teredo within a year. Some kinds of timber might be expected to have a longer life. The service of creosoted piles has been estimated as about 15 years. Besides, piles 70 feet in length were desired. This requirement put the ordinary reinforced concrete piles out of consideration. What was actually done was to use an untreated timber pile and then to encase it where it passed through the water in a reinforced concrete shell. This shell was made of such size as to allow a space between it and the enclosed wooden pile. A rich concrete was put in this space at the bottom and thus excluded the external water. Upon pumping out the retained water, the major portion of the space was filled with a lean concrete and a top layer of rich concrete then added in which the column reinforcement was placed. The steel used for reinforcement was in the main round bars of mild steel. The piles averaged 58 feet in length; the shells, 18.4 feet. The cost of these shells was $1.78 per linear foot. It is said that the cost of the untreated wooden pile together with its protective coating was not greater than what would have been the expense for a creosoted pile.

At both the Baltimore docks and the wharf in the tropics, concrete is exposed to the action of sea water. But there is no violence in this action. However, a very large application of concrete construction has been recently carried out in a very much exposed maritime situation off the coast of Florida. It is 156 miles from the mainland to the island of Key West. Scattered along this interval are a number of islands, so that in reality the total linear amount of intervening land is about one-half the distance. Some of the water passages are only a few hundred feet in width; one is about 2½ miles wide. The greater portion of the aqueous route is of a shallow depth.

But for about 6 miles the water reached depths up to 30 feet; and this in connection with an exposed situation. Reinforced concrete viaducts have been built to accommodate trains and resist the storms. A quarter million barrels of cement and about 5,700 tons of steel went into these works.

The viaduct from Long Key is 2 miles long and passed through water having a depth ranging from 13 to 20 feet. The floor of the Gulf is of coral. To construct a pier, about 30 piles would be driven in with their tops projecting up from the floor. A cofferdam would be sunk to include them and a seal of concrete 1 yard thick be placed. The water could now be pumped out and the form concreted. The reinforcement would, of course, be put in place before depositing this concrete. The pier would then be allowed 3 weeks to mature. The concrete was mixed with fresh water to avoid the effect of sea water on the steel. Corrugated bars were used in reinforcing the walls and the 184 arches. High water is 31 feet below the top of this structure, so that the track is well protected from the waves.

It may surprise some, but concrete has actually been used as the chief material in the construction of boats. A reinforced concrete boat was built thirteen years ago for use on the River Tiber in Italy. Not only the hull but posts and roof of the structure above deck were of concrete. This house boat was 67 by 21 feet. Another Italian boat is the Liguria, a barge in actual service. It is 57 by 18 feet and is rated at 150 tons. The Gretchen is an American example of the stone boat. She has sailed over long distances on the Atlantic and was reputed as comparatively a rapid sailer in a heavy sea. Her reinforcement was a multitude of small rods. This boat drew 14 feet of water and was 65 feet long and had a beam measurement of 16 feet.

Concrete is an obvious material for coal pockets, especially because of its fireproof character. A further advantage is the avoidance of a large maintenance charge. At Charlestown (Boston), the Lehigh & Wilkes-Barre Coal Company had been expending about $1,000 yearly on repairs upon a coal pocket. This has now been replaced by a concrete structure having a capacity of 10,000 tons. It has a depth of 24 feet, and has a length of 182 feet and a width of 92 feet. It is founded upon 750 Simplex concrete piles. If wooden piling had been used, the amount of excavation thus necessitated would have been very considerable because it would have been necessary to cut them off 10 feet below the surface in conformity with the building laws.

Moreover, about 2,000 wooden piles would have been required because of the limit of ten tons' bearing capacity per pile. With the concrete piles, however, the footings for the columns were constructed with but little excavation. The columns, side walls, girders, beams, floors—pretty much everything except the roof—were of reinforced concrete. When a full load of coal is filled in on the floor, the weight per square yard is 18 tons.

A similar application is to the construction of grain elevators. Reinforced concrete has been used at Baltimore in two important buildings of this kind and also in the case of a third at Buffalo. The question of fire is here very important. The grain elevator of the Pennsylvania Railroad at Baltimore is the largest of the three and is constructed to hold 1,000,000 bushels. There are 53 cylindrical bins having a common height of 79 feet. There are four rows of eight each. The remaining twenty-one bins occupy spaces in between, three rows seven in a row. The set of 32 have the larger size and measure 24.2 feet in internal diameter. The walls are 8 inches thick and have both vertical and circumferential reinforcement. The vertical reinforcement is round bars of 1⅜-inch diameter. The circumferential reinforcement consists of interlaced flat bars. By a patented device the bins were cast in sections. This mold would be attached to the heavier vertical reinforcement and jacked up as needed.

It is unnecessary to emphasize the fact that concrete while economical is not cheap. So that when large masses are used, it is advisable to reduce the expense by using what may be called "pudding stones." At McCalls Ferry a large dam and adjoining power house span the Susquehanna River. This is a tremendous application of concrete. However, pudding stones were very properly employed in the construction of the great dam. Here steel was employed not so much to reinforce but to supply frames for the molding surfaces. Great pelican cranes of steel were also employed to handle the concrete, etc. The face of the dam is a double curve and thus required a precise mold. Sections of the dam, 40 feet in length, would be constructed to alternate with open spaces of the same length. When it was desired to close such open spaces, a great steel apron would be let down on the upstream face. Concrete could then be laid in the open space.

In all the applications of reinforced concrete with which our attention has so far been occupied, the case has either been one of well-recognized practice

or closely related to such practice—with the possible exception of concrete barges. There are two other lines of engineering application in which it is very desirable to employ concrete, but where we are scarcely entitled to regard its use as anything more than experimental. Reference is made to telegraph poles and cross-ties. If a concrete pole really proves adapted to its service, then we may expect a great reduction in maintenance expense. It is estimated that renewals of wooden poles in the United States cost yearly $13,000,000. The prospect of getting a pole which will not need renewal for a long period is certainly attractive. But the actual service is severe. This is due not so much to the load which must be carried as to the horizontal movements under wind pressure. But by using proper reinforcement, it is thought by some, the pole may be made to withstand the horizontal thrusts. Some experiments have been made of a type of pole recommended by the American Concrete Pole Company, Richmond, Indiana. Four vertical rods bound together by wire constitute the reinforcement. Such a pole 7 x 7 inches at the top and 12 x 12 inches at the bottom was tested to destruction. This pole was 30 feet long and had its butt end sunk 5 feet into the ground. The vertical rods were ⅝ inch in diameter and were bound with No. 9 wire. A horizontal thrust or pull at the top of 840 pounds accomplished a deflection of 6 inches. When this was increased to 1,780 pounds, the deflection amounted to 17 inches. When 2,800 pounds pressure was employed, the deflection was 30 inches accompanied by a slight cracking. A deflection of a full yard together with cracking at the ground line resulted from a pressure of 3,640 pounds. When 7,200 pounds pressure was employed, the cracking became bad and the deflection amounted to 60 inches. A cedar pole of the same size was deflected 11 inches by a pull of 840 pounds. With 1,780 pounds, the deflection was nearly a yard (33 inches); and with 2,200 pounds the pole broke about 3 feet from the ground. The problem of the telegraph pole will probably be solved, if this has not already been done.

With regard to the cross-tie the case is more difficult. Plain concrete slabs or beams cannot be used after the manner of the wooden tie because of their want of elasticity. What is called “center binding” would be disastrous to plain concrete. The rocking action of the passing load is also a factor which enters. One method of dealing with center binding is to divide the tie into two parts, connecting them with steel rods. The Corell tie is an example of

this. In the Percival tie, the under part of the concrete block is given a sharpened edge. Beneath the rail itself, the cross-section is a kind of oval. There is longitudinal reinforcement in the form of four rods, three arranged at the top and one near the bottom. Three rods are bound with wire. There is a cushion block of wood which absorbs and distributes the shocks from the bottom of the rail. Screw spikes and metallic sockets are employed. Some three or more years ago a hundred such ties were put in service in a Texas railway. In June, 1909, seven only were found to have received serious injury. It is thought that this damage was scarcely chargeable to the ties themselves as when in position they were between wooden ones whose deterioration might easily have been the cause of undue disturbance being thrown on the concrete ties.

We have considered to a slight extent the use of steel as the material of concrete forms. This line of application, however, promises to become a very large one. Two notable constructions are now under way in which the steel form plays a large part. These are the great Gatun Locks of the Panama Canal and the Catskill Aqueduct. The three double locks at Gatun will require about 2,000,000 cubic yards of concrete. Each pair of locks is on a separate level and has three longitudinal walls. One separates the lock chambers. This central wall is 60 feet in width. It is not solid as so much concrete would not be required as the water level is approached. Consequently, there is a kind of V-section which traverses it longitudinally. This is filled in except for three galleries—one for drainage, one for the electric wires and one for the men. There is a longitudinal culvert arranged below the fill in the body of the concrete wall. In the side walls of the lock chambers are other longitudinal culverts. From the central supply culvert transverse distributing culverts run off beneath the floors of the adjacent lock chambers. These have vertical outlets into the lock chambers themselves. Similarly, but for purposes of emptying the locks, the longitudinal culverts arranged along the outside are connected by transverse culverts and vertical openings with the lock chambers. The members of the two systems of transverse culverts alternate with each other. The main supply culvert has a diameter of 22 feet part of the way and of 18 feet part of the way. Now these many culverts, various in form and size, are to be molded in the mass concrete by means of steel forms. As originally announced, there would be 12 forms of open hearth boiler steel for the main

supply culvert. Each of these weighs 177,000 pounds. One hundred forms were to be required. The two main outlet culverts of similar dimensions to the main supply culvert were thought to require 21 forms, each 12 feet in length and having a weight of 300,000 pounds. The transverse culverts were to require 100 forms, each having a length of 10 feet and a weight of 217,000 pounds. There were thus to be 133 forms having an aggregate weight of 15,000 tons. It is possible that there may be some modifications of this plan in minor particulars. The side walls of the lock chambers are to be mainly vertical planes having a height of, say, 81 feet. To retain the fresh concrete in place, 12 face plates, constructed of sheet steel are to be used. These are 7½ inches in thickness, having face dimensions 78 x 36 feet. Steel towers running on suitable tracks control these face plates. It is estimated that towers and plates will have an aggregate weight of 26,000 tons. So that, quite apart from any possible reinforcement application, steel to the total of about 41,000 tons is to be used for forms and immediate accessories. But this 41,000 tons is not all. The concrete is to be cast in great monoliths and to retain the ends of these while the concrete is fresh, steel girders 6 feet high are to be employed. If these locks were to be of stone then steel would have played a rather subordinate part.

The Blaw Collapsible Steel Centering Company are engaged at Panama, but they are also applying their systems of molding concrete to the great aqueduct which is to supply New York City with water from the Catskill Mountain region on the other side of the Hudson River. A steel centering is used to give form to the interior. Steel forms are also employed to shape the upper part of the external surface. At Baltimore, more than three miles of sewer construction was carried out in accordance with the system of the same company. The centering used for one portion where the height was 11 feet and the width 12¼ feet (inside) was employed in 50-foot lengths. In 2 hours, 6 men could remove such a 50-foot section together with its falsework and have it in readiness for a repetition of its service. A typical half-round Blaw center consists of one or more steel plates bent to conform to a cross-section of a semi-circle. Turnbuckles retain this shell in position. If we are going to employ this form in sewer construction, we first dig out our trench to such dimensions and form as to furnish the mold for the outside surface of the lower part of the concrete sewer. We then lay concrete in a longitudinal strip along the bottom, giving the upper surface the form

of a shallow gutter. When this is sufficiently hardened, the semi-circular center may be slid along it to suitable position. The center has its concavity opening upwards. The concrete of the invert of the sewer is now placed. The same or a duplicate center may now be used to mold the interior of the upper part of the sewer.

Portland cement has been in use for a long time. But reinforced concrete is so modern that in some important lines of engineering application the fundamental data underlying practice are not fully determined. In what may be regarded as the first decade (1870-1880) of the considerable manufacture of Portland cement in the United States, the total amount produced was only 42,000 barrels. Fifty years and more would be required for the production of enough cement to construct the Gatun Locks. Over a decade would be necessary to yield enough cement for the operations of the Hudson Companies. The price at this period was about $3.00 per barrel. In 1908 it was 85 cents. But the production in this year was more than 1,200 times that in 1880. The value per year of the present output is about $50,000,000.

CHEMISTRY AND THE INDUSTRIES.

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Chemistry has always been a utilitarian science, a science whose direct applications to our every-day interests has been on every side recognized. Even in the days of alchemy, that fantastic forerunner of our present science, her devotees were concerned with the changing of the base metals into the noble ones, of lead into silver, and of copper into gold, and also with the search for the philosopher's stone, that mysterious something which would give perpetual youth.

From these workers arose in the course of the years, the facts and the theories which were incorporated into the science of chemistry. But it is not entirely to the alchemists that chemistry owes its development. By far the greater number of facts, if not of theories, came down to us through the traditional knowledge of the chemical industries. Numerous animal and vegetable products, such as sugar, starch, the oils, gums and resins, had been familiar commodities as long back as history records. And the ancients were informed in such typically chemical industries as that of dyeing with vegetable dyes, pigment manufacture, varnish making, soap making, paper making and the fermentation industries. In fact the science of chemistry as we have it today owes much more to these unknown workers in the industries who transmitted their chemical facts from father to son, than it does to the creations of the imaginations of those picturesque, if not so truthful, alchemists.

It is entirely impossible to divorce the science of chemistry from its industrial applications. The science owes much to the industries. The industries owe even more to the science. And if that relationship has been very close in the past, it is much closer now than it ever was; and it is getting closer all the while. The utilitarianism of our age makes it absolutely

necessary that the two shall be so united that the utmost of good shall result from the union.

