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THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 22.

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AMERICAN PROGRESS—II.—FROM 1820 TO 1840.

In no era of our country's existence does it appear that greater progress was made than during the twenty years previous to 1840. Early in 1840, Dr. Richard Hare introduced the deflagrator, a form of voltaic battery capable of giving effects of great intensity, and also another form of voltaic apparatus called the calorimotor, designed to generate, with a low intensity of electricity, an enormous volume of heat. By means of it large rods of platinum can be ignited and fused in a few seconds, and its magnetic effects are equally surprising ; yet it is hardly capable of producing the faintest spark between the carbon electrodes. During the same year Henry Burden invented his first cultivator, which was the beginning of a series of splendid inventions. In 1825 he received a patent for a machine for making the wrought spike, and in 1835 for a horseshoe machine. Then followed an apparatus for making the hook-headed spikes used on railways, a self-acting machine for reducing iron into blooms after puddling, another horseshoe machine, a machine for rolling iron into bars, and finally an entirely new machine for horseshoe making, which is a marvel of mechanical skill. It is self-acting, and produces, from iron bars, horseshoes at the rate of one a second. From these several inventions, Mr. Burden amassed an immense fortune. Also in about 1820, Jordan L. Mott invented the stove for burning small coal. Previously only large lumps had been devoted to domestic purposes, and the small fragments were wasted. During his lifetime he took out more than forty patents connected with coal-burning apparatus, and also instituted the change from blast furnaces to the cupola in making stoves and other light castings. His son carries on the business of his father at the present time in this city on a most extensive scale.

In 1822 James McDonald, of New York, patented an important machine for breaking and cleaning unrolled flax and hemp. During the following year, Nicholas Longworth, of Cincinnati, made his first essay in making wine from Catawba and other native grapes, thus starting the manufacture of the famous Catawba wines. At the same time another great inventor became known in the person of Joseph Saxton. In 1823, he invented the machine for giving the epicycloidal form to the teeth of notched wheels; in 1825 he made an astronomical clock, for adjusting the compensation rod in the pendulum of which he invented the reflecting pyrometer and comparator. In 1829, he went to London and there invented the magneto-electric machine. Subsequently he devised a self-registering tide gage, a deep sea thermometer, a dividing engine, and an hydraulic printing press with flexible platen.

In 1824, the Franklin Institute in Philadelphia was founded, and in the fall of the year its first annual fair was held. During the same year, Zadoc Pratt established his great tannery in Prattsville, on Schoharie Creek, N. Y., for the manufacture of hemlock-tanned leather. He probably tanned more sole leather than any man in the world, and, it is said, employed a capital of over $250,000, and continued the business till his death, without a single litigated lawsuit, or the loss of one dollar in bad debts, or having a single hide stolen. He was elected to Congress in 1836, and there proposed the introduction, through United States' consuls and national vessels, of foreign seeds and plants for distribution by the Patent Office, the publication and engraving of all important patented inventions for circulation throughout the country, and the establishment of a bureau of statistics. The year 1825 is memorable for the completion of the Erie canal, one of the greatest engineering works in the country. It connects the Hudson river with Lake Erie, is 363 miles long, and cost only about $8,000,000 to construct. Also in 1825 the first house furnace using flues was employed in Philadelphia, by Professor W. R. Johnson; and in London Jacob Perkins exhibited steam artillery, which did good experimental execution against iron targets, before the Duke of Wellington.

The first signs of the electric telegraph now become apparent; for in 1826, Harrison Dyer erected a line on Long Island and used frictional electricity to give sparks wherewith to mark chemically prepared paper. Dr. Nott, of Union College, in the same year, patented his celebrated stoves, which gave him a worldwide reputation. In 1827, John McClintic, of Pennsylvania, devised the first practical mortising and tenoning machine; and in the same year Mr. W. C. Redfield published his "Laws of Storms," wherein by long-continued observation, he showed that storms are vast whirlwinds, having both a rotary motion and a motion of translation on a curved path. Mr. Redfield's discoveries are of immense value, since they afford a knowledge of cyclones which enables navigators to avoid them. The first locomotive trip in America was made on the Carbondale and Honesdale road in Pennsylvania, in 1828. During the same year, the first American patent for a locomotive was obtained and the first straw and hay paper was made. It was in 1828 that James Bogardus invented the ring flyer for cotton spinning now in general use, and then, like Saxton and Burden, produced invention after invention with wonderful celerity. In 1829 he invented mills with eccentric grinding plates, which have never been fully superseded, in 1832 the dry gas meter, and a machine for transferring bank note plates. In 1836 he devised a marvelously ingenious engraving machine, and in 1840 machines for pressing glass tumblers. He also made important improvements in drilling machines, and in 1847 erected in New York the first cast iron building, we believe, ever constructed.

