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A CENTURY OF PROGRESS IN THE UNITED STATES.

BY EDWARD W. BYRN, A.M., AUTHOR OF "PROGRESS OF INVENTION IN THE NINETEENTH CENTURY."

In no period of human endeavor has the work of man been so built into tangible and enduring things of a useful quality as in the century just about to pass into history. In a few days the calendar of the Christian era will be adjusted to a new figure; the greatest cycle of the world's progress will have completed its round; and the wheel of time will have started on a new revolution. In the evolution of history the thoughtful student is impressed by the great change in methods and subjects wrought by the nineteenth century. Ancient and medieval history dealt with bloody wars, limiting creeds, cunning politics, and the greed of conquest. Modern history must leave these to a subordinate place, and substitute for them, as of greater importance, the genius of invention, the elements and agencies of industrial progress, and the arts of peace; and in so doing it marks the approaching millennium of happiness, good will and material prosperity which men have always longed for. The nineteenth century has given us the first realization of this longing. What is yet to come remains for the future. But the hope of the future must always be founded upon the experiences of the past. What men may do, and what men may dare, are measured largely by past achievements. Progress onward and upward, however, has so monopolized the attention of the nineteenth century man, and has so held his gaze to the front, that he rarely has found time to look back; and yet this retrospect is the faith of the future and the guarantee of further progress. It is timely and helpful, therefore, to make a brief review of the industrial progress of the century, its causes and its effects; for such a review constitutes a sort of stock-taking that discloses to us where we stand, and what we may with reason hope for in future development. So broad is this field, and so diversified its subjects, that space limitations compel its condensation into the briefest expression. Progress along all lines has manifested itself in a remarkable degree, but the great pioneer to it all has been

INVENTION.

In the early days of invention a haphazard and sporadic growth marked the path of the advance; and the brilliant genius of the solitary worker, sometimes a hero, but oftener a martyr, stood out in bold relief amid the apathetic environment of conservatism, and the prejudiced and bigoted atmosphere of superstition. The nineteenth century was to mark in this field a great revolution; speculative philosophy was to be left to the dreamer; and the thought of man assumed a new and more concrete shape. The legitimate claims of matter asserted their equal rights and correlated values with the abstractions of thought, and the era of material prosperity set in. The railroad, the telegraph, and the steam vessel annihilated distance; peoples touched elbows across the seas; and the contagion of thought stimulated the ferment of civilization until the whole world broke out into an epidemic of industrial progress. The germ speedily asserted its living qualities and grew into a new civilization. Invention was its mother, and a free government was its father. To-day a survey of the wonderful industrial progress of this greatest of all countries and greatest of all governments inspires the patriot of the western hemisphere with a justifiable pride, and commands the admiration and respect of the whole world.

When the nineteenth century began, the United States was of limited territory, flanked by England on the north, Spain on the south, and France on the west, a storm-swept coast on the east, and a hostile and ubiquitous host of aborigines in our midst. The necessities of life were still directing the energies of the early settlers almost entirely to agricultural pursuits and to supplying by the quickest methods the immediate wants of food and shelter. It is not surprising then that most of the notable steps of invention at this time should have been taken in foreign lands. As, however, the American people were quick to appreciate and adopt anything of practical value, and as in later years United States patents have been quite generally taken for the most important of these foreign inventions, the latter have become a part of the great working assets of industrial progress in the United States which cannot be ignored in any estimate of the causes of its growth.

In the very beginning of the first decade, Volta, of Italy, had given the world the chemical battery which bears his name; Louis Robert, of France, devised a machine for making continuous webs of paper, which rendered the web perfecting printing press possible; Jacquard, also of France, invented a pattern loom. Somewhat later, Trevithick, an Englishman, built the first steam locomotive; and Winsor, his countryman, organized the first gas company.

In our own land, Col. John Stevens and Robert Fulton successfully established steam navigation and laid the foundation for the present great commerce and splendid naval equipment of the world.

In the second decade (1810–1820) König's rotary steam press marked a great advance in printing; Stephenson built his first locomotive; Fulton built the first steam war vessel; Niepce invented heliography, the pioneer step in photography; Sir Humphrey Davy invented the safety lamp; the English engineer Brunel supplied in civil engineering notable improvements in the methods of driving subterranean and submarine tunnels; electro-magnetism was discovered by Oersted; the American ship "Savannah" utilized steam for the first time for crossing the Atlantic; and Blanchard invented his lathe for turning irregular forms.