The application of science in general, and of chemistry in particular, to the industries has this one general result. It takes that industry out of the “rule of thumb” class, and places it firmly on a sound basis. It is no longer conducted in a haphazard manner, but according to intelligent design, based on the most accurate scientific information. Of course the fierceness of business competition has ordered this change, more than any other factor. The pure science of chemistry would have developed without industrial applications, because there are investigators who are seeking the truth regardless of any of its immediate applications. But in the industries, it is a matter of dollars and cents. The most efficient is the winner. And the most efficient is the one who utilizes in his business all the scientific information that can be brought to bear on the subject, and who is always looking for new facts that can be applied.

Chemistry, then, is applied to the industries in two distinct ways, the first in discovery, in finding a new substance which can be used, or a new process by which some useful or necessary substance can be made; the second in improvement, in making a certain product better, or cheaper, in utilizing wastes, or in starting from cheaper raw materials.

There are but two kinds of industries: (a) Those which are based on processes which change the form of matter, such as the manufacture of furniture for example, and (b) those which are based on processes which change the composition of matter, such as the manufacture of Portland cement from clay and limestone. Now group “b” comprises by far the greatest number of industries, and since the science of chemistry concerns itself with just those changes in the composition of matter, it is evident that most of our industries are chemical in their nature. We have but recently come to realize this. A list of such industries and operations which are essentially chemical would be found to include almost every industry that we can think of. I need only make mention of the subject of fuels, gas and coke, of cement, mortars, brick and other building materials; of petroleum and its products; of asphalt; of the products of the destructive distillation of wood; of cellulose and of paper; of pigments, resins, varnishes; of rubber; of soap, fats and the fatty oils; of gums; of sugar and of starch; of the textile

industries and of the dyes; of leather and glue; of explosives; of the heavy chemical industries, the manufacture of acids, alkalies and salts; of the manufacture of glass and the ceramic industries; of the fermentation industries; of the manufacture and standardization of medicines; of the subject of soils and artificial fertilization; of the subject of foods, and of nutrition; of the subject of water, sewage and sanitation; of photography; of all the electro-chemical industries and processes; of the production of steel, of copper, of lead and of all the other metals. I need only mention this formidable array of subjects and industries to convince the most sceptical one that chemistry does in fact, concern us, directly or indirectly, in all of our activities.

As I have said previously, chemistry influences industry in two distinct ways: First, in the discovery of new substances and new processes; secondly, in the perfection of known substances and known processes. In either of these fields the chemist is proud of his record. The conquests are so numerous that he is at a loss as to how or where to begin if he would tell of them. The whole field of industrial chemistry is one succession of chemical achievements, mammoth industries that had their humble birth in the chemist's test tube, his beaker, or his retort; the wealth of by-products saved to the world from what was a few years ago sheer waste; and above all increased efficiency in the manufacture of all products. The chemist does not claim more than his due when he points out that his activity covers the whole field of our daily experiences, and that his activity has always been for the lessening of waste, for greater efficiency, in a word, for the development of civilization. To illustrate the points which have already been brought out, the story of the soda industry, the beginning of the modern chemical industries, can be used. The beginning is far back in another century, so intimately is the development of the soda industry bound up with the advance of civilization.

The value of what we now call the alkalies as detergent substances, was known from the earliest times. The first alkali recorded in history is burned lime, and was called "caustic" on account of its characteristic property. Caustic lime is but slightly soluble in water, hence its use is greatly limited. History fails to tell who it was who first solved the problem of making a more soluble alkali, but some one, early in the Middle Ages, discovered that by the action of caustic lime on the so-called potashes, the ashes which

remained on burning wood, a very soluble caustic was formed. And to this, the long since forgotten chemist gave the name “caustic potash.” The chemistry of the discovery is as follows: All plants take potassium, a very light metal, in some form or other from the soil, to form the so-called mineral, or bony structure, in other words the skeleton, of the plant. When these plants are burned the potassium in the form of a salt, chiefly potassium carbonate, is formed in the ash. These potassium salts can be extracted by water, and recovered on the evaporation of the water. These potassium salts, the so-called “potashes,” were extensively used in the industries of the time, for example, in making soap, in making glass, in dyeing and in a score of other minor ways. But even as our forests cannot now meet the demand for timber, so they could not then meet the demand for the “potashes,” for it requires a large amount of wood to give a comparatively small amount of potashes, the percentage of potassium salts in wood being very small indeed. Simultaneously with all this, in northern Spain, on the seacoast, a number of towns were engaged in burning sea weeds. It was found that the ashes of sea weeds while not the same as potashes, nevertheless could be substituted for them. This is historically recorded as the “barilla” industry. Barilla consisted of 5 per cent of carbonate of sodium, a metal very similar to potassium. Sodium does for sea plants just what potassium does for land plants. Barilla was merely a substitute for potashes, and a very poor substitute at that. But it was destined to offer the key that solved the whole problem. The chemists of that time showed the chemical similarity between the active ingredient of potashes, carbonate of potassium, and the active ingredient of barilla, carbonate of sodium. The demand for these alkalies made by the industries was incessant and ever-increasing. The chemists realized that the direct natural sources of the two, namely, the wood of the forest and the weeds of the sea, were and always would be, inadequate to meet the enormously growing demands of the industries. They saw that some other source would have to be discovered, or the bodies would have to be prepared artificially. They realized that while potashes were better than barilla, nevertheless potassium salts, the ingredients of potashes, were much less widely distributed in nature than the sodium salts, the ingredients of barilla. So they set out with the definite object of preparing sodium carbonate. In 1791 LeBlanc took out a patent for his now famous process. He was not the only one who worked on the problem; he happened to be the successful one.

This was the first of the great triumphs of chemistry in the industrial field. The significant point in this story of soda, is that those industries which were using the alkalies had reached the limit of their development, because the supply of the alkalies was so limited. Remember, also, that those industries were fundamental ones. Some historian has said that you can measure the civilization of a people by the amount of soap it uses. And here, we see the soap industry of Europe, the seat of our present civilization, crippled for want of an alkali. The position of the chemist, his responsibility to society, is the significant thing in the story. Here was a crisis in the development of civilization, as important to us as the crisis of the battle of Marathon. Because the problem was solved in the retort, instead of on the battle plain, because the battle was fought by the quiet hand of the chemist, instead of by the fighting men of Greece, we do not hear so much of it. But it was a triumph, and the credit belongs to the chemist. To us, as much depended upon the result of the battle of the molecules in the retort, as upon the defeat of the great Darius.

Nor was this battle in the retort a tame one. LeBlanc's method is an extremely complicated one. To conduct the process at all requires chemical knowledge of the most varied kind. And to apply the improvements that have been worked out in the laboratory, and to carry into practice the many subsidiary manufactures that have sprung from this main industry, demands so much technical ability that it has been said that this manufacture is not merely the foundation of the immense chemical industries of today, but is also the guiding spirit in them.

LeBlanc, of course, could not foretell the enormous development his industry was to attain. Nor could he conceive of the ramifications running from it into countless other activities of our present civilization. The manufacture of sulphuric acid, one of the most important products of modern industry, is intimately bound up with that of soda. And, in the manufacture of sulphuric acid, nitric acid is required, and must be made. Hydrochloric acid is a by-product of the soda process, and was for a long time permitted to go to waste. Now it is one of the most valuable products of the LeBlanc soda process. It is used to make bleaching powder, potassium chlorate, and otherwise in the industries. Also, the alkaline waste from the soda process is rich in sulphur. This sulphur is now recovered and

put on the market as such, helping to meet the demand for sulphur that the Sicilian mines cannot supply.

All those varied industries that were either created or fostered by the soda industry have made possible the almost fabulously complicated processes that are now carried out in the manufacture of the aniline dyes, the artificial odors, like vanillin whose complexity can be gathered from its formula, $C_6H_3OHOCH_3CHO$, which tells many things to the chemist, but not much to the layman, and the artificial febrifuges like antipyrin, whose formula is $C_{11}H_{12}N_2O$. All these chemical industries that are the outgrowth of the soda industry, and that are so dove-tailed with our civilization, have been built up on the science of chemistry, and worked out by chemists. I have selected this story of soda to show the commanding position held by the science of chemistry in directing the course of civilization. It shows, too, how the entire structure of that civilization is built around the contributions of the chemist.

As has been already said, it is impossible to separate chemistry from industry. The farther we go and the more we develop and the more complex our civilization becomes, the closer become the ties uniting science and industry. And as everything that deals with the change in composition of matter is chemistry, it is evident that chemistry is omnipresent. In the light of what it has accomplished, who shall say that it is not omnipotent?

The story of soda is a beautiful example of how industry and the need of civilization can act as a beacon light for the science of chemistry. This illustration will show how the pure science has created new industries and opened up new activities for civilization. In 1838 in England, there was born a boy who afterwards was to be known as Sir Wm. Perkin. He came of a very intelligent family. Besides, he was gifted with a natural aptitude for chemistry. More than that, he was put under the direction of Professor Hofmann, one of the most brilliant of chemists. Perkin would have been called by any one, an ideal bit of raw material. Hofmann, like many others of those German chemists, had a faculty of instilling that enthusiasm that is necessary in the performance of an epoch-making advancement. Perkin caught that enthusiasm. He rigged up a laboratory in his house and worked at night and in his vacations on those interesting problems that Hofmann discussed in his lectures. During one of these vacations, he was trying to

build up, artificially, the substance called quinine, which was up to that time a purely natural product. His work took an unexpected turn. Instead of building up quinine, he built what chemists call now phenyl-sufranine, or mauvëine. This was a new substance with properties that rendered it an excellent dye. Perkin established a factory in which the new substance could be prepared on a large scale; and within a year of its discovery, he had it on the market. This discovery of Mauve, the first of the artificial dyes, gave a great impetus to the study of coal tar, from which it was made. Coal tar, up to that time, was a waste product, made in the process of heating coal for the manufacture of gas. This coal tar is the raw material which is used in that enormous chemical industry, the manufacture of the derivatives of tri-phenyl methane, the so-called aniline dyes. There is invested in this industry alone, $750,000,000; and the whole structure, complex as it is, is built on the foundation of a pure chemical research that was undertaken merely to gratify the investigative desires of a true scientist, with no thought of its financial results. This achievement of Perkin stands out as one of the great discoveries of chemistry. And the story of Mauve shows how science has led the way for industry, just as the story of soda shows how industry has pointed out the way for science.

Many more stories of the victories of scientific industry could be told. Much has been done. But the chemist does not live in the glory of the past. He lives in the possibilities of the future. Every advancement of the past has opened up many fields of possibilities. If much has been done, much more remains to be done. And the work of the future will require the services of the scientist more than did the work of the past. Those problems whose answers were obvious, have all been solved. The problems of today are deep ones; they require all the ingenuity, all the ability that the trained chemist can bring to bear upon the problems. And they will all tend to increased efficiency.

While chemistry is a fundamental science, while it covers such a variety of subjects, while the total amount of its established facts is indeed enormous, nevertheless, it must be said with frankness that this vastness is made up for the most part by details and more or less isolated facts and ideas. Chemistry can boast of remarkable achievements. But the greatest achievements are yet before it. And the reason is this: Chemistry is not yet a really unified science. The real fundamentals which will string together all of the isolated

facts and ideas, material of which the chemist has, indeed, reason to feel proud, are for the most part lacking. That is why the future is so much larger than the past. And that is why the world can expect from the chemists much greater achievements in the future than it has seen accomplished in the past, great as they have been.

In the most fundamental terms, chemistry concerns itself with the changes which the different kinds of energy produce upon matter. Chemistry concerns itself with two things, energy and matter. And yet chemistry must admit that it does not know the nature of matter or the nature of energy. And not knowing, it cannot appreciate.

In this direction lie the achievements of the chemistry of the future. As the nature of matter and the nature of energy gradually unfold themselves to the advances of chemical investigation, remarkable possibilities for future development are disclosed. We are beginning to see how really wasteful we have been. The frightful wastes which the movement toward the conservation of our natural resources has called to our attention, sink into utter insignificance when we consider what we have lost on account of our ignorance. We are just beginning to appreciate our wastefulness of chemical energy. A piece of coal, for example, has in it the possibility of doing ten times as much work as it is doing now. A piece of radium has stored in it an almost infinite amount of energy. How to change this internal or chemical energy into the other forms of energy with which we are familiar, into heat, or electricity, or ordinary mechanical energy, that is the problem of the future. The utilization of this vast amount of potential energy that is stored up in all forms of matter, the harnessing of it in the service of humanity, this is the problem which confronts the chemist. It goes down to the very fundamentals of his science.

But the start has been made. The point of the wedge has already found entrance. The discovery of radium, and the study of its decompositions, has opened wide our field of vision. The problem must yield, as the blows of chemical investigation fall upon the wedge and drive it home.

Chemistry has always been a utilitarian science. Its results have always been at the service of humanity. And if we can judge the future by the past, even discounting for the enthusiasm of the chemist, we can forsee improved

processes which will reduce our present wasteful methods; we can see new processes making for us such things as india rubber from starch, for which we must now depend upon the bounty of nature; and we can dimly see the time when we shall be able to utilize some of that energy which is hidden away in the recesses of matter, and whose vastness we have just begun to appreciate.

THE CLOSE RELATION OF THE PRODUCER-GAS POWER PLANT TO THE CONSERVATION OF OUR FUEL RESOURCES.

BY ROBERT HEYWOOD FERNALD.

[Professor of Mechanical Engineering, Case School of Applied Science.]

Official reports show that the coal placed on the market amounts annually to between 450,000,000 and 500,000,000 short tons in the United States alone. These figures, however, are somewhat misleading as they do not in any way show the tremendous wastes that are going on due to our present methods of mining and restrictions in qualities of coal that can be transported and placed on the market at a reasonable profit. Careful investigation has shown that the coal wasted or left in the mines in such form as to be inaccessible to future generations amounts each year to practically 100 per cent of that placed on the market, or in other words, at the present time some 450,000,000 tons are annually lost as far as commercial value is concerned.

If this condition is allowed to continue it is estimated by the United States Geological Survey that our available supply of bituminous coal will be exhausted within the next two hundred years.