We now reach the period when the discoveries of Professor Joseph Henry, foremost of living American scientists, were made known. Previous to his investigations, the means of developing magnetism in soft iron were imperfectly understood. He was the first to prove by actual experiment that, in order to develop magnetic power at a distance, a galvanic battery of intensity must be employed to project the current through the long conductor, and that a magnet surrounded by many turns of one long wire must be used to receive this current. He was also the first to actually magnetize a piece of iron at a distance, and he invented the first machine moved by the agency of electromagnetism. In 1829 he exhibited to the Albany Institute electromagnets of power superior to any before known ; in 1831 he transmitted signals by an electromagnet through a wire more than a mile in length, and caused a bell to ring. In 1833, while Professor of Natural Philosophy at Princeton College, he explained the electromagnetic telegraph, but he never reduced the principles described to actual practice. Professor Henry also as early as 1830 demonstrated that the discharge of a Leyden jar consists of a series of oscillations backward and forward, a fact afterward by him proved true of lightning. He also made the remarkable discovery that a voltaic current induces an extra current in the conductor in which it is itself conveyed, which, however, manifests itself only on making or breaking connection with the battery. The system of conductors adapted to the demonstration are flat spirals of copper ribbon, known as Henry's coils; and by these, induced currents of the ninth order have been demonstrated, and the possible number is theoretically unlimited.

The years 1830 to 1833 were prolific in electrical discovery. Following so close upon Henry's investigations as almost to be mingled with them came those of Dr. Charles G. Page. He invented ingenious electromagnetic locomotives, two of which pulled a car, weighing eleven tuns and carrying fourteen passengers, at the rate of nineteen miles an hour; he observed that the molecular changes in a bar of iron produced by magnetization are attended by audible sounds; he invented a pole changer whereby a magneto-electric machine may be made a substitute for a galvanic battery in electrolytic and galvanoplastic operations. He also devised the earliest form of induction coil, and made a large number of important discoveries in connection therewith, resulting in the invention of a spark-arresting circuit breaker.

It was in the autumn of 1832 that Samuel F. B. B. Morse, then an artist in painting by profession, embarked at Havre to return to this country. On that voyage, while in casual conversation with a passenger on the recent discovery of the relation of electricity and magnetism, he conceived the idea of the electromagnetic and chemical recording telegraph substantially as it now exists. Before the close of the year a part of the apparatus was constructed in New York; but the telegraph was not experimentally exhibited in operation until 1835. In 1837 he filed a caveat and sought, fruitlessly, Congressional pecuniary aid. From this time, the inventor's life was a continued struggle against scanty means and adverse circumstances, until the session of Congress of 1842-3, when he obtained an appropriation, and in 1844 the experimental line between New York and Washington was completed, and the practicability of the electromagnetic telegraph demonstrated. To Professor Morse is also due the origination of submarine telegraphy, and the first submerged lines were laid by him in New York harbor in 1842. He also made the first daguerreotype apparatus and took the first sun pictures produced in America.

In 1832 Edward Evans patented the method of unhairing hides by sweating, without the use of lime. During the same year, Dr. Samuel Guthrie, of Sackett's Harbor, N. Y., discovered chloroform, although he did not understand its true constitution, and called it chloric ether. At this period also was produced the first lock stitch sewing machine, by Walter Hunt. Hunt made and sold his machines, but was an erratic genius, too versatile to be successful, and through his sheer negligence lost the opportunity of acquiring the fame and fortune which Elias Howe and other patentees subsequently realized. In 1832 M. W. Baldwin, of Philadelphia, was engaged in perfecting many of his numerous inventions in locomotive mechanism. He devised the plan of attaching cylinders to the outside of the smoke box, metallic ground joints, and other valuable improvements. His most important invention was the flexible truck locomotive, patented in 1842. Seth Boyden, of Newark, N. J., had already discovered the japan or varnish by which patent leather is produced, and had laid the foundation of the manufacture of that material, which has been successfully carried on at the latter place ever since. He also pursued experiments with a view to converting the hardest laminated iron into soft malleable iron; and these succeeding, he began making malleable iron castings, between 1831 and 1835. He subsequently invented several important improvements in steam engines, notably the cut-off instead of the throttle valve, and the connection between cut-off and governor. The first practical automatic pin machine appeared in 1832, and was the invention of Dr. John I. Howe, of Connecticut. It formed the head of the pin by dies from a coil of fine wire. In 1833, Hussey, of Maryland, made the first practical harvester. It had open fingers, with a knife reciprocating in the space. He was followed in 1834 by Cyrus H. McCormick, who invented the reaper, in which a sickel-edged sectional knife was reciprocated by mechanism from the drive wheel, and fingers gathered the grain. This was an invention of great importance; and it met with worldwide usage and secured great rewards to the inventor, who still carries on the business of manufacture on an enormous scale in Chicago.