In the third decade (1820–1830) Faraday converted the electrical current into mechanical motion, and in experiments in the liquefaction and solidification of gases laid the foundation of the modern absorption ice machines; pins commenced to be cheaply made on Wright's machine; the first public passenger railway was opened in England between Stockton and Darlington; Sturgeon invented the prototype of the electro-magnet; Prof. Henry perfected the same and rendered it effective for all useful purposes in the arts. Barlow's electrical spur wheel, Ohm's law of electrical resistance, Becquerel's double fluid galvanic battery, and Dal Negro's electrically operated pendulum marked other notable steps in the electrical field. Friction matches were introduced by John Walker, Neilson's hot blast for smelting iron was the greatest of the early steps in metallurgy, Stephenson's locomotive, "Rocket," took the prize for speed, the "Stourbridge Lion" was imported and was the first practical locomotive to be put to work in America, Daguerre invented the daguerreotype, and Ericsson supplied the steam fire engine.

In the fourth decade (1830–1840) the United States began to show the fertility and resourcefulness of its inventors to a remarkable degree. Prof. Henry telegraphed signals to a distant point by his electro-magnet and invented his electric motor; McCormick and Hussey invented and put in service their respective reapers; Baldwin built the "Old Ironsides," and from this time on American locomotives began to assert their claims to recognition, until to-day in number and quality they excel all others. Prof. Morse gave the world the telegraph; Colt invented his revolver; Saxton devised magneto-electric machines; the link motion was invented by James; Davenport made his electric motor; Profs. Draper and Morse made the first photographic portraits; and Goodyear discovered the process of vulcanizing rubber. Important steps were also being taken abroad. Faraday discovered magnetic induction, and also established the relation between chemical and electrical force; Pixii constructed magneto-electric machines; Jacobi invented his rotary electric motor and built the first electrically propelled boat; Daniell devised his constant chemical battery; Cooke and Wheatstone devised an electric telegraph; Steinheil discovered the feasibility of utilizing the earth for the return section of the electric circuit; Defries furnished the gas meter; Fox Talbot made photographic prints from negatives; and Prof. Grove made the first incandescent electric lamp.

Ten years more completed the first half of the century, and this decade (1840–1850) brought Sickel's steam cut-off; Triger's pneumatic caissons; Nasmyth's steam hammer; the first telegraphic message from Washington to Baltimore; the introduction of anæsthetics by Dr. Wells and by Dr. Morton: the Hoe type-revolving machine; House's printing telegraph; guncotton and nitroglycerine; Howe's sewing machine; Savage's time lock; Bain's chemical telegraph; Bakewell's facsimile telegraph; Bourdon's pressure gages; Brewster's stereoscope; the Corliss engine; the first submarine cable (Dover to Calais); the collodion process in photography; Sloan's gimlet-pointed screw; and American machine-made watches.

In the next decade (1850–1860) we find Dr. Page's electric locomotive; the Ruhmkorff coil; Helmholtz's ophthalmoscope; Maynard's breech-loading rifle; the Smith & Wesson, the Spencer, and the Henry magazine fire-arms; the Channing & Farmer fire alarm telegraph; Gintl's duplex telegraph; the Watt & Burgess and the Voelter processes for making paper pulp from wood; Wilson's four-motion feed for sewing machines; Bessemer's process of making steel; Hjorth's dynamo-electric machine; Ericsson's hot air engine; Taupenot's dry plate photography; the Michaux bicycle; Hughes' printing telegraph; Woodruff's sleeping car; Perkin's aniline dyes; Siemens' regenerative furnace; iron floor beams in building construction; Phelps' printing telegraph; first Atlantic cable; Giffard steam injector; Gardner's underground cable car system; the discovery of coal oil in the United States; the first use of the electric light in a dwelling, by Farmer; launching of the "Great Eastern;" Osborne's process of photo-lithography; the improved spectroscope, and the Kirchhoff and Bunsen system of spectrum analysis; Planté's storage battery; Reis' crude telephone; and Carré's ammonia absorption ice machine.

The following period (1860–1870) included the civil war, but even this terrible calamity could not arrest the momentum of inventive progress. As might be supposed, the inventions of this period reflected to some extent the strife of battle, and we find here the introduction of Timby's revolving turret, Ericsson's iron-clad "Monitor," the Gatling gun, the white gunpowder of Schultz and of Dittmar, dynamite, Nobel's explosive gelatine, the Whitehead torpedo, Moncrieff's disappearing gun carriage, and the rebounding gun lock. The McKay shoe-sewing machine revolutionized the shoe industry. Col. Green invented the drive well. Otis introduced his passenger elevator, the first barbed wire fence appeared, and rubber dental plates were introduced. In this period, also, Louis Pasteur began his great work in bacteriology and established the germ theory of disease. Martin's process of making steel was introduced. Wilde, Siemens and Gramme brought out their several dynamo-electric machines. Burleigh invented his compressed air rock drills, and Tilghman his sulphite process for making wood pulp paper. Oleomargarine was produced, the Suez Canal opened, the Pacific Railway was completed, the first Westinghouse air brakes were devised, the Windhausen refrigerating machines were brought out, and the Mont Cenis tunnel was practically completed.