A realization of the seriousness of this situation has led to a careful and systematic study of the present lack of efficiency in the utilization of fuels for both power and metallurgical purposes, to investigations into more efficient use of the present marketable grades of fuel, and to a consideration of methods of using the so-called low-grade fuels, lignites and peats.

The United States Geological Survey has for several years been investigating the economic value of coals and lignites as gas-producer fuel. This work, begun with tests of coal and lignite at the coal-testing plant erected at the Louisiana Purchase Exposition, St. Louis, Mo., in 1904, was

continued at St. Louis and at Norfolk, Va., and is now being carried on by the Survey at the fuel-testing plant in Pittsburg, Pa. The tests were undertaken because it was evidently desirable to determine the value of the gas producer as a means of increasing efficiency in the use of the coal supplies of the United States. The early tests proved decidedly encouraging, demonstrating that many coals now wasted or not mined because they are not satisfactory fuel for steam-power plants can, by conversion into producer-gas, be made to do from two to three times as much work as can be done by the best grades of steam coal burned in a boiler plant. In consequence, the making of producer-gas tests and the study of the processes that take place within the gas producer now form an essential part of the fuel investigations conducted at the Pittsburg plant under the provisions made by Congress for the analyzing and testing of mineral fuels.

Rapid Development of the Gas Engine.

It was not until late in the nineteenth century that the gas engine came into common use, and although many types have been devised within the last twenty or thirty years it is only within eight or nine years that large gas engines have been constructed. This development started eleven or twelve years ago in Germany, Belgium, and England, but marked progress has been limited to the last eight years.

For a long time the natural fuel of these internal-combustion engines was city gas, but this was too expensive except for engines of small capacity. It was seldom found economical to operate units of more than 75 horsepower with this fuel. Cheap gas was essential for the development of the gas engine, but the early attempts to produce cheap gas were somewhat discouraging, and for a time it seemed very unlikely that the gas engine would encroach to any extent on the field occupied by the steam engine. The theoretical possibilities of the internal-combustion engine operating with cheap fuel promised so much, however, that the practical difficulties were rapidly overcome, with the result that the internal-combustion engine has become a serious rival of the steam engine in many of its applications.

The development of the large gas engine within the last few years has been exceedingly rapid. It was only ten years ago that a 600-horsepower engine

exhibited at the Paris Exposition was regarded as a wonder, but today four-cycle, twin-tandem, double-acting engines of 2,000 to 3,500 horsepower can be found in nearly all up-to-date steel plants, and there are installations in this country containing several units rated at 5,400 horsepower each.

Development of the Gas Producer for Power Purposes.

The rapid advance of the large gas engine was made possible by improvements in the production of cheap gas directly from fuel by means of the gas producer. An early form of producer introduced in Europe, and now in general use both abroad and in the United States, is known as the suction producer, a name suggested by the fact that the engine develops its charge of gas in the producer by means of its own suction stroke. Although many producers of this type are now used, most of them are small, seldom exceeding 200 horsepower. A serious limitation to the utility of the suction producer has been the fact that, owing to the manner of generating the gas, no tarry fuels could be used, a restriction that prevented the use of bituminous coals, lignites, peats, and other like fuels. The fuels in most common use for producers of this type are charcoal, coke, and anthracite coal, although attempts are being made so to construct plants that they can be operated with bituminous or tarry coals.

To meet the demand for the concentration of power in large units, instead of operating a large number of separate installations of small power capacity, the pressure producer was devised. This producer develops its gas under a slight pressure due to the introduction of an air and steam blast, and the gas is stored in a holder until it is required by the engine. As the gas may thus be stored before passing to the engine, and as its generation does not depend on the suction stroke of the engine, tar and other impurities may be removed from it by suitable devices, and the use of bituminous coal, lignite, and peat thus permitted.

The pressure producer was closely followed in the course of development by the down-draft producer, which fixes the tar as a permanent gas and therefore completely uses the volatile hydrocarbons in bituminous coal, lignite, and peat.

A few scattered producer-gas plants were installed for power purposes in the United States before 1900, but the application of this type of power in any general sense has been developed since that date. During the first few years of this period of development anthracite coal, coke, and charcoal were used almost exclusively, although occasionally pressure and down-draft plants ventured to use a well-tried bituminous coal known to be especially free from sulphur and caking difficulties and low in both ash and tar making compounds. The rapid development of the anthracite plant was to be expected, but it remained for the United States Geological Survey in its testing plants at St. Louis and Norfolk to demonstrate the possibility of using in such plants practically all grades of fuel of any commercial value, without reference to the amount of sulphur or tarry matter which they contain. Figures 1 and 2 illustrate the very rapid increase in the number of installations and in the total horsepower of the plants operating with bituminous coal and lignite since the beginning of these investigations by the Geological Survey in 1904.

Owing to the fact that the dates of installation of many plants are not ascertainable, it is impossible to present the exact growth either in number of installations or in horsepower. The relative rate is, however, approximately shown by Figures 1 and 2, the data for which were secured from 375 installations. The points for the year 1909 are estimated from the returns for the first five months. These points have been checked by two or three methods and indicate only the normal increase established by the rate of development before the business depression of 1908. It is probable that the actual figures for the entire year may exceed those indicated.

Relative Results of Steam and Producer-Gas Tests.

In considering the relation between the economic results of plants of the two types under discussion, namely steam and producer-gas, the fact should be remembered that today, in the ordinary manufacturing plant operated by steam power, less than 5 per cent of the total energy in the fuel consumed is available for useful work at the machine.

In this connection it is of interest and value to glance at the possibilities of the best-designed and most skilfully operated commercial plant now in use.

The data concerning the steam plant selected for this determination are derived from a table prepared by Mr. Stott, superintendent of motive power, Interborough Rapid Transit Company, New York City, which, as Mr. Stott says, shows “the losses found in a year’s operation of what is probably one of the most efficient plants in existence today, and, therefore, typical of the present state of the art.”

Figure 1.--Annual increase in number of producer-gas power plants in the United States.

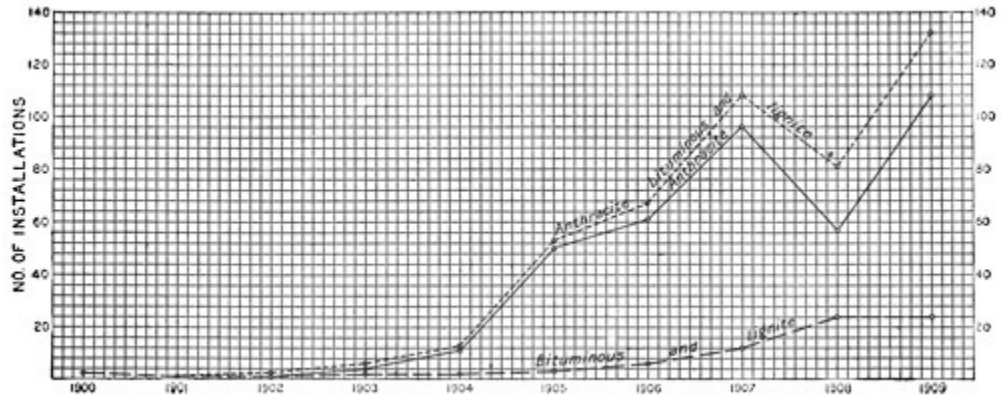
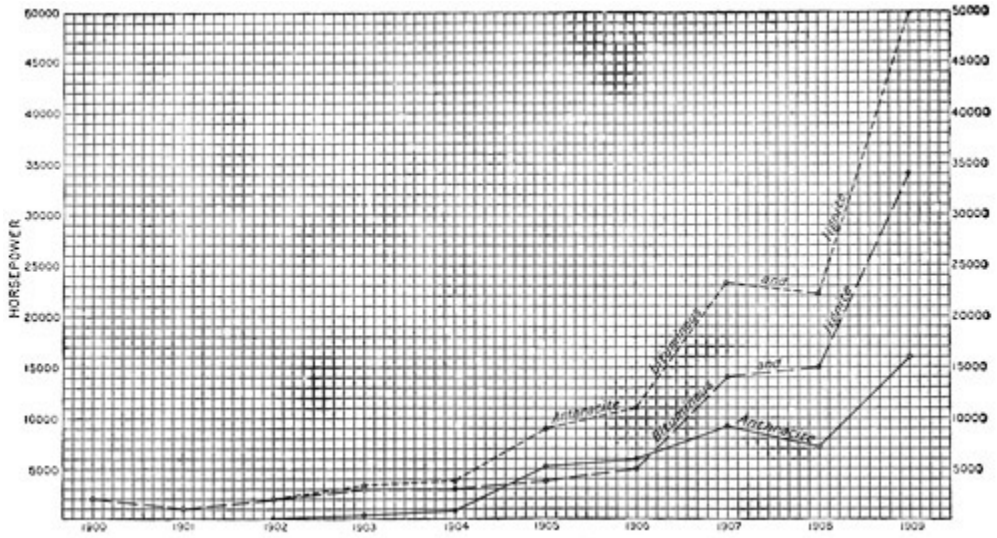


Figure 2.--Annual increase in the total horsepower of producer-gas power plants in the United States.



Average losses in steam plant of the Interborough Company in converting 1 pound of coal, containing 12,500 British thermal units, into electricity.

	British thermal units.	Per cent.
Loss by friction	138	1.1
Loss in exhaust	7,513	60.1
Loss in pipes and auxiliaries	275	2.2
Loss in boiler	1,000	8.0
Loss in stack	1,987	15.9
Loss in ashes	300	2.4
Total losses	11,213	89.7
Energy utilized	1,287	10.3
	12,500	100.0

Mr. Stott further presents a table showing the thermal efficiency of producer-gas plants, concerning which he says:

The following heat balance is believed to represent the best results obtained in Europe and the United States up to date in the formation and utilization of producer gas.

Average losses in a producer-gas plant in the conversion of 1 pound of coal, containing 12,500 British thermal units, into electricity.

	British thermal units.	Per cent.
Loss in gas producer and auxiliaries	2,500	20.0
Loss in cooling water in jackets	2,375	19.0
Loss in exhaust gases	3,750	30.0
Loss in engine friction	813	6.5
Loss in electric generator	62	.5
Total losses	9,500	76.0
Converted into electric energy	3,000	24.0
	12,500	100.0

The thermal efficiency of such plants, as given by different writers, runs as high as 33, 36, and 38.5 per cent, and for some plants figures as extravagant as “above 40” are boldly published. Although the present aim has been to give the figures for a producer-gas plant that may compare favorably with those of the steam plant of the Interborough Company, an effort has been made to keep well within obtainable efficiencies. Attention is also directed to the fact that the producer-gas plant considered should be large enough to compare favorably with the steam plant. This precludes comparisons with suction plants, which are relatively small but give higher proportional efficiencies than the larger pressure and down-draft plants, for these require more or less auxiliary apparatus.

Mr. Stott seems ready to accept a thermal efficiency of 24 per cent for the best producer-gas plants for comparison with 10.3 per cent efficiency for his steam plant, but a careful study of the problem has led to a more conservative estimate for the producer-gas plant, namely, 21.5 per cent.

The tables just given show the comparative efficiencies reached in plants of the best type, both steam and producer-gas, but these are seldom realized in common practice. The results obtained in the government plant at St. Louis are probably more nearly representative of the ordinary type of apparatus. These results are as follows:

Relative economies of steam and gas power plants at St Louis in the conversion of 1 pound of coal, containing 12,500 British thermal units, into electricity.

	Steam Power.		Gas Power.	
	British thermal units.	Per cent.	British thermal units.	Per cent.
Losses in exhaust, friction, etc.	11,892	95.14	10,812	86.5
Converted into electric energy	608	4.86	1,688	13.5
	12,500	100.00	12,500	100.0

The ratios of the total fuel per brake-horsepower hour required by the steam plant and producer-gas plant, under full load, not counting stand-by losses, are presented below as derived from 75 coals, 6 lignites, and 1 peat (Florida).

The curves in Figure 3 show graphically the great economy secured with the producer-gas plant. The figures for the producer-gas tests include not only the coal consumed in the gas producer, but also the coal used in the auxiliary boiler for generating the steam necessary for the pressure blast—that is, the figures given include the total coal required by the producer-gas plant.

Ratios of fuel used in steam and gas plants.

Average ratio, coal as fired per brake-horsepower hour under boiler to coal as fired per brake-horsepower hour in producer	2.7
Maximum ratio, coal as fired per brake-horsepower hour under boiler to coal as fired per brake-horsepower hour in producer	3.7
Minimum ratio, coal as fired per brake-horsepower hour under boiler to coal as fired per brake-horsepower hour in producer	1.8
Average ratio, lignite and subbituminous coal as fired per brake-horsepower hour under boiler to lignite as fired per brake-horsepower hour in producer	2.7
Maximum ratio, lignite and subbituminous coal as fired per brake-horsepower hour under boiler to lignite as fired per brake-horsepower hour in producer	2.9
Minimum ratio, lignite and subbituminous coal as fired per brake-horsepower hour under boiler to lignite as fired per brake-horsepower hour in producer	2.2
Average ratio, peat as fired per brake-horsepower hour under boiler to peat as fired per brake-horsepower hour in producer	2.3

In considering the possible increase in efficiency of the steam tests with a compound engine, as compared with the simple engine used, the fact should not be overlooked that a corresponding increase in the efficiency of the producer-gas tests may be brought about under corresponding favorable conditions. Not only is the producer passing through a transitional period, but the gas engine must still be regarded in the same light. In the larger sizes the vertical single-acting engine is being replaced by the horizontal double-acting engine. Other changes and improvements are constantly being made which tend to increase the efficiency of the gas engine, as compounding and tripling the expansions have already increased the efficiency of the steam engine.

As has already been stated, the gas engine used in the tests here reported is of a type that is rapidly becoming obsolete for this size, namely, the vertical, three-cylinder, single-acting.

A brief consideration of these points will lead at once to the conclusions that a comparison of the producer-gas plant and steam plant used in these tests is very favorable to the former, and that any increase in efficiency in the steam tests that might result from using a compound engine can be

offset by the introduction of a gas engine of more modern type and a producer plant designed to handle the special kinds of fuel used.

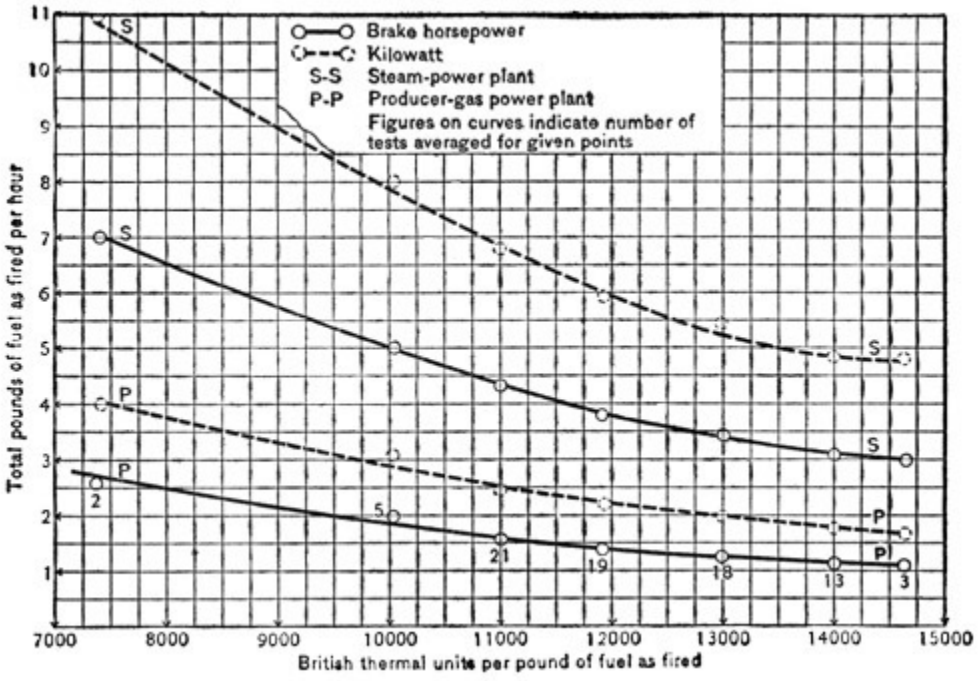


Figure 3.—Comparative service of coals and lignites in gas-producer and steam-boiler plants.

It should be noted that many fuels which give poor results under steam boilers have been used with great ease and efficiency in the gas producer, which thus makes it possible to utilize low-grade coals and lignites that have heretofore been regarded as practically useless. Several of the poorest grades of bituminous coals have shown remarkable efficiency in the gas producer, and lignites and peat have been used with great facility, thus opening the way to the introduction of cheap power into large districts that have thus far been commercially unimportant owing to lack of industrial opportunities. Experiments with “bone,” a refuse product in bituminous-coal mining, have given excellent results, showing an efficiency in the producer equal to that reached by good steam coal under boilers. Recent investigations with other low-grade fuels, such as mine roof slabs, culm, and washery refuse, have also demonstrated the possibility of using such material to advantage in the producer under proper commercial conditions.

Number and Class of Plants.

A list of producer-gas power plants recently secured indicates that at present there are over 500 such plants in operation in the United States, ranging in size from 15 to 6,000 horsepower.

Figure 4.—Summarized data of producer-gas power plants in United States.

	No. of plants.	Horsepower.	
		Total.	Average.
Anthracite coal:			
Over 500 horsepower	8	7,550	950
500 horsepower or less	407	40,550	100
	415	48,100	116
Bituminous coal:			
Over 500 horsepower	20	49,000	2,450
500 horsepower or less	17	5,150	300
	37	54,150	1,460
Lignite:			
Over 500 horsepower	3	7,275	2,430
500 horsepower or less	19	1,725	90
	22	9,000	410
All plants	474	111,250	235

	Horsepower.		Per cent of total number.	Per cent of total horse-power.
	Mini-mum.	Maxi-mum.		
Anthracite coal:				
Over 500 horsepower	600	1,500	…	…
500 horsepower or less	15	500	…	…
	15	1,500	88	43
Bituminous coal:				
Over 500 horsepower	750	6,000	…	…
500 horsepower or less	35	500	…	…
	35	6,000	8	49
Lignite:				
Over 500 horsepower	525	3,750	…	…
500 horsepower or less	25	250	…	…
	25	3,750	4	8
All plants	15	6,000	100	100

Data secured from this list are summarized in the table on the previous page according to the type of fuel used, and separately for all plants above 500 horsepower and for those not exceeding 500 horsepower.

It will be observed from this table that about 88 per cent of the total number of installations in this country are operating on anthracite coal (a few using charcoal or coke), and that bituminous coal and lignite are used in the remaining 12 per cent. Of the total horsepower approximately 57 per cent is derived from bituminous coal and lignite and 43 per cent from anthracite coal, charcoal, and coke. In point of size it will be noted that the bituminous plants average 12½ times the size of the anthracite plants.

In 1906 a large number of these plants were carefully inspected in order to secure definite information from the owners and operators regarding the more or less successful operation of such installations. Similar inspections were made in 1908.

Deductions from Visits of Inspection.

The deductions made from the visits in 1906 were as follows:

1. The plants as a whole are giving remarkable satisfaction considering the very brief period of development that has passed since the introduction of this type of power.

2. The most serious difficulty seems to arise from the lack of competent operators to run the plants rather than from defects or troubles in the plants themselves.

3. Incompetent salesmen are undoubtedly to blame for serious misrepresentations and misunderstandings.

4. The neglect shown by some manufacturers in respect to their plants after they are installed and paid for has not been farsighted, and the failure of the manufacturers to give the purchasers or operators of plants full information regarding their construction and method of operating has certainly been detrimental to the business.

At the present time (1910) the following modifications might be advantageously made to the above statements:

1. Unchanged.

2. This situation still prevails, although there are many more competent operators today than three years ago. Time will eliminate this difficulty.

3. With stronger companies this situation is greatly improved.

4. Experience has shown that such neglect produces serious troubles and financial loss to the manufacturer, and a very decided change for the better has developed in the last few years. There are, however, a few small concerns still operating in the producer field on what may be considered a false basis.

Centralization of Power Development and Distribution.

Central stations for power and lighting are springing up all over the country. Electric lights are now in general use in towns numbering their population by hundreds only. Electric transmission for street-railway service is practically universal and electric power for shop drive is in great demand. The substitution of the electric locomotive for the steam locomotive for terminal service and even for line duty by several leading railway systems is no longer a mere expectation but is an every-day working reality.

These changes and developments in every section are, to a large extent, tending to do away with the individual small steam equipment, whether stationary or locomotive, and are bringing to the front the central power station, ranging in size from lighting and pumping plants of less than 100 horsepower in the smaller towns to those of 100,000 horsepower or more required to meet metropolitan demands.

European Examples of Advantageous Location.

In the development of central power plants and the reduction of the cost of power, the producer-gas power plant is an important factor. In this

connection the question of locating such plants directly at the mines is well worth careful and unbiased attention in the engineering profession. The advantages to be derived from such a location have already attracted the commercial interests of Europe. As examples worthy of thoughtful consideration, the general conditions of operation of three typical European installations are here described:

Plant A.—This plant, although not situated directly at the mines, is but a short distance away, and the company owning the plant also owns the mines from which the fuel is secured. The plant is of the Mond by-product type and consists of eight pressure producers of 2,500 horsepower each. The fuel used is a run-of-mine bituminous coal said to contain 8 to 9 per cent ash and 1 to 2 per cent sulphur. This would indicate that they are utilizing the best grades of coal from their own mine in the local gas plant and allowing the lower grades to remain unmined, a fact which I verified before leaving the plant.

The plant is designed for the recovery of the sulphate of ammonia and for supplying gas to the neighboring towns for both metallurgical and power purposes. As one unit is always held in reserve, the plant is called 16,000 horsepower. The main distributing line is 3 feet in diameter, and at the time of my visit there were 37 miles of main, the longest single run being 6½ miles. Each producer gasifies, on an average, 20 tons of coal per twenty-four hours. The report of the engineer in charge indicates that the plant had been in operation twenty-four hours a day, seven days a week, for two and one-half years without a shut down.

Plant B.—This plant, which is located in the center of a peat bog, proved of especial interest. It has a capacity of 300 horsepower only, and is about 3 miles from the town to which the electric current is supplied. One-half of the plant (150 horsepower) was installed in 1904 and the remainder in 1906. This is probably the first as well as the smallest producer-gas installation to be located at the mine and transmit high-voltage current to a point some distance away. This installation, in 1909, consisted of two suction producers (special peat type) rated at 150 horsepower each, and two horizontal twin single-acting four-cycle gas engines of 150 horsepower each, direct connected to alternating-current three-phase generators, which were running splendidly in parallel at the time of my visit. The 3,000-volt current

is transmitted to the town, where it is used during the day for lighting shops and for shop motors. At night the plant supplies the lights for the streets and residences. The charge for residence light is 9 cents per kilowatt hour. Both units are in operation from 5:30 a. m. to 6 p. m., and one continues to 11 p. m. each day.

A 35-horsepower peat machine is used for preparing the fuel. This is driven by an electric motor supplied with current from the power plant on the bog. As only 750 tons of dry peat are required per year there is no attempt to work the plant to its maximum. Local farmers are employed and they work as little or as much as they please, as there is no difficulty in getting out all the peat needed for a year during the working season, which in this locality is from April 15 to September 1. As a result 14 men are employed more or less of their time. They receive about 50 cents per day each and get out about 20 tons of peat per day.

Coal at this point in Europe costs $3.75 per ton. The dry peat delivered on the operating platform of the producer plant costs only 80 cents per ton.

Plant C.—This plant is installed at the collieries. At the time of my visit it was under full operation, using roof slabs that gave little indication, on casual inspection, of containing any combustible material. It was claimed that this fuel averaged over 60 per cent ash—a claim which seemed entirely reasonable. At the time of this visit (1908) the producers were not only supplying a number of furnaces with gas, but were also operating a 1,000-horsepower and a 250-horsepower gas engine. A 500-horsepower engine was being added to the equipment. The engines in use were direct connected to electric generators. The 10,000-volt current is used for operating the local mine machinery and also for furnishing lights for neighboring towns and power for a street railroad. The plant was reported to be using over 100 tons of this low-grade fuel per day.

Favorable Conditions in the United States.

In the United States cheaper power is constantly sought. The water-power possibilities of the country are being realized and the hydro-electric power plant is a wholesome cause of competition. The supply of fuel of marketable grades is not unlimited. Prices for such fuel must necessarily

increase. The cost of transporting coal from the mines is high, and the possibility of obtaining a sufficient supply of cars to handle low-grade fuels is questionable. The power demands of the country are increasing, and this power must be developed at a reasonable cost. The time is approaching when the cheapest fuel obtainable must be used to the best economic advantage in order to develop power at a unit cost consistent with commercial progress.

Consideration of the conditions indicates that in order to keep the price of power developed from fuel down to a consistent figure—

(a) Grades of fuel which warrant transportation, or which may be defined as “marketable,” should be used with the greatest possible practicable economy.

(b) The very large percentage of coal of so-called low grade which today is left at or in the mine must be utilized.

(c) Advantage must be taken of the large deposits of lignite and peat which are found in many sections of the country.

It is undoubtedly true that in general, under conditions which do not require the use of steam for other than power purposes, the producer-gas power plant meets the requirements of (a).

At present the only method of advantageously handling the fuels mentioned in (b) and (c) is in the gas producer, and the utilization of these lower grades of fuel on an extensive scale demands concentration of the power plants within close proximity to the fuel supply.

The logical conclusion from a careful study of the producer-gas power situation is that the time is not distant when financial interests in power production will be directed toward the centralization of the producer-gas power plant at the mines and the distribution of the energy developed either by high-voltage long-distance electrical transmission or by pipe systems for conveying the gas.

EFFICIENCY IN SHOP OPERATIONS.

BY H. F. STIMPSON.

[Consulting Efficiency Engineer, New York. Published in The Iron Age, Jan. 6, 1910, and reproduced by special arrangement.]

Managers of industrial enterprises will undoubtedly agree that there are few qualities which are more to be desired in equipment, methods and men than that of efficiency. From an extensive study of this subject in various parts of the country, together with interviews and correspondence with several hundred concerns, the writer has become convinced that there is a general lack of definite comprehension of what efficiency is, whence it springs, how it may be measured and developed and the results which its cultivation will produce. The object of this monograph is an endeavor to throw some light upon these things and to afford a new viewpoint from which to study industrial operations.

The Evolution of Industrial Management.

In the first place we must realize that the management of industrial enterprises is in a state of evolution. The tremendous growth of the past few years has caused certain previously satisfactory methods to become inadequate to present needs. Many details which in the days of smaller affairs could be absorbed by personal inspection and mentally stored for use when needed must now, because of their very volume, be made matters of record.

The character of these records has much to do with their value. Because financial records are so ancient they have exerted an undue influence upon the character of all other records. While under our present civilization, the ultimate object of industrial operations is to create financial profits, there are many highly important records which cannot be adequately expressed in terms of money. The business of manufacturing consists of a repetition of

mechanical operations. Mechanical operations necessarily involve considerations of weight, distance, time and effort, but not of money.

The reason for the failure of so many cost systems to serve the desired end is that they are based upon a wrong unit. These systems become useful only beyond a certain point. Other systems have been the result of a blind craving for aid, but being without broad underlying principles and not properly tied together and simply, in many cases, disjointed attempts to improve isolated details, they too have failed. The result is that attempts by specialists to improve industrial conditions have been often looked upon with suspicion and this is not altogether without reason. These very failures, however, have drawn the attention of men in certain lines of engineering to the rapidly developing needs of manufacturers. They have attempted to solve the problems by the use of engineering instead of by accounting methods, and the results which have been attained prove conclusively that a material advance has been made.

What Is Efficiency?