The next decade (1870–1880) included the periods of the great financial panic in the United States and the critical political strife incident to the contested Presidential election. This retarded to some extent the growth of patents in numbers, but it does not seem to have arrested the thought of the inventor, nor to have affected its quality. The Hoe web perfecting press was developed, and put to work in the office of The New York Tribune. A great array of valuable inventions followed, among which may be mentioned the Locke grain binder; the Ingersoll rock drill; Stearns' duplex telegraph; Westinghouse's improved automatic air brake; Lyall's positive motion loom; Janney's automatic car coupler; Edison's quadruplex telegraph; Gorham's twine binder for harvesters; Lowe's process of making illuminating gas from water; the roller mill and middlings purifier for making flour; Pictet's ice machine; cash carriers for stores; Prof. Bell's wonderful speaking telephone; cigarette machinery; Edison's electric pen; steam feed for sawmill carriages; Hallidie's cable cars; Edison's phonograph; the Otto gas engine; Jablochkoff's electric candle; Sawyer-Man electric lamp; Berliner's telephone transmitter of variable resistance; Edison's carbon microphone; liquefaction of oxygen, nitrogen, and air by Pictet and Cailletet; the development of the Remington typewriter; Edison's electric lamp with carbon filament; gelatino-bromide emulsions in photography; the Birkenhead and Rabbeth spinning spindles, and the Gessner cloth presses; Siemens also installed the first electrical railway at Berlin; and the Mississippi jetties were built by Capt. Eads. The Lee magazine rifle, Faure's storage battery, and Greener's hammerless gun were other inventions of this period.

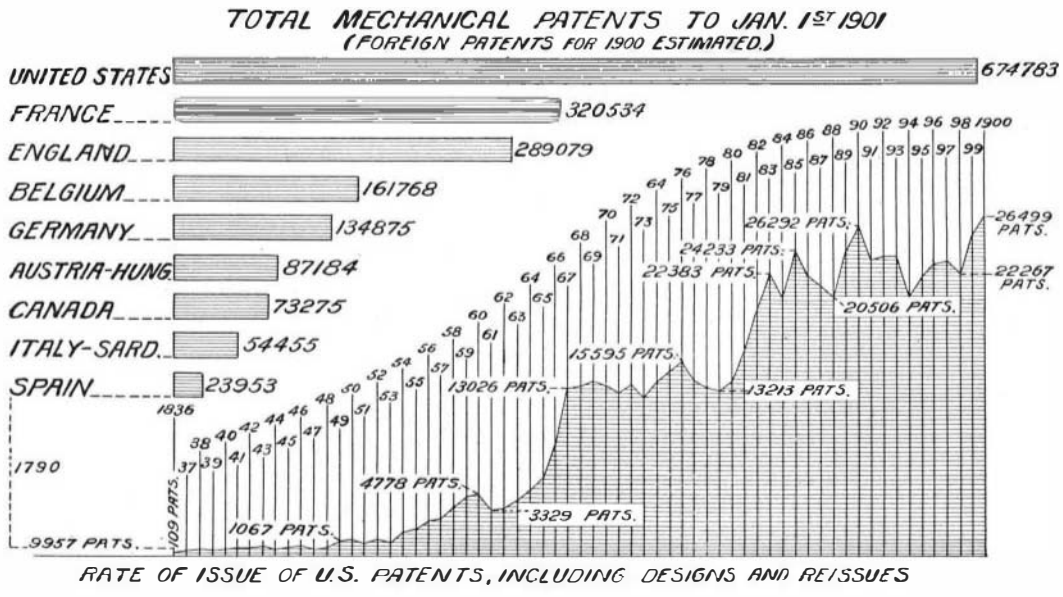
In the next decade (1880–1890) the radical inventions of the preceding periods had gotten well into the commercial activities of the national life, and this decade represents the greatest epoch of prosperity the republic has ever enjoyed. It added the following important inventions: Telegraphing by induction, the Blake telephone transmitter, the Reece buttonhole machine, Mergenthaler's linotype machine, Cowles' electrical process of making aluminium, the Welsbach gas burner, the graphophone, electric welding by Elihu Thomson, the McArthur and Forrest cyanide process of obtaining gold, Tesla's system of polyphase currents, Harvey's process of annealing armor plate, De Laval's rotary steam turbine, the Kodak camera, De Chardonnet's process of making artificial silk, nickel steel, Hall's process of making aluminium, the Dudley dynamite gun, photography in colors, and the Krag-Jorgensen magazine rifle. Great advances were also made in explosives and smokeless powders, among which may be named rack-a-rock, bellite, melinite, and cordite. In medicine, antipyrene was brought out, while in bacteriology Koch identified the bacilli of tuberculosis and cholera, Pasteur the bacillus of hydrophobia, Loeffler the bacillus of diphtheria, and Nicolaier the bacillus of

lock-jaw. The first American electric railway was installed between Baltimore and Hampden. "Flood Rock" in New York Harbor was blown up, the Brooklyn bridge was built, the electrocution of criminals ordered in New York, the Lick telescope was erected, and in Europe the St. Gothard tunnel and the great Forth bridge were completed and opened to traffic.