With this understanding of the present conditions, let us consider what efficiency really is. It has been defined as “the ability to produce certain results,” and this at the very outset necessitates the existence or creation of a standard of measurement. Our perception of efficiency, therefore, is correct only in proportion to the precision of the standard, which must be accurately developed from data which are not only exact, but complete. A machinist, believed to be operating at high efficiency, was observed while turning a shaft. His cut, feed and speed seemed to be beyond criticism. When the shaft was finished, however, he had to spend half as much time in hunting up a chain and pad to remove the shaft from the lathe, as he had taken in turning it. This cut his actual efficiency from 100 per cent down to 87 per cent, yet the man was not at fault. His normal work was to operate a lathe and not to hunt for things which should have been provided for him. The points to be observed here are not only the importance of using the right standard of measurement, but that the efficiency of the man depended very largely upon his surrounding conditions over which he had no control. These conditions depend upon the efficiency of the management in securing proper equipment from the owners. This in turn depends upon the efficiency

of the management's records in enabling it to state clearly and accurately what increase in output and consequently in profits will result from improving the conditions—thus justifying the expenditure required. We see from this that the true standard is not the possibility under existing conditions, but that which can be obtained under other and more desirable conditions.

Managerial Opposition to Change.

The management, which immediately controls the records and conditions should be the prime source of efforts towards the increase of efficiency throughout the plant. The opposition of managers to progress in this respect is exceedingly great, yet not altogether surprising for these reasons:

1. There is a widespread fallacy that so-called practical experience in the manual operations or technical processes of a business is the chief essential to success in its management. This is due to the fact that perfection of workmanship, of which he knows much, is more important in the eyes of the artisan than the actual cost of the operation, of which he knows little, or than the cause of this cost, of which he knows less.

2. It is only recently that educational institutions have afforded any opportunity for adequate instruction in the art of management, pure and simple, a principal feature of which is the intelligent regulation of cost.

3. There has been, and now is, as a result of these two things, a failure to appreciate the necessity and value of exact data, in proper terms, of refined and scientific methods of collecting and using it and of logical reasoning in the solution of industrial problems.

The highest degree of efficiency, therefore, is only to be realized in a shop where executive methods have reached a high stage of efficiency, for in these is unquestionably its source.

Time Measurement Important.

The first step is to recognize the necessity and value of a proper measurement of time, as a guide not only to the executive but to the

workman. A man was observed during 8 successive repetitions of the operation of making a machine mold in a foundry. The unit times varied 5.2 to 23.6 minutes, the total time for the eight being 104 minutes. Under the method of timekeeping in use at that shop it was only ascertained that the eight operations took 1¾ hours or an "average" of 13 minutes each, and the labor cost and distribution of burden were made on that basis. Because of the absence of any standard time whatsoever it was not realized that had the man done each of the eight in 5.2 minutes, they would have been completed in 41.6 minutes, resulting in a saving of over 60 per cent of the total time. Had the man received a proper work ticket bearing this standard time, before he began the work, there is no doubt that he could have easily performed the work in the shorter time and a marked difference in proportionate burden and cost would have resulted. Under the existing methods the management could not know of the waste, and so was helpless to prevent or cure it.

Every item of time, therefore, is capable of division into two parts: A standard or necessary time and a (more or less) preventable waste, which latter is the easier thing of the two to determine.

An Example of Increased Efficiency in Riveting.

A gang of four were engaged in riveting some steel plates. By the use of a stop-watch it was found that a large proportion of the total time of the riveter and bucker-up was not utilized; yet some one was always at work. The reason was that the men proceeded along the work in such a way that the bucker-up covered with his body the holes as yet unfilled by rivets, he moving from left to right. When, therefore, a rivet was driven, these two men had to stand aside until another rivet was placed by the rivet passer. Upon the instruction of the engineer, they reversed the direction of their movements so as to cover only the filled holes, thus enabling the passer always to have a rivet ready for them and making their speed in driving the real gauge of the speed of the operation. Furthermore, when they encountered a hole that needed reaming (as was sometimes the case, until the fault was located with the fitters and remedied), the riveter would lay down the gun, pick up the reamer, ream the hole, lay down the reamer, pick up the gun and drive the rivet. When persuaded to test consecutively ten or

more holes after driving the first rivet in a seam to anchor the plates and then to drive the ten consecutively, they progressed faster with less effort. These men, receiving not only a standard from the engineer, but kindly instruction as to how to attain it, and being stimulated, not by abuse, but by a scientifically determined bonus—increased their output over 150 per cent beyond the original amount.

In this plant, by the use of these methods, and in about seven months, the general increase in efficiency of the men was such that the force was reduced 67 per cent without reduction in volume of output, but with a great reduction in net total unit cost, even after paying the bonus alluded to and the cost of the expert services which alone produced this result.

The Use of Bonuses.

It is proper to say a word here on the subject of bonus as a means of increasing efficiency. The principal merit of this motive lies in the fact that immediate personal gain is the strongest incentive to immediate personal effort. It operates just as strongly on the employe as on the employer. Hope of promotion is too vague and the actual chances too limited to exert much pressure, but an extra sum in the pay envelope—or better still, in a separate one—for the disposal of the "old man himself," will do wonders. To be most effectual a bonus must not begin at the point of standard efficiency, but at the point when average efficiency ceases and extra effort begins; and it should increase on a curve faster and faster as the point of standard efficiency is neared, because the accompanying effort will be correspondingly greater.

Efficiency Methods and Department Heads.

So much for the individual operator. And now for the executives. From foreman up to and including the highest official the same methods can and should be applied. Under ordinary circumstances, the workman in need of material, tools or instruction keeps his skirts clear by a more or less indefinite and unintelligible request to the foreman. He thinks it the foreman's duty to look after him, but that if he does not do so it's no business of his. Put that man on standard time and bonus and if there is

anything he thinks the foreman should do or get for him he speaks loudly and directly. This the foreman does not resent—as would ordinarily be the case—for his efficiency is determined by the combined efficiency of his men and upon this his bonus depends. Anything, therefore, that interferes with the progress of the men touches him closely, and he will move heaven and earth to eliminate it. All kinds of defects which were previously hidden from the superintendent are now brought to his attention, and he welcomes them for exactly the same reason that actuated the foreman. Thus the change that comes over a shop when efficiency is accurately measured and adequately rewarded is often astounding.

But this is not all. The possession of exact data as to standard and actual times makes possible a certain great improvement in, and addition to, the executive staff and a material increase in the efficiency of the foreman and department heads. By this is meant the installation of a planning department, by which the apportionment of the time of men and machines is controlled. The advantage, indeed, the positive necessity, of the services of engineers and draughtsmen in apportioning the different parts of the product is well understood. The requirements of each part, the strains to which it will be subjected, the kind, quality and quantity of material required to resist these strains, the shapes of the pieces, their relations to each other and many other things are all given most careful attention. The value of fully constructing the design on paper, as a means of discovering possible errors or difficulties, and of correcting or overcoming them before large expense for material and workmanship has been incurred, are too well realized to need more than a simple statement for their acceptance. No sane executive would expect his department heads to take a copy of his customer’s order and individually work out the details with which they are particularly concerned and expect the parts to fit. Yet this is just exactly what is being done as regards the apportionment of productive time; and a tumult of broken promises of delivery, excessive cost of production, enormous wastes of time in changing jobs, etc., is the immediate and unavoidable result.

What Can Be Done.

It is perfectly possible, but only to one trained in the particular art, to schedule the different operations on all of the different parts of the product;

to plot the productive times required, so that each may begin at such a time in relation to the others that all will arrive at the point of assembly at the proper time and in the proper sequence; to combine these studies of the different productive orders on a chart which will show the disposition to be made of all the men and machinery; to prepare advance programs for each man and machine engaged in productive labor; and thus to give to the superintendent and foremen the advantage of the same predisposition of time that they now have of material.

As it is now, the time of these persons is entirely too much occupied with this problem of the disposition of time for which they are only partly equipped, having, it is true, much of the necessary information, but no training in the scientific handling of it. They are, therefore, unable to devote the time they should to the immediate study of the operations and the provision of tools, material and instruction to the men. They try to be all over the shop at once and they depend on getting their information at first hand, and consequently fail more or less clearly to cover the ground. Having such schedules and programs as are above described, and with the proper work tickets distributed on a dispatching board, each one in the division representing the work upon which a man or machine is engaged, having the time of commencement and the standard time thereon, the foreman can see at a glance without leaving his office what men will shortly finish their work and what steps must be taken to see that the drawings, tools and materials for their next work are ready for them in time. Having seen to this he has some leisure to give his attention to matters immediately requiring it, knowing, if anything is obstructing the other men, that their anxiety to earn their bonus will cause them promptly to bring such matters to his attention. Having this schedule, moreover, the foremen are enabled to order material, etc., ahead and to do so intelligently, thus making the work of the shop transportation department much simpler. In one case by this means 25 men were able to handle the intra-shop transportation in a more satisfactory manner than 75 men had previously been able to do.

The planning department also greatly aids and is in turn aided by the purchasing department, for the times when material must or can be got can intelligently be determined to their mutual advantage. The sales department, too, when it once gets the idea that the shop is not working miracles, but has its limitations, can make delivery promises which really mean something

and can be kept, and this is a trump card of no small importance when the fact becomes realized among the customers of the concern.

Responsibility of the Management.

In the opinion of those whose opportunities have enabled them to get at the facts, the inefficiency in manufacturing, which undoubtedly generally exists today, in spite of the prevailing impression to the contrary, is only about one-fourth due to the things over which the employes have control and three-fourths to conditions imposed upon them by the management. The methods outlined above have achieved results whenever they have been faithfully and honestly tried, with proper co-operation by the management and under the direction of skilled specialists, and the results have continued and will continue as long as the methods are followed. The effect upon the men is that from being often listless, indifferent and antagonistic, they become energetic, ambitious and loyal friends.

One thing more: Much has been done and overdone in the line of so-called welfare work. It is a highly creditable and necessary line of effort, when confined to attempts to remove from the path of the employe any obstacle which prevents him from developing his skill and efficiency to the highest degree. An uncomfortable, unhappy person cannot be efficient. But as steam is necessary to the engine, so is incentive necessary to the worker to get him to make the best use of the facilities provided for him. Under our present civilization, the same incentive which pushes on the master will push on the man, and that is direct personal gain in dollars and cents, not for itself, but for and what that gain will bring. It must come to him quickly after the exertion which its expectation calls forth, for if long delayed, the effect is lost. It must also come to him separately from his regular wage that its amount may be the more readily realized.

Moreover, the results of efficiency methods, within the writer’s knowledge, are sufficient to convince him that their general adoption would so increase the purchasing power of the employe, by increasing his wages and decreasing the cost production, as to have a markedly beneficial and steadying effect upon the business of the country.

Efficiency methods, however, cannot be successfully designed or installed by those trained in other lines and prejudiced by other associations. After these methods have been scientifically developed to suit the existing conditions and actually put into operation by those skilled in the art, they may gradually be relinquished into the control of those who have been educated in the process of installation, with some hope of success for their future operation.

THE BRIDGE BETWEEN LABOR AND CAPITAL.

BY JOHN MITCHELL.

[Former President United Mine Workers of America.]

If the interests of labor and capital were identical—as some contend—there would be no chasm between them to bridge; and if the interests of labor and capital were irreconcilable—as others contend—any effort to unite them would be futile. From an experience extending over a considerable period, I am quite convinced that neither of the foregoing propositions will stand the test of close analysis. My judgment is that the interests of labor and capital, though divergent in some respects, are nevertheless reciprocal and inter-dependent.

To elucidate in a practical way the subject of the proper relationship between employer and employe, it is necessary to review the activities of these two factors in the field in which their interests are common and to mark the point at which they diverge. The employer and the employe are mutually interested in the successful conduct of industry; the profits of the one and the wages of the other obviously are contingent upon it, as both profits and wages must be paid from the earnings of the enterprise in which the capital of the one and the labor of the other are jointly invested. This being true, the workman and the employer are equally concerned in the character of the product which is manufactured and sold by them, just as they are interested equally in good markets and regularity of employment. Having worked in co-operation up to the point of turning out an article that commands a wide and profitable sale, the question of dividing the earnings of their joint efforts presents itself. It is the failure of the attempt to adjust satisfactorily this controversy that gives rise to the differences between employers and workmen and is the basis of the labor problem as we have it today. True, there are many questions of discord apart from those of wages and profits, which result in serious industrial conflicts, but followed back to their source, it will be found that these issues are inseparably related to

those of wages and profits. In other words, the demand for a shorter workday, for healthful, sanitary surroundings, has its origin in the irrepressible desire of the working people for a progressive improvement in their conditions of life and labor.

In ancient and mediaeval times when the structure of society was simple and each family consumed all the things it produced; or even at a later period when the master and the journeyman worked together side by side, and when the master had been a journeyman and the journeyman expected to become a master, there was little cause for controversy, and the problem of labor was not difficult of solution. It was not until the invention of machinery, the advent of the factory system, the use of steam, and the application of new processes that the question of the relationship of employer and employed grew so complex and impersonal that new methods became necessary in the proper adjustment of industrial affairs. As step by step industry developed from the stage of the privately owned factory to the firm and corporation, to the combination and the trust, the real employer was removed further and ever further from personal contact with his employes. As a consequence of this transition, the salaried manager took the place once held by the actual employer, and the simple and friendly relations of early days gave way to the intricate and complex industrial life of this generation.

Coincident with the development of industry which has revolutionized the whole life and history of our people and our civilization, have come the local, the district, the national, and finally the international organizations of labor. These gigantic associations and federations of workmen are the logical and the inevitable consequence of an industrial development which threatened the subjugation of the individual workman and forced him, in self-defense, to merge his interests and his identity with those of his fellow workmen. The momentous change in the status of the workman which accompanied the revolution of industrial processes, transformed the whole problem of labor from the question of production to that of distribution, and it is the effort to find an equitable adjustment of the problem of distribution that is taxing to the utmost the ingenuity of economists, philosophers, and statesmen.