The last decade of the century (1890–1900) is still so near to us, and is so filled with invented agencies of importance, that selection is rendered specially difficult, and only a few of the most important may be named. We find the Parsons rotary steam turbine, which in its applications in marine engines has raised the speed of smaller steam craft to that of an express locomotive; the Northrup loom, which acts almost with the discretion of a thinking mind; the Acheson process of making carborundum, the Yerkes telescope, Edison's kinetoscope, and the allied developments of the phantascope, cinematograph, and biograph, whose moving and apparently living scenes fill the observer with wonder and admiration; the production of calcium carbide by Willson, and the electric furnace for making the same; the discovery and application of the X-rays by Roentgen, the Krupp armor plate, the developments in liquid air and apparatus for producing it by Linde, Tripler, Dewar, Ostergren, Berger, and others; the mercerizing of cloth under tension to render it silky, the Schlick system of balancing marine engines, the improved disappearing gun, the practical development of the bicycle and automobile, the building and launching of the "Oceanic," the largest steam vessel ever produced; and wireless telegraphy by Marconi.

These represent the most notable agencies which have stimulated the industrial progress of the nineteenth century. Conceived in the progressive thought of mankind, they have been nursed into a healthy and strong existence under the fostering care of the patent systems of the world, and especially by those of our own land. Former ages have furnished many a brilliant genius, but his thought has too often died with him. Will not all agree that it is the patent system which has in the nineteenth century crystallized this thought into enduring records, and in furnishing the stimulus of fair and just reward to the inventor has thus become, more than any other single factor, responsible for the great array of invented agencies and the wonderful industrial growth of the present time?

In this connection it may not be amiss to show what this patent system has produced in the way of original inventions. The growth of patents is graphically illustrated in the accompanying chart, which not only gives the variations in patents in the United States from year to year, but also a comparison of the total number of patents of the principal different countries of the world. It will be seen that up to the end of the year 1900 sixty-five thousand more patents will have been taken out in the United States than in Great Britain and France put together.



RATE OF ISSUE OF U.S. PATENTS, INCLUDING DESIGNS AND REISSUES

On this foundation the modern civilization of the nineteenth century has been built, and from it has rolled the mightiest wave of material prosperity which the world has ever known. Submerged within it and surrounded by it, as we are on every hand, it is difficult indeed to rise to a point of comprehensive vision. Its very magnitude precludes any correct comprehension by the average observer. A mountain cannot be estimated at close range in any proper appreciation of its relative values, and the boundless sea in its vastness furnishes no comparisons; and so in looking at this great tidal wave of industrial growth, we must stand a little apart from it to get any idea of its proportion. Looking down the corridor of time we obtain a better vantage point of view, since this will show us by its shrinking values the juxtaposed relation of the then and the now, as separated by a hundred years.

MANUFACTURES.

In the year 1800 this branch of the industrial life of the country was of such small extent that scarcely any records of it remain. Some cotton and woolen mills were to be found, but the spinning wheel was still a part of the domestic furniture, more useful than ornamental, the hand loom was the main reliance of the farmer, and home-spun fabric was still in evidence everywhere.

In 1831 the capital invested in cotton manufactures was $40,612,984. In 1890 it was $354,020,843, and the value of the product was $267,981,724 The number of spindles in factories in 1790 was only 70; in 1890, a hundred years later, it was 14,188,103. In 1800 the price of cotton yarns was from $1.03 to $1 36 per pound. In the last decade of the nineteenth century it ranges from 13½ cents to 18½ cents, and the price of cloth has diminished in like proportion, while the wages of the cotton mill operatives have more than doubled.

If a man wanted a pair of shoes a hundred years ago, he had his shoemaker to make them, and he had to wait for them until they were finished. The pay of this shoemaker was 73½ cents a day. If he wanted a house, the carpenter with broad-ax laboriously hewed the lumber, and with hammer, saw and hand-plane slowly dressed and put together what is now known as the mill-work, for which he received wages at the rate of something over 70 cents a day. The printer was the skilled mechanic, and at $1 a day he set the type, and worked off on a creaky hand-press the limited edition, whose crude sheets now form valued curios. To-day the shoemaker on the McKay machine makes many hundred pairs of shoes a day, the laborious work of the carpenter is performed almost entirely by the planing, sawing, boring, mortising and turning machines of the great woodworking mills, while the printer, with wages more than trebled and hours of labor reduced, has been elevated to the dignity of an expert manipulator of the linotype machine, performing the work of four or five compositors, or has become the operator of the octuple press, printing papers by steam at the rate of 1,600 a minute, ready pasted, folded and counted for distribution.