In the search for a panacea to heal the industrial ills against which society so justly complains, many suggestions are made and innumerable remedies proposed. On the one hand are found forces that would deny to labor the right of organization and combination, although exercising and enjoying the benefit of these rights themselves; on the other hand are forces at work advocating and demanding the abolition of the whole competitive system; between these extremes stands a great army of workmen and employers earnestly striving to find grounds of mutual agreement upon which the rights and obligations of each may be defined and brought into harmony. With all due respect to the opinions of others, I submit that the path of safety, progress, and justice lies in the middle course—in the recognition of the right of organization on the part of both labor and capital, by which and through which these factors in our industrial progress may work out their inevitable destiny, contracting freely each with the other upon all questions of mutual concern.

The trade agreement is the bridge between labor and capital. It restores, so far as it is possible to do so, the personal relationship, the mutual interest which existed prior to the advent of the factory system. It is an acknowledgment of the inter-dependence of labor and capital, a recognition of the reciprocal interest of employer and employe. When the right of organization among workmen and employers is fully recognized and freely conceded, and when these forces adopt and practice the policy of collective bargaining, the day of the strike and the lockout, of the boycott and the blacklist, with their attendant evils, losses, and hardships, will have largely passed away.

THE UNEMPLOYED.

BY JOHN BASCOM, D. D., LL. D.

[Formerly President University of Wisconsin.]

A striking feature of the industrial world and one well fitted to occasion alarm is the large number of persons thrown, from time to time, out of employment. We are forced by it to accept one or other of two conclusions; that the economic world is mismade, incapable of a quiet and successful run, or that our handling of it has been in some way unskillful and misapplied. This fact of unemployment has become very conspicuous, and to those who suffer from it, and to those who sympathize with them, exceedingly grevious. A certain portion of the human family, and that in the most progressive nations, find themselves superfluous, out of connection with the means of living though others are obtaining support, comfort and luxury. They have nothing to do but to die in their tracks. Like the feeble ones in a forced march through an enemy's country they first fall behind and then perish. This state of the case does not arise by accident and then pass away, it has periods of severity which frequently return, and stands among those constant dangers which may at any time overtake a few. This evil comes especially to industrious countries, like England, and to portions of our own country, like Pittsburg, noted for their enlarged production. The causes and remedies of this state of things become, therefore, subjects of anxious inquiry. We may assert that the want of employment is due in a general way, to the deficiencies and vices of men, but this assertion does not sufficiently point out the immediate occasion of the difficulty, nor furnish us its remedies.

Failure of the means of livelihood arises from indolence, ignorance, vice and unfavorable conditions on the part of those who suffer from it, conditions often of the nature of accident. But while the recipients of this disaster are plainly recognized, the disaster itself comes to them in a measure independent of their failures. We need to know not only those who

are likely to suffer from a given disease, but how the disease itself arises. The central and most productive cause in this series of provocations is indolence; the others accompany indolence and more or less arise from it. By indolence we mean a want of life and hence a weakness of all the functions of life. We may mean physical inactivity or intellectual sluggishness or moral indifference, or may mean them all blended in one or other of the various ways in which a weak and perverted life manifests itself. The tramp is physically indolent, he hates work. This indolence readily extends to intellectual activity; the indolent person is ignorant of the value of success, of its motives and of its means. The world reveals few incentives to him and makes few appeals. This indolence and ignorance do not wholly arrest the wants and desires of men, and hence vice, as in the case of the thief, enters as the most ready and immediate means of gratification. The torpid nature of the moral judgment lends itself to this result, and nothing but fear, itself weak and vacillating, stands between the indolent man and habits of gross indulgence, inconsistent with personal and with social welfare.

The accidents, misjudgments and disappointments which are liable to overtake us all owe the injury which they inflict to the weak personality on which they fall, and so misfortune seems to follow and persecute those who are least able to bear it. The indolent, passive mood is a good medium for the accumulation and transfer of every form of disaster. The class of the helpless is much enlarged by this flow of every form of evil to these low places in conduct and character.

We may clearly recognize these facts and suppose them a sufficient explanation of the farther fact, that so many are thrown out of employment and find themselves the waifs of society with no secure attachment to it. They do, indeed, make conspicuous the failure of occupation and determine the direction it will take. Their numbers are seriously increased by it, and their very presence gives the conditions of its recurrence. They are both causes and effects. They stand on terms of action and reaction with all the embarrassments of production. They help to reduce wages, and when wages are reduced, they are the first to be driven out of employment. They are the symptoms of the disease, the product of the disease and the means by which it is carried farther. All failures in the productive process extend, in their worst results, to this class of defectives. They are the recipients of past

evils, of present and of coming evils. They arise in connection with a false form of production, must be treated with it and removed with it. They are a composite product, their faults not being wholly their own but in part the faults of the economic system with which they are associated. They are not the scapegoat on whose head the sins of the people may be laid and then be borne into the wilderness.

In discussing the causes and remedies of unemployment, we shall see how far and in what way these feeblest workers are involved in it. We cannot improve society by simply striking off the evils that have been developed under it. Healthy growth alone can rid itself of failures. It often happens in physical disease that what is accepted as a remedy in the end aggravates the difficulty.

One dislikes to use the word pauper, it so frequently carries with it an unreasonable and cruel contempt. Yet there are paupers in the human household, and when the temper is once present it is most difficult of removal. It is a form of leprosy that eats out all vital power. The pauper temper indicates a disposition to secure immediate ease with no reference to the comfort of others. It accepts any advantage that offers without the slightest wish to return it. Yet even this spirit may offer some excuses for itself. The evils of society which may have originated far off in the action of the leaders of men, are apt to go booming downward till they reach, in their most distinctive form, the pauper class, or those but little above it. Diligence, thrift, skill, ward off the blow and escape with only a partial loss. Those who are always in the way of it are the weak ones, to whom prosperity brings but little and adversity occasions immediate overthrow. When those who at best are but partially occupied, find that labor is altogether failing them, the question of relief becomes most difficult. There is no profitable labor at disposal, and to provide labor means farther loss; it is charity in its most disguised, expensive and unrequited form. The worst lesson we can teach those already inclined to negligence is that a form of labor may be put in the place of real labor, and that the question of adequacy is one to be answered by society, not by the needy, recipient of favor. Whatever we may do for men of feeble productive power we are not to lead them still farther on in the direction of indolence and worthlessness. Actions are not to be separated from their normal results. We may frequently be called on to bear the injury which proceeds from another

man’s wrongs, but we are never called on to disguise the wrong itself. A portion of the wrong is our own; that we should correct. While the evils are in the process of infliction we are to bear them sympathetically, but not in a form which disguises their true character.

Something of the same danger inheres in old-age pensions. Workmen of usual diligence should receive a return for their labor which would enable them to provide for age. As long as workmen, reaching the age of three score, generally become dependent on the public, it is perfectly plain that their wages are too low, that the returns of production are not fairly distributed. A pension acknowledges the evil, but does not remove it, it tends rather to confirm it. That the losses which accompany industrial accidents should be divided between workmen, managers and the community at large is plainly just, and is no temptation to remissness. The accident is not the fault of any one person or class of persons. If it falls upon a large number, it is more readily borne and increases the motives to care. Our machinery is operated for the benefit of the entire community, and it is only fair that the entire community should help to bear the increased dangers. That injuries should be still left with the workmen on whom they have accidentally fallen is another proof of the slight hold they have on the public mind.

Any remedy for the lack of employment which is prompted simply by compassion and still leaves the evil to overtake the workman is not social hygiene; is not a recognition of the partiality and disproportion which still inhere in our productive methods. Labor should be successful and rewardful when left to its own development. It is bad to create a pauper temper and most difficult to contend with it when it has once been called out. Men should be subject to their own incentives of hope and fear, success and failure, as far as possible. The same discipline which comes to the active, is the natural spring of action in the sluggish. Any compassion which reduces the motives of effort that should come to the entire community, or which leaves the community satisfied with a maladjustment of duties, can never provide an adequate correction of bad distribution. We are placed between a narrow and a wide humanity, between an immediate reduction of suffering and a removing of its conditions. The final result is the test of our wisdom and good will.

There are partial remedies of the failure of employment which are fitted to give relief without endangering the future or disturbing the general conditions of employment. Occupations especially irregular, like that of the stevedore, may receive especial attention, or may be united to other forms of labor so as to secure greater uniformity. In these occupations the employer may frequently have but little motive to correct an evil from which he prospers by reduced wages. Excess and deficiency in the various branches of work should be made, as far as possible, to correct each other. Workmen are often not in a position to meet successfully these evils. They accept the drift of the labor market with small power to control it.

Bureaus of intelligence should be established so that the variable demands for labor of different localities may be quickly met. This is a public service, and should have the ease and certainty of such service. The same reasons which lead the Government to take the direction of immigrants should lead it to render similar aid to workmen. Workmen are often ignorant of the extent and character of the employment offered in the distance, and are subject to the exactions which arise in connection with this want of knowledge. The greater one's want the more difficult is the change of locality. Quickness of response demands both intelligence and nobility.

Savings banks and insurance, while not directly affecting the demand for labor, tend to equalize and reduce the losses which accompany variability. They also tend strongly to call out that forecast of evil and preparation for it which belong to thoughtfulness. The strokes of fortune lose something of their unexpected and injurious character, and men are put on voluntary and better terms with the world.

We are not, however, to look on these reductions of danger as covering the whole problem. Life has its accidents and we can greatly reduce the evil results of them by patience and prudence, but there still remains the more thoroughgoing effort by which the evil is anticipated and turned aside.

There should be that general harmony of effort, that proportion of its several parts to each other, that recognition of the common welfare, which fortify us against disaster, and force it in the background when it comes. There is a wise method in production, and a just relation of its agents to each other, which should greatly reduce the liability of a want of labor, and

should ultimately remove it altogether. A true democracy should be exempt from this general failure in the results of activity. Much of our political economy has rested on inferences drawn from a faulty state of society, as if it and the conclusions contained in it expressed the real laws of our being. Society, in its most civilized forms, has always developed a proletariat, it has suffered drainage, and we have come to think this a sort of necessity, a natural result of social growth. With this starting point and expectation we are ready for periods of unemployment, and look at the misery which arises from them as a corrective. Superfluous lives cannot be gotten rid of on cheaper terms. We might as well suppose that disease is an inevitable attachment of physical life and must be left to go with it. Society never has too many workers, and when they are not wanted it is because they have been in some way misdirected. Strong men, industrious and intelligent men, are the wealth of society. There is never a time in which there is little or nothing to do in the world; if we think so it is because we cannot see, or see falsely. Our intelligence determines what is to be done and our diligence performs it. The world is never deficient in occasions for labor, no matter how defective we may be in performing it. Nor is well-devised labor wanting in its returns; intelligence and diligence, in full exercise, always contradict the notion. The world could not be the home of man on any other terms. Human life begins to be superfluous the moment labor miscarries, and the miscarriage sinks down to those who have the least intelligence and industry. The constitutional disease of society, that which it has propagated with most show of knowledge, is ignorance and indolence. When we reach this stratum we are always in difficulty; the more in difficulty because we come to it in a sluggish rather than in a corrective temper.

Incident to indolence and ignorance are those vices of temper by which we wish to reach results without labor, or to reach them by the labor of others rather than by our own labor. As long as these vices are prevalent among men, whether in the upper or the lower strata of society, or, as is sure to be the case, in both, periods of arrest will come. Men will be baffled in their narrow aims, and will have no broader, more generous ones to put in their place. For a time they will lie idle till the customary impulses revive and once more set them in action. Industrial inactivity is like a financial panic. It is the result of the transient suspension of habitual feelings, and does not relax till men return to their usual frame of mind. These distrustful and

apprehensive periods are liable to return as long as men are not pursuing sound purposes in a sober way. Any deficiency in fairness, integrity and mutual confidence divides society against itself, and renders a portion of its efforts futile. This is the more true as the division and subdivision of labor increases, and the final adjustment of returns is made by complicated exchanges. When a portion of the community finds its share of good things much reduced, when in the distribution of the rewards of labor, custom or cunning or force has robbed them of a reasonable portion, the motives of labor are greatly lessened, the means of exchange are lessened and the sense of unity and integrity of society is lost. There is in civilized society a large body of just and honest production which goes far to sustain the mind in renewed effort, and keep firm the ties which bind men together. Yet the element of distrust, as in a financial crisis, extends through the community and weakens the points of life.

The first condition of social, economic strength is that all the members of society shall find suitable occupation and by means of it become the givers and receivers of aid. This plain, simple fact has been much obscured by accepting competition, often in an unethical and unsocial form, as the general law of economic activity. This law it is not; and it needs at all times to be held in check by ethical impulses and by the welfare of the community. It is this welfare which is the supreme law. Labor owes much of its degradation to a rigid and unreasonable application of competition. As we go down in the scale of occupations, and in efficiency in those occupations, the greater is the injustice and injury that attend on competition till we reach a point at which large numbers are pressed by it to the very verge of life. Then comes in that mischievous generalization which tends to make human degradation a permanent product of nature. The increase of human life is said to be geometrical, the increase of the means of life arithmetical, and so the two tendencies grind eternally against each other. Our best sympathy is expressed in letting this collision come to the quickest, shortest results. Some of this crushing process obtains between ill-trained and sluggish, well-trained and active men. Let it have way.

Yet the agricultural products of the world have not only never given out, they have never been brought near a maximum. Food, raiment and shelter are most varied in kind and abundant in quantity where men are most numerous. The Algonquin Indian wandered in the forest in the winter, unfed

and unsheltered. The foundation of his trouble was his indolence and ignorance. The inhabitants of India may perish by famine in large numbers. The distress arises not from the fact that the people have outstripped the productive power of the world, but because they have outstripped their wisdom in handling those powers.

Let men covet wealth, and at the same time use narrowly and competitively the means of attaining it, and the two strata of society, upper and lower, will shape between them a human life in which want will stand over against luxury, hatred over against contempt, and the two classes, oppressed by spiritual destitution and physical poverty, will wage with each a variable and hopeless warfare such as wisdom and good will can alone leave behind us.