In the manufacture of agricultural machines the growth of the reaper has been one of the notable things as bearing on the industrial evolution of the century. This industry began about 1840 with the contemporaneous operation of Hussey and McCormick in this country, and in that year not more than three machines were made. To-day the estimated annual production of the factories in the United States in this class of machines is 180,000 self-binding harvesters, 250,000 mowing machines, 18,000 corn harvesters, and 25,000 reapers; the output of one great factory alone, in the year 1898, being 74,000 self-binding harvesters, 107,000 mowers, 9,000 corn harvesters, and 10,000 reapers. This with 75,000 horse rakes meant for this factory a complete machine for every forty seconds in the year, working ten hours a day. This, however, is only one branch of agricultural machines. There are drills, thrashers, seeders, plows, harrows, and hand implements beyond calculation. In the field of wearing apparel, shoes, clothing, hats, and rubber goods are made in enormous quantities. These with ships, mills for iron and grain, mining machinery, steam engines and locomotives, printing presses, sewing machines, bicycles, electrical apparatus, food stuffs and the thousands of other manufactured products, furnish an object lesson of industrial progress which it is well nigh impossible to adequately estimate and present in intelligible form. The growth of manufactures in the United States, however, is evidenced in late years by the exports of manufactured articles. These for 1900 are $433,851,756, which is 28 per cent above those of 1899 and the largest in the history of the country. Mulhall estimates the total value of manufactures in the United States in 1900 to be $13,326,000,000 and the hands employed 6,710,000.

RAILROADS AND POSTAL SERVICE.

In 1800 there were no railroads. The rumbling stage coach was the only means of public conveyance. Traveling at the rate of six miles an hour, how long would it take from New York to Washington, and how many relays of horses, and how much delay and discomfort? To-day, a magnificent locomotive and a luxurious palace car whisk us across the country at the rate of nearly a mile a minute. The business man finishes a day's work in New York, and taking a sleeping car eats breakfast in Washington in time to attend an early committee meeting in Congress.

The first public railroad built was the Stockton and Darlington line in England, which was opened for traffic in 1825. In 1829 the "Stourbridge Lion" was imported from England and put to work on the Delaware and Hudson Canal Company's railroad. In 1832, Baldwin built the "Old Ironsides," and from this time on the railroad was an established institution. In the year 1899 the steam railroads of the United States have a total track mileage of 250,362; there are 37,245 locomotives, 26,184 passenger cars, 8,121 baggage and mail cars, and 1,328,084 freight cars. There were 537,977,301 passengers carried, 975,789,941 tons of freight moved, and the total traffic earnings were $1,336,096,379. Mulhall estimates the capital invested in railroads in the United States in 1900 to be $11,380,000,000. To this must be added the enormous growth in street railways with their thousands of cars.

Along with the development of the railroad has come the wonderful extension of the postal service. In 1799 there were in the United States 677 post offices; in 1900 there are 76,688. In 1799 the receipts from postage were $264,846; in 1900 the receipts from postage and money orders are $102,354,579.29. In 1799 the miles of post roads were 16,180; in 1900 they are 500,989. At the beginning of the century postage was paid according to the distance carried, and Postmaster-General Habersham of that period, in one of his reports, recommending a change in the postal rates, remarked that "a postage of 12½ cents or under is so inconsiderable that it is freely paid, but in all cases above that sum it seems something of an object, and it then begins to be called money." To-day two cents carries a letter to Manila, half way round the world. With a special delivery stamp a letter mailed at noon in New York reaches Washington and is delivered to its address by special messenger in the evening of the same day, and the New York daily morning papers are distributed in Washington in time to be read at the breakfast table there on the same day of their issue. For the year ending June 30, 1900, there were 7,129,990,202 pieces of mail matter handled by our post offices. This was about 93 pieces for every man, woman and child of our population, more than half of which were letters and postal cards.

AGRICULTURE AND LIVE STOCK.

The nineteenth century has been remarkable in this field chiefly for the great addition which it has made to our national wealth, the agencies which have contributed to this increase, and the means for economizing the cost of production. At the beginning of the century, a little patch of ground, oftentimes a mere clearing in the forest, and a few domestic animals occupied the attention of the farmer, while the crudest of implements aided him but slightly in his work. At the end of the century 5,500,000 farms are producing annually 2,078,143,933 bushels of corn, 547,303,846 bushels of wheat, 796,177,713 bushels of oats, 228,783,232 bushels of potatoes, 56,655,756 tons of hay, and 10,000,000 bales of cotton. To-day the great Western wheat farms of forty-five to ninety thousand acres and the processions of self-binding reapers in the harvest field stand as correlated factors of growth. More than ten thousand patents for plows, as many for reapers, and a proportionate number of planters, cultivators, thrashers and other implements and tools, indicate the vastness of this field of activity.