A first remedy for unemployment is to make employment remunerative; so remunerative that the workman shall be the buyer of many things as well as the seller of one thing. When his single sale of labor stands in equipoise over against his many purchases, we shall have buyers as well as sellers and our production and traffic will never cease. We have in trade-unions a first step in the adjustment of exchange. Workmen strive to escape the competition of the incompetent and shiftless, to redirect distribution in ways more just and equal, and by this means to be able to play their own part in economic life more advantageously for themselves and for all. This effort is new in its breadth of application, but has never been new with the wise and thrifty. Personal skill and professional attainments have always lifted themselves above the storm-swept plain of competition, and gathered about themselves a prosperity and comfort resting on special and superior exertion. So long as we subject ourselves to the fortunes of the indolent and set up our standards of life at the very foot of the slope, we shall have a competition like that of the Chinese to contend with. We shall march so near the verge of the precipice that many will be pushed over it, and the least flurry will be disastrous. A sufficient return for diligence is the first claim and the safety of labor; it enhances its motives and fortifies it in the possession of what it holds.

With paucity of pay on the one side goes the superabundance of profits on the other side. The returns of management should be more moderate, more uniform, more consonant with the general welfare. We can hardly doubt

that an industrial community, well-organized, with a fair share of intelligence, diligence and honesty, will commend reasonable prosperity extending to all its members. Indeed this is what actually takes place in the midway forms of effort. The very poor and the very rich complement each other. Healthy and wholesome activity is as possible to the community as to the individual. The chief difference lies in the increased complexity of communal action and the ease with which results are misunderstood and misinterpreted. The instinctive and voluntary life of the individual is replaced in the community by divided counsels. Men shape opinion and interpret results in view of their own interests rather than in view of the public welfare. The public welfare is as much within the scope of human thought, when attention is directed to it, as is individual well-being. Indeed the universal and stable prosperity of economic society is as much dependent on the diligence and sobriety of its members as is individual welfare on well-ordered labor. The qualities which enhance success in the one direction are much the same as those which cause it in the other direction. Extreme and intemperate action work the same mischief in the one field as in the other. Society is sufficient unto itself when its purposes and methods are truly social. A sudden suspension of labor, a large number out of employment, are the result of disturbing causes which have found their way into the ordinary processes of production. These causes are an unreasonable accumulation of power in single hands, speculative ventures and a social philosophy which holds in light esteem the immediate interests of the mass of the community. I have in mind a peculiar manufacture which had provided the needed buildings, and surrounded itself with the homes and help called for. There came a combination of those engaged in this industry. The works, comparatively new, were discontinued. Production sought a new center and the old community was left to suffer the loss of slow dispersion.

We are protected against theft and criminal violence, but we are not protected against the unprovoked losses which come to us from the speculative aims of the adventuresome capitalist, though these losses may greatly exceed those of robbery. The stability of labor and the returns of labor are often affected in the great centers of production by opportunities, fanciful or real, which offer themselves to a few of achieving large wealth; opportunities not so much of creating wealth as of raking it together. The

mass of men do not so much as conceive that they have any ground of complaint of operations which sweep out from under them the supports of well-devised industry. Wealth which in its making and use tends to break up the ordinary methods of industry, to throw off the minds of men from the familiar reconciliations of industry and, above all, to weaken the sense of responsibility which lies between labor and capital, must, from time to time, issue in industrial disaster to the confusion and loss of labor. Do the best we may and we cannot anticipate every disturbance, but we are inexcusable for overlooking the disasters we bring upon others who are working with us. Much of what is called enterprise renders those engaged in it almost wholly negligent of the incidental injuries which fall to those about them. The equilibrium of labor is dependent on the equilibrium of productive enterprises, and when these accept no restraints the disturbance will reappear here and there in the productive world very much at random. Labor presses at one point and is relaxed at another, subject to the speculative schemes of capital. Extreme wealth in the hands of a few lacks the economic and social and moral motives which make it a calculable and reliable means in the hands of many. When it is in the process of accumulation it is lawless; when it is accumulated it sinks into indolence.

While some gains are pretty sure to accompany the acquisition of great wealth, once acquired, it disturbs the even flow of economic forces, and may easily give rise to irregular occupation that brings serious disturbance to those whose daily wants are to be supplied by labor. It may be thought that these fluctuations in production arise from its very nature, and that if we leave men of very different degrees of intelligence to contend with each other for the prizes of industry, great inequalities of prosperity are sure to appear. We can escape them only by forcing back enterprise and making the moderate, medium men the standards of achievement. This presentation seems plausible, and will always be urged by those who are willing or eager to take large risks. Men of large productive power are easily stimulated, and their resources are kept, in reference to the community at large, in the most fruitful form when they are compelled to moderate their efforts, and are not left to the extreme and eccentric ways normal to them. The community is interested in habitual lines of industry more than in those which disturb the minds by sudden profits which cannot be emulated or repeated. Men will separate themselves from their fellows in the rivalries of production. Only

thus is the power of intelligence fully disclosed, yet the ordinary arrangements of society, its privileges and opportunities, should be made as equal as possible; no unfair advantage should be given to one or another form of production; nor methods be allowed to the successful in achieving wealth which are not admissible in the community at large. The laws of the game should be wisely framed and firmly preserved. It is the able and ambitious who bring the most strain to safe restrictions, and for whom they are chiefly made. Equality of opportunity is the cardinal principle, and cannot be sacrificed in favor of enterprise. The enterprise that is wholesome keeps within this law. It may also be thought that this rigid restraint would deprive the community of some of the most prevalent means of welfare as well as of some of the most illustrious agents in prosperity, and that those great and efficient combinations which we have come to designate as trusts would be lost to us; that as the result of this loss we should quickly settle down into a sluggish routine, mediocre ideas ruling the public mind, and so miss that very prosperity of which we are in search. Industrial corporations are most efficient agents in wealth-making. We cannot for a moment think of throwing any real obstacle in the way of their formation. But while we need their aid, we should also remember the evils which are liable to come with them. They are the creatures of law, and the law in giving birth to them should assign them the form and restrictions which are most consistent with the public welfare. They are not to be allowed to fall into speculative hands, an instrument of unrestrained power.

Industrial corporations afford ready means by which small capital and moderate men are compacted into a service quite beyond the range of individual producers. The difficulty has been that much dishonesty has entered into the formation of corporations, and that unreasonable power has been exercised by those who have had them in charge. The responsibility of a corporation to the community, expressed in a sound financial organization and in the relation of its officers to its stockholders, would in no way restrain the usefulness of these industrial agencies, and would make them wholly consistent with extended and equal opportunities in production. Immense wealth has often been acquired in connection with corporations whose usefulness to the public has been thereby restricted and the profits of stockholders disregarded. Nowhere is the eagerness of personal enterprise so tempted, nowhere does it display itself more disadvantageously than in

the large and oftentimes obscure undertakings of corporations. It is not in reduction of these agencies, but in behalf of their safe and profitable use, that the claim arises for uniform and well-regulated action. In large corporations, as in insurance companies, when the business itself has fallen into routine, extravagant salaries have been resorted to as a means of increasing the returns of officers. Oftentimes the plea for raising salaries is one which is self-propagating. Expenses have been greatly enlarged and the remuneration must keep pace with them. Yes, but will not this very increase lead to increased expenditure? Industrial corporations have been, in the present generation, a conspicuous means of production, but they have also conspicuously promoted a bad distribution of wealth, and so helped to promote irregularity and ultimate suspension in the productive process. There may never come a time in which the adventuresome capitalist will not magnify his own usefulness to the community, but there may come a time in which men shall see that the wealth of a few may be purchased at the expense of that general comfort which is the proper return of industry.

A possible rapidity in the acquisition of wealth inflames the speculative temper. We mean by the speculative temper, purchase and sale, not in reference to production but with the hope of making large profits independently of production. Speculation is an expression of a venturesome spirit which, in its impatience, lays light emphasis on the usually slow methods of increase, and promises itself a rapid road to success. This hope is often disappointed, and when disappointed carries with it a more or less extended retardation of business. When the annual losses by bankruptcy in the United States reach $200,000,000, the distress of those whose means of livelihood have been involved in this overthrow must become a very sensible factor. Such a sum would, in its successful use, provide for many households.

The temper which goes with sanguine and unscrupulous methods is a careless, and often a cruel, one. The democratic notion of equality is overridden, is pushed aside as of no significance in the business world. The same persons who insist on an open shop, and give free play to competition when it depresses labor, regarding it as a familiar and convenient principle in determining wages, may combine with each other to control products and enhance profits. The general welfare, which is the controlling idea, is lost sight of or readily forgotten. They have one standard when they look out on

the community at large, and another standard when they are preparing the way to make and hold fast their own gains. The directors of business come easily to think that the welfare of the community is identical with their own welfare, and that the enterprise with which they sustain their own affairs is identical with that on which the public prosperity depends. They readily come to the conclusion that their activity, so essential to the community, should be cherished by the community. How possibly can production progress without them. Discrimination in their favor is a short cut to the common prosperity. Men of comfortable means and the poor even owe what they have to the enterprise which scatters wealth everywhere. There is sufficient truth in this feeling, when not too boldly put, to hide its failures. The expenditures of the very rich in the purchases and exchanges they involve do carry a measure of advantage to all, but they also bear with them an unjust distribution, a luxury and a poverty, which weaken the unity and sap the strength of society. It is the very gist of democracy that each man shall count one; that in spite of the diversities and the advantages among men they shall still remain units of the same value in the freedom and propagating power by which the gains of the race are stored. It is neither identity nor arbitrary difference that is admissible, but every man and every class of men carry with them the potentialities, the social and spiritual possibilities, which are the germs of historic development. This is the principle with which all petty social distinctions and all civic tyrannies have been at war.

While, therefore, the evil of monopolies may appear in various forms and be met in different ways, they cannot be permanently removed except by social conditions which equalize opportunities and compel wealth and power, in all their activity, to conform to general safety. Production in all its forms and in all its agents must be subject to that temper of fairness, and come under those principles of equal rights, which bind the parts of the community together, and make them one producing and one enjoying agency. Every assertion of settled superiority in persons, classes and races must be set aside, and the world in its physical, intellectual and spiritual wealth be left open to all. Thus history has treated men, and is more and more treating them, in their claims to consideration. This birthright of men is not to be denied or stolen; for they who steal it have nothing more than this same birthright to plead in extenuation, the combinations which look to

the defense and extension of these original gifts are in order, and all combinations which carry them beyond the bounds of their own territory are another outbreak of anarchy.

The soundness of this assertion has been recently exemplified in the history of Pittsburg. Pittsburg is the center of an industry which has come, perhaps more than any other, under the domination of a few leading men. In the Homestead strike they succeeded in dealing a heavy blow to workmen in their efforts to secure something like a fair hold on production. A little inquiry into a community built up for a few and ordered by them discloses conditions quite at war with general well-being. Wages are kept down by the constant presence of the unemployed: the accidents of a dangerous occupation are left to fall upon workmen; the health of the community suffers great neglect, the remonstrances of workmen are met with the response, If they do not like the method let them quit; and the general good order and comfort of citizens receive but little attention. Here is an object lesson in which work, sure, skilful and unflinching; wealth, eager, unscrupulous and unsympathetic, have divided the world between them; no right gained, no power lost. Men may make wealth under these conditions, withdrawing it from the fitting returns of labor, but they cannot, wise as they may be or generous as they may seem to be, restore that wealth to the community in a form in which it will subserve the same living purpose it might have subserved if it had never been withdrawn. The life of a community is achieved where its activity is most intense and constant. Failing in our service at these vital centers, no extraneous effort will cover our fault. We might as well draw sap from a tree and then pour it out on its roots.

We have now given three constitutional remedies for the want of employment. The first is a more equal distribution of the rewards of production, thus making the demand for products as extended and uniform as their production. The second is increased restraints, especially in connection with corporations, in the action of the leaders of industry, rendering them more amenable to the wants of the community to which they belong. The third, arising from the other two and supporting them, is more unity, more harmony between the several agents of production.

There was a report not long since in England of an industrial commission, which had given protracted attention to the irregular demand for labor. The remedies offered were chiefly palliative. It may be thought that this form of cure is all within our reach; that what is here offered as constitutional correctives are beyond our power. There is some truth in the feeling, and would be much truth in it, were not the actions and the sentiments now enforced under urgent consideration for reasons of public welfare, not directly involved in unemployment. We cannot expect to remove so grave an evil as this, the wavering demand for labor, short of some important change in the organization of society. Society is a structure of so many and such delicate dependencies that its perfect action must include the general integrity of the current relations between men. Unwholesome results of frequent recurrence are the most direct proof of an unsound system. Palliatives may soften the evil but cannot overcome it. We should aim immediately to reduce the difficulty and ultimately to remove its causes.

QUESTIONS IN BUSINESS ADMINISTRATION.

BUSINESS ECONOMICS.

The Modern Industrial System.

1. Describe the three-field system of agriculture. Page 2.
2. What were the significant characteristics of a manorial society? Page 2.
3. What is said to justify the institution of private property? Page 4.
4. What is competition in modern industrial life? Page 4.
5. Why has the name “capitalistic production” been applied to modern industry? Page 6.
6. Compare the domestic system of industry with the factory system. Page 7.
7. What are the fundamental conditions of our economic life? Page 8.

The Agricultural Resources of the United States.

1. What has been the policy of the Government in its disposition of the public domain? Illustrate. Page 9.
2. What has been the unique and characteristic feature of the land policy of the United States? Page 9.
3. What has been the result of the land policy of the United States? Page 10.
4. What was the first effort toward the solution of farming in the arid soils of the West? Page 10.
5. Explain what is meant by dry-farming. Page 11.
6. How do the farms of the United States compare in size with those of European countries? To what is this difference due? Page 11.
7. What does the movement of the population from the farm to the city indicate? Page 13.
8. What change in method is agriculture undergoing in the United States? Give the reason for this change. Page 14.
9. Discuss the cereal production of the United States. Page 15.
10. Upon what question does the future of the cotton production depend? Page 17.
11. What movement is now put forth to aid in the preservation of our forests? Page 18.