Of live stock the United States has, in 1900, 13,537,524 horses, 2,086,027 mules, 16,292,360 milch cows, 27,610,054 other cattle, 41,883,065 sheep, and probably 37,000,000, hogs. The great dairy interest and the enormous meat packing establishments are founded upon these. In the year book of the Agricultural Department the estimated quantity and value of dairy products for 1899 is: Butter, 1,430,000,000 pounds; cheese, 300,000,000 pounds; milk, 2,090,000,000 gallons. This with the skim milk, buttermilk, and whey, and the calves dropped annually, makes the produce of the dairy cows exceed $500,000,000 annually. During the period covered by the five fiscal years 1895 to 1899, the United States exported nearly $3,500,000,000 worth of domestic agricultural produce. The average annual value reached $694,874,000. The agricultural exports for 1900 reached the sum of $835,858,123. What the full production will be in this great field remains for the twelfth census to disclose. Seven hundred clerks in the one division of agriculture alone have been busy for some months tabulating the statistics. This number will soon be raised to one thousand, but not until June, 1902, will the work be complete.

COMMERCE.

A hundred years ago a voyage to the Orient was of only occasional occurrence, and an event of stirring importance to both the commercial world and the family circle. Steam was not yet applied, and the old sailing craft, at the mercy of the seas and adverse winds, might reach her destination and return; but a year's absence was to be expected, and the return was uncer-

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A CENTURY OF PROGRESS IN THE UNITED STATES.

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tain. To-day steam has almost entirely superseded sails, and in our magnificent modern ocean liner a trip of five days and as many hours takes us across the Atlantic; then flitting along the coast, up the Mediterranean Sea, and thence through the Suez Canal, we come in contact with all the peoples of the world in less than a month. Steam navigation, first established in 1807 by Fulton, was the great agency of commercial growth. The ratio of steam to sails for the world has increased from 30 per cent steam in 1860 to 80 per cent in 1894. This enormous field of industry cannot be treated except superficially, and we must let the figures tell their own story.

In 1800 the exports of the United States were $70,971,780, and the imports were $91,252,768, or more than $20,000,000 in excess of the exports. Up to 1876 the imports, as a rule, preponderated over the exports. For the last quarter of a century, however, our exports have (with the exception of the years 1888, 1889, and 1893) largely exceeded the imports. In the year 1900 our exports were $1,394,186,371, which is the highest point ever attained. The imports for that year were $849,714,670, which gave us a credit in the balance of trade amounting to over $544,000,000, as compared with a debit of $20,000,000 in 1880. The total of exports and imports for the year 1800 represented an aggregate for our foreign commerce at the beginning of the century of $162,224,548, while that for 1900 is more than $2,000,000,000, which is the largest in the history of the country. Add to this the inland commerce of our great navigable rivers and on the vast areas of the Great Lakes, and the total reaches incomprehensible figures. It is said that over 10,000 vessels are employed in this inland commerce. According to the report of chief of engineers for 1900, the total Lake Superior traffic through the American and Canadian canals for the eight months of navigation ending April 19, 1900, was 21,078 vessels carrying 27,520,205 tons of freight and 51,050 passengers. The traffic through the Detroit River between Lake Huron and Lake Erie is, however, even greater. The freight alone is estimated at 40,000,000 tons, and it is said that the number of passages of vessels through is fifteen times as many as those through the Suez Canal.

Notwithstanding these amazing figures the commerce of the United States is still in its infancy. With the recent acquisition of the Hawaiian Islands, Porto Rico and the Philippines, the development of Alaska, the increasing demand of the world for our products, the building of the Isthmian Canal, and the encouragement to American shipbuilding, the most rational prophecy must seem to many an enthusiastic dream too wild for realization. But the American people are not dreamers.

MINERAL RESOURCES.