The Mineral Resources of the United States.

1. Into what groups may the natural resources of a country be divided? Illustrate. Page 19.
2. What two answers are given to the problem of the conservation of a Page 20.

limited supply of resources?

3. What steps have been taken towards stopping the devastation of our resources? Page 21.
4. What estimates are given as to the amount of coal in the United States and as to how long this supply will last? Page 22.
5. What is the most favorable situation for iron deposits? State reasons. Page 24.
6. Where is the most wonderful iron-mining region in the United States? What makes it such a remarkable region? Page 24.
7. Of what importance are the precious metals? What is the practical problem confronting American gold-mining companies at present? Page 25.
8. To what use was copper put in Homeric times? What has caused it to rise to the front rank in recent years? Page 26.
9. How does the present-day application of water power to machinery differ from its application prior to 1890? Page 28.

Capitalistic Production.

1. What five causes does the census report give for the rapid industrial development in the United States? Page 30.
2. Give Carroll D. Wright's definition of a factory. Page 31.
3. Illustrate the two meanings which "division of labor" may indicate. Page 32.
4. Show how the subdivision of labor brings about the extension of labor-saving machinery. Page 33.
5. Name the economies of a large-scale production. Page 36.
6. What improvements have made large-scale production possible? Page 36.
7. In what lines of business is there little or no development toward large-scale methods? State the reasons. Page 37.
8. What is meant by standardization? What are the advantages of such a system? Page 38.

Trusts and Monopolies.

1. Enumerate the phases through which combinations for the purpose of fixing prices, have passed. Page 40.
2. What is the advantage of the corporation? Page 41.
3. Give a brief history of the trust movement. Page 42.
4. What economies are secured by a combined or federated industry? Page 43.
5. Name some of the savings which are peculiar to trusts. Page 44.
6. Give an illustration showing the profits of a successful trust promoter. Page 45.
7. What is the effect of industrial combinations upon competitors? Upon producers of raw material? Page 46.
8. Explain the two phases of the relation between trusts and labor. Page 47.
9. What conclusion as to the power of the combination over prices, does the Industrial Commission reach? Page 48.
10. From what two sources do the evils of combination come? What Page 50.

remedies have been suggested to meet both classes of evils?

Speculation and Crises.

1. How does the speculator reduce for the merchant the speculative risk attaching to price fluctuations? Illustrate. Page 52.
2. What social value lies in the service of the speculator? Illustrate. Page 53.
3. Explain the difference between legitimate speculation and illegitimate speculation (gambling). Page 54.
4. What is a crisis? Page 55.
5. Discuss the immediate occasion of a crisis. Page 56.
6. What is W. S. Jevons' theory as to the causes of crises? Page 58.
7. Explain the over-production theory which is given as a cause for crises. Page 58.
8. What is the credit theory of the cause of a crisis? Page 59.
9. Where is the true explanation of a crisis to be found? Page 60.
10. Is it possible to prevent the recurrence of crises? Page 60.

The Modern Wage System.

1. Give some beneficial results and some abuses of the factory system. Page 61.
2. Name five points which Mr. Hobson gives to show that, in the transition to the factory system, the position of the laborer has been one of increasing dependence. Page 62.
3. How does President Hadley define wages? Page 63.
4. Describe the systems of labor which preceded the modern wage system. Page 64.
5. How has the extreme individualism of Adam Smith's theory been modified? Page 65.
6. What are the three peculiarities of the sale of labor? Page 66.

Labor Organizations and Collective Bargaining.

1. Why have labor organizations grown more rapidly in the United States and England than on the Continent of Europe? Page 69.
2. What are the two types of trade unions in the United States? Page 69.
3. Describe the two most important national organizations which have been in this country. Page 70.
4. What are the methods by which labor organizations monopolize the labor market? Page 71.
5. Why do labor leaders object to piece work? Page 72.
6. What are the two arguments in favor of shorter hours put forth by the trade unionist? Page 73.
7. What is the economic justification of the shorter working day? Page 74.
8. Give illustrations where unions have directly limited the amount of output. Page 75.
9. What is the attitude of the majority of the employers in the United States toward collective bargaining? Page 77.

10. What erroneous ideas exist as to the purpose of labor organizations? Page 78.
11. Describe the method of settling an industrial dispute by conciliation. Why is the principle of arbitration fast going out of favor? Page 79.

Women and Children at Work.

1. Describe the evils of the early factory system in England. Page 80.
2. Are the women crowding the men out of their occupations and taking their places? Page 81.
3. What is the most important reason for the low economic position which woman occupies in the industrial world? Page 83.
4. How does George L. Bolen justify the employment of women? Page 86.
5. How can the evil arising from child labor be cured? Page 87.
6. What obstacles have been in the way of efforts to improve labor conditions by legislation? Page 88.
7. Name, and give examples of, the two classes into which the factory acts may be divided. Page 88.
8. What has been accomplished in the United States in the way of labor legislation? Page 89.

Unemployment and Insurance.

1. Classify the unemployed. Page 91.
2. What are personal causes of unemployment? Page 92.
3. Name some industrial causes of unemployment. Page 93.
4. In what does the remedy for the normal unemployment in modern industry lie? Page 95.
5. Suggest some methods of alleviation of the evils of unemployment. Page 96.
6. State briefly the common law doctrine regarding liability for accident. Page 98.
7. What have foreign countries done toward placing the burden of industrial accidents upon the industry itself and not upon the laborer? Page 99.
8. Describe the establishment of compulsory insurance against sickness and old age in Germany; in Great Britain. Page 100.

Machinery and Industrial Efficiency.

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2. How does the reabsorption of labor displaced by machinery depend upon the demand for an article? Page 102.
3. How may machine methods cause irregularities in wages and employment? Page 104.
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5. Describe the system of industrial education which exists in Germany. Page 107.
6. How does the English system of industrial education differ from the German? Page 108.
7. What is the character of the industrial schools of the United States? Page 108.

8. How have the people of the United States been aided in their industrial development? Page 109.
9. What two obstacles have been met by the movement for better industrial education in the United States? Page 109.

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2. What is the economic theory of profit-sharing? Page 111.
3. What are the objections against the profit-sharing system? Page 112.
4. Why is the system of profit-sharing comparatively limited? Page 113.
5. According to President Hadley, where is there more chance for the success of profit-sharing? Page 113.
6. How does co-operation differ from profit-sharing? Page 114.
7. What are the reasons for the lack of success of co-operation in this country? Page 115.
8. Describe the methods of the Rochdale Society. Page 115.
9. How does producers' co-operation differ from consumers' co-operation? Page 116.
10. Give three examples of successful productive co-operation in the United States. Page 116.
11. Enumerate the advantages of co-operation. Page 116.
12. What is the ultimate ideal of enthusiastic co-operators? Page 117.
13. Discuss the defects of co-operation. Page 117.

Problems of Distribution.

1. What are the three great problems of economic society? Page 119.
2. Define functional distribution; personal distribution. Page 119.
3. What views are given as to whether functional distribution is actually governed by natural law? Page 121.
4. Discuss briefly the distribution of rent. Page 122.
5. What is the socialists' idea as to the profits which a business manager receives for his services? Page 123.
6. State three theories which have been developed to explain the distribution of wages. Page 124.
7. How was the wealth of the United States distributed in 1893? Page 125.
8. Are the poor becoming poorer? Page 127.

Saving and Spending.

1. What is the relation between saving and spending? Page 129.
2. What is the real goal of all rational economic endeavor? Page 130.
3. Give the arguments which are put forth condemning luxury. Page 132.
4. What arguments are put forth to show that luxury is an indispensable stimulus to progress? Page 133.

5. What is the attitude toward luxury taken by economists? Page 133.
6. What is meant by “a socialization of luxury”? Page 135.
7. Give an illustration of a waste in consumption due to lack of knowledge and training. Page 135.

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2. Give the attempts made in the United States to create a slow, steady inflation. Page 139.
3. State three arguments in favor of bimetallism. Page 139.
4. Where can we find a sufficient answer to the arguments in favor of government paper money? State the answer. Page 141.
5. Of what does the money of the United States consist? Page 141.
6. What essential quality of good bank money do bank notes lack? Explain. Page 143.
7. Enumerate the suggestions which have been made as to a new basis for the issue of bank notes. Page 143.
8. Name two other problems connected with the banking system of the United States. Page 144.

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2. How do the state commissions differ in power? Page 148.
3. Explain the monopoly character of express companies. Page 149.
4. Show the importance of the internal natural waterways of the United States. Page 151.
5. What problem is offered by our canal system? Page 151.
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Taxation and Tariff.

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2. What rules of taxation were laid down by Adam Smith? Page 154.
3. What is the benefit theory of taxation? How does this theory fail? Page 155.
4. What is the faculty principle of taxation? Page 155.
5. What measures have been suggested as to how to measure ability? Give the objection to each. Page 155.
6. What are the arguments supporting progressive taxation? Page 156.
7. Where does the Federal Treasury derive its revenue? Page 157.
8. What tax is the main reliance of the state and local governments? Page 158.
9. Describe an ideal system of taxation for the United States. What is the advantage of such a system? Page 159.
10. What is the character of the considerations in determining tariff Page 160.

policies?

11. Explain the home market argument in support of protection; the wages argument. Page 161.
12. What is the doctrine of comparative costs? Page 162.
13. How do free traders answer the home market argument? The infant industries argument? Page 162.

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2. What is the theory of anarchism? Page 165.
3. Explain Herbert Spencer's theory of extreme individualism. Page 165.
4. What is the theory of government most generally held by economists and writers in the United States? Page 166.
5. In what country is the culture state theory very generally held? Explain the theory. Page 167.
6. What does the view known as state socialism advocate? Page 167.
7. Give Professor Ely's definition of socialism. Page 167.
8. Explain the cardinal and distinctive element of socialism. Page 168.
9. Enumerate the socialists' criticisms of our present methods of production. Page 168.
10. What do socialists urge as bases of distribution? What basis do socialists of today agree is the best one to meet the requirements of justice? Page 170.
11. What were Henry George's arguments against private ownership of lands? Page 171.
12. What is the real issue as to the municipalization of local public utilities? Page 172.

Economic Progress.

1. What improvement has been made in the condition of the working class in the United States? In Great Britain? Page 173.
2. What factors have aided in the enormous expansion of production? Page 174.
3. Give two reasons why labor has not profited more by the great increase of wealth. Page 175.
4. State some lines along which reform is needed. Page 176.

Manufacturing.

1. How does the word "manufactures" as it is ordinarily used today differ from its original meaning? Page 180.
2. What conditions have made western Europe and the eastern part of the United States great manufacturing sections? Page 183.

Modern Manufacturing Systems.

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2. How did the use of steam affect the location of factories? Page 187.

3. What factors made the price of silk so high before the nineteenth century? Page 188.
4. Why is Gary, Indiana, an advantageous location for a manufacturing center? Page 189.
5. How is it possible to operate by water power, a factory located a hundred miles from a waterfall? Give two examples. Page 190.
6. Illustrate the use of electricity in a typical modern factory. Page 192.

Use of Machinery in Manufacturing.

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2. Enumerate some of the machines invented in the eighteenth century. Page 195.
3. How did the invention of machinery affect the importation of cotton? Page 196.
4. Show the need of machinery in the iron and steel industry. Page 197.
5. Describe the earliest process of making pig iron. Page 198.
6. What is the Bessemer process of making steel? Page 201.
7. What have been the causes of the great development of the iron and steel industry? Page 201.
8. What is the difference between English and American steel works? Page 202.

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2. Why was the United States slow about developing manufacturing industries? Page 205.
3. Why is any comparison of the value of the manufactures of the United States with that of other countries defective? Page 210.
4. Name an article which is the product of one factory but which becomes the manufacturing material of another. Page 211.
5. What factors have contributed toward making the United States the world’s greatest manufacturing nation? Page 212.
6. How can it be judged as to whether the value of manufactures of a country is in excess of the consuming capacity? Page 214.

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2. What are the advantages gained by having a business in the hands of a company or corporation? Page 215.
3. Compare the durability of gold with that of other products. Page 217.
4. What was the amount of capital employed in manufacturing industries in 1850? In 1905? Page 218.
5. How did the Census of 1905 differ from previous censuses in the matter of manufacturing establishments? Page 219.
6. How does the growth in capitalization rank with that of the other important branches of manufacturing? Page 220.

Trusts and Combinations.

1. What principle was the cause of the origin of the modern company or corporation? Page 222.
2. Explain the provisions of a pool. Page 223.
3. How were the defects of the pool overcome? Page 224.
4. What are the advantages of a trust or combination? Page 225.
5. What has been the effect of trusts on prices? On wages? Page 226.
6. Name and classify according to product the companies of which the United States Steel Corporation was formed. Page 228.

The Iron and Steel Industry.

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2. What method was used by the early Germans for extracting the iron from the ore? By the English in 1700? By the early American colonists? Page 236.
3. Why was coke used in the smelting of iron ore in England much earlier than in America? Page 238.
4. How did the development of railways aid in the preservation of our forests? Page 239.
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Transcriber's Note

Obvious printing errors, such as backwards, upside down, or partially printed letters, were corrected. The last two lines of the Table of Contents, printed in reverse order, were corrected. Final stops unprinted at the end of sentences were added.

Dialect, obsolete and alternative spellings were left unchanged. Pittsburgh (PA) is spelled without the final "h" throughout the book. Omitted words were not added to the text.

Footnotes in the text were renumbered sequentially and moved to the end of the article in which the anchor occurs. Footnotes within tables were changed to letters and were moved to follow the table in which the anchor occurs. In some tables, a footnote may have more than one anchor; consequently, no link is provided from table footnotes to any anchor.

Wide tables were split for easier viewing on small screens.

The following items were changed:
Bimettalism to Bimetallism
Added space between Ph. D. for Ernest Ludlow Bogard byline
whch to which
1880 to 1800
hamp to hemp
million to millions
manfactures to manufactures

guns to gums
ultilitarianism to utilitarianism
guns to gums
grinding to guiding
lead to led
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