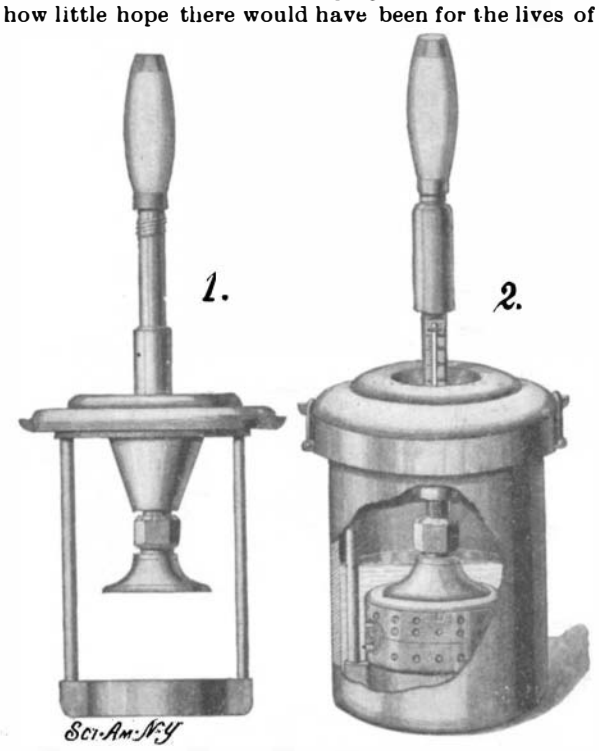
In 1800 there had been practically no development of the mineral resources of the country. The abundant forests supplied the necessary fuel, and for most of the people, took the place of coal. There were no railroads, battleships, nor sky-scraper buildings with their enormous demands for iron and steel; coal oil and natural gas were undiscovered assets, and the great electrical art with its demand for copper was not yet born. To-day the annual output of the United States for its principal mineral products is, as given by the Geological Survey for the year 1899, 13,620,703 long tons of pig iron valued at $245,172,654; 585,342,124 pounds of copper valued at $104,190,898; 54,764,500 ounces of silver valued at $70,806,626; 3,437,210 ounces of gold valued at $71,053,400; 193,321,987 short tons of bituminous coal valued at $167,935,304; 53,944,647 long tons of anthracite coal valued at $88,142,130; $20,024,873 worth of natural gas; and 57,070,850 barrels of petroleum valued at $64,603,904. The total production of petroleum in the United States during the past forty years, from 1859, when it was discovered, to the end of 1899, is 943,513,609 barrels. This amount of oil would fill a tank having a base of one square mile to a height of 189 feet, or it would form a river 15 miles long, a quarter of a mile wide, and 50 feet deep. Let the mind try for a moment to estimate the number of lamps which have been filled, trimmed, and kept burning from this supply. The total value of the mineral products of the United States, as estimated by the Geological Survey for the year 1899, is $976,008,946.

FISH AND FISHERIES.

The fisheries of the United States have always been valuable, but in the early part of the century they were superintended only by a kind Providence. Fortunately, the bountiful supply exceeded the demand. In the year 1860 they had attained a commercial value of $13,768,198. In 1871 the Fish Commission of the United States was established, whose principal work was the propagation of useful food fishes, including lobsters, oysters and other shell fish, and their distribution to suitable waters. In the prosecution of its work the Commission has 34 stations situated in different parts of the country, 5 fish-distributing cars, 2 steam vessels and 1 sailing vessel. This institution is now planting in American waters desirable food fishes at the rate of 9,000,000 annually, and they include shad on the Atlantic coast, white fish on the Great Lakes, salmon on the Pacific coast and cod on the New England coast. The value of this national enterprise has long since established itself, and the fishing industry to-day is an important and growing branch of our national resources. According to the Statesman's Year Book for 1900, the fisheries of the United States employ 6,529 vessels and 202,129 persons. The capital invested is $61,868,616, and the annual value of the product is $47,826,328. Oysters constitute about a third of the product.

TELEGRAPH AND TELEPHONE.

In 1800 communication between remote points was only by mail, and the mail was slowly carried by post horses and sailing vessels. To hear from friends in Europe required many months of delay. To-day we communicate with Europe by cable in a fraction of a minute and talk over the telephone with friends a thousand miles away. In 1844 the first line of telegraph was built, under the direction of Prof. Morse, between Baltimore and Washington, by special appropriation of Congress, and the first message over it—"What hath God wrought"—was prophetic of a mighty revolution in the world's life. To-day one great company—the Western Union—has 933,153 miles of wire, 22,900 offices, and in the current year sent 63,167,783 messages. Add to this the equipment and business of the Postal Telegraph Company, and the total would be 1,108,153 miles of wire, 25,900 offices and 80,667,783 messages. Even these figures must be increased somewhat by small companies, the fire alarm and the district messenger service, while submarine cables to the number of 1,500 add 170,000 miles of line and 6,000,000 messages annually in extension of the business of the United States. It is appalling to think how helpless we would have been in our campaigns in the East, and how little hope there would have been for the lives of



THE TUTTLE-BOWIE VULCANIZING APPARATUS.

our compatriots in Pekin, had there been no cable. The telephone, invented by Prof. Bell in 1876 and immediately introduced, utilized in 1899 in the hands of the one parent company a million and a half instruments and over a million miles of wire, and in that year more than five million connections were made daily. The telegraph and telephone are the great distance annihilators and time savers of the nineteenth century, and enter into the life of almost every other industry. They are both American inventions.

THE BALANCE SHEET.

In closing this review no more significant object lesson can be presented than the nation's balance sheet, which for the year ending June 30, 1900, was:

RECEIPTS.	
From internal revenue	$295,327,926.76
From customs	233,164,871.16
From postal service	102,354,579.29
From miscellaneous	38,748,053.97
Total receipts	$669,595,431.18
EXPENDITURES.	
Civil and miscellaneous	$98,542,411.37
Military establishment	134,774,767.78
Naval establishment	55,953,077.72
Indians	10,175,106 76
Pensions	140,877,316.02
Interest on public debt	40,160,333.27
Deficiency in postal revenues	7,230,778.79
Postal service	102,354,579.29
Total expenditures	$590,068,371.00
Surplus	79,527,060.18

This surplus of a single year is more than seven times as much as the entire receipts of the government in 1800, and ten times as much as its entire expenses in that year. To-day the United States is by far the richest country in the world. Its wealth exceeds that of the United Kingdom, which is the next in rank, by about $22,000,000,000. In 1800 our population was 5,308,483; now it is 76,304,799. The sixteen States have grown to forty-five, and our territory expanded from 909,050 square miles to 3,846,595 square miles. At the opening of the revolutionary war there were but 40 newspapers. In 1850 these had grown to 2,526, and to-day we have 20,806. Note also the following growth in national wealth. According to the eighth census, that wealth was in 1789, $619,977,247; in 1850, $7,135,780,228; and in 1860, the highest estimate, by individual returns, made it $19,098,156,289. According to Mr. Mulhall the wealth of the United States in 1890 reached $64,876,000,000 and in 1900 will be $91,040,000,000. This makes in 1900 the sum of $1,195 for each inhabitant. The addition which the last ten years has made to the national wealth is $25,000,000,000. This result in the accretion of national resources is commented on by Mr. Mulhall himself as "really stupendous." Expressing the growth of this period in more comprehensible terms, he says it means that for every day in every year of the past decade the United States has grown (daily) at the rate of 4,000 in population, 800 in school children, 29,000 in acres of farms, $7,500,000 in wealth, and $1,100,000 in manufactures. According to Statistician Powers of the twelfth census, this saving of $25,000,000,000 in ten years is a greater saving than all the people of the Western continent were able to make from the discovery by Columbus to the breaking out of the civil war, which statement seems justified by the figures already given from the eighth census. He also says that the savings of these ten years represent more houses, buildings, machinery, tools, implements, clothes and means of transportation than the race was able to add by its savings from Adam to the Declaration of American Independence.

The infinitude of factors in this epoch of progress is too great for comprehension, and embarrasses the mind in any effort to expand to a full appreciation of its details. The United States, however, has not yet attained its majority, and the future has still great things in store for us. Seventeen million children are in our schools and colleges, and these in the next century will take our places as active workers, and with the masterful equipment of education, coupled with the energy of new blood, a reverent respect for religion, patriotism and morality, and a heritage unparalleled, such forces will undoubtedly carry the republic to a greater prosperity and a more exalted destiny.

A RAPID METHOD OF VULCANIZING RUBBER.

A new method of vulcanizing has been patented by Mr. G. H. Tuttle, of Montgomery, Ala., and Mr. G. M. Bowie, of Whitecastle, La., by means of which it is said only one-third the time ordinarily consumed is required. Fig. 1 is an elevation of the press employed, and Fig. 2 is a perspective view of the vulcanizer, together with a box containing the article to be vulcanized.

The apparatus as shown in Fig. 1 consists of a bottom and a funnel-shaped top connected by uprights. Into the funnel-shaped top a screw fits, which also engages the socket of a presser-plate. The socket is in the shape of a nut, so that it can be turned by means of a wrench. Into the upper face of the top a rod screws, which carries a thermometer, a handle, and a protecting sleeve, which can be screwed on a thread on the rod or shifted down, as in Fig. 1, to cover the thermometer.

Between the presser-plate and the bottom a box is to be inserted, consisting of a top and a bottom and perforated upper and lower sections, the several parts being fitted together loosely, so that they can be readily taken apart. The press, with the box, is set into a vessel, the upper rim of which engages a corresponding groove in the top of the vulcanizer, the vessel and vulcanizer being locked together by catches or other fastening devices.

The article to be vulcanized is embedded in plaster-of-Paris in the perforated box; and the box is then placed on the bottom of the vulcanizer. Together with the lower portion of the press, the box is immersed in hot water for the purpose of softening the rubber. When the rubber has been softened, the nut socket is turned to apply further pressure for the purpose of expelling the excess of rubber. Then the press with the box is inserted in the vessel, into which enough hot mercury has been poured to cover the box. The vessel is therefore placed upon a stove. The heat of the mercury passing into the box through the perforations causes the rubber to be vulcanized in the well known manner. To secure this result, a temperature of about 320° F. is maintained in the box for about half a hour. The box with the vulcanized article is then removed from the vessel and the mercury is allowed to cool.

By this improved method the same results are attained as with the ordinary methods, but in about one-third the time. Moreover, the heating medium is always fully under control, and being a metallic liquid cannot explode.

THE American District Telegraph Company is about to adopt the audiphone system in New York city. The ordinary call boxes will not be done away with, but the audiphone will be substituted where desired. A monthly rental will be required for the new system.