In 1834 Professor Denison Olmsted, of New Haven, Conn., by observations of the great meteor shower of the preceding year, reached the theory that meteors are portions of a nebulous body drawn into the earth's atmosphere and inflamed by the heat generated by the resistance of the atmosphere to their motion. During the next year, Dr. J. W. Draper began his magnificent investigations of the actinic rays of the spectrum, which included experiments on the absorption of the chemical rays by solid and liquid media, the decomposition of carbonic acid by light, the interference of chemical rays, the crystalization of substances by rays of light, the supposed magnetizing properties of light (which he found not to exist), and the effects of light upon vegetation. Dr. Draper was the first to photograph Fraunhofer's lines, the first to take a portrait by daguerreotypy, the first to suggest the relation between the spectra of incandescent bodies and their physical or chemical composition, the first to devise charts of the spectral lines of bodies, the first to explain the mechanical cause of flow of sap in plants, and that the yellow ray and not the violet produces the reduction of carbonic acid therein, and the first to photograph the moon. No one American investigator has made more original researches, or extended them over a wider field, or contributed more largely to the general progress of Science, than Dr. Draper.

In 1836, another great invention appeared in the shape of revolving fire arms, which were patented by Colonel Samuel Colt, of Hartford, Conn. These were first used in the Florida war of 1837; but it was not until the outbreak of the Mexican war of 1847 that Colt erected the works in Hartford which have since assumed such immense proportions. Colt also invented a submarine battery of great power. In the next year (1837), A. A. Wells patented the process now in general use for forming the bodies of fur hats by depositing the material directly on a perforated cone revolving in connection with an exhausting fan. At about this time John Ericsson successfully applied the screw propeller to purposes of navigation in England, and immediately thereafter emigrated to this country, to which belongs his subsequent record, of which mention will be made further on. In 1839 the United States government despatched an exploring expedition to the antartic regions. No other explorations of that part of the globe have since been made, and the somewhat doubtful report of an antartic continent, brought back by the United States' vessels, has not been fully verified. During the same year Charles Goodyear made the important invention of vulcanizing india rubber. He had already discovered a method of treating the surface of native india rubber by nitric acid, which allowed a surface of rubber to be exposed on goods, hitherto impracticable owing to the adhesiveness of the material. In the course of experiments in 1839, he found that a piece of rubber, mixed with ingredients among which was sulphur, upon being accidentally brought in contact with a red hot stove, was not melted; but that in certain portions it was charred, and in other portions remained elastic, though deprived of all adhesiveness. More than sixty patents were afterwards taken out by him for improvements in treating india rubber and on articles manufactured from it. In 1839 also Erastus B. Bigelow invented his power loom for weaving ingrain carpet. This machine could easily weave from twenty-five to twenty-seven yards per day, whereas the previous hand loom production never exceeded eight yards. The invention was followed later by a power loom for Brussels and tapestry carpets, one of the most ingenious pieces of mechanism ever devised. Mr. Bigelow also invented a machine for weaving coach lace, and another for weaving counterpanes, both of which are in extensive use.

Here we may close the review of a period remarkable for the number of great inventions made during its continuance. The original types then produced have since formed the foundation of thousands of modifications and improvements, and the end of making such changes seems far from being attained. Progress therefore since 1840, though rapid, is due to development of previous ideas, more perhaps than to origination of new ones.

Our next issue will contain a continued history of the more remarkable inventions and discoveries from 1840 up to the present time.

RECLAIMING THE STEPPES.

It is a well known fact that there exists in the southeastern portion of the Russian empire an immense basin, depressed below the level of the ocean. In this basin lies the Caspian Sea, and into it also flow the great rivers Ural and Volga, which drain a large portion of central Russia. In the course of ages, the rivers have carried down soil and formed vast deposits which have encroached upon the sea, contracting its dimensions and elevating its bottom in parts, so that for large vessels it is no longer wholly navigable. As the sea diminished in size, so did the supply of watery vapor in the adjacent atmosphere become less; and moisture failing, the land near by has gradually changed into a desert, which is steadily growing. It is thousands of years, probably, since the arid wastes or steppes began to form; but their spread has continued until now an immense region is unfit for human habitation.

To reclaim this desert and restore it to its former state of fertility is the object of a gigantic engineering project, recently suggested by Mr. Spalding, an American engineer resident in Europe. The plan involves the connection of the Caspian with the Black Sea by means of a canal, which is described in detail on another page of this issue. It appears that the surface of the Caspian is forty-eight feet lower than that of the Black Sea. Mr. Spalding proposes to excavate from the Caspian a cutting, 480 feet wide, westward to such a distance that at its western end it would reach a depth of 32 feet. The surface of the earth at that point would be 16 feet below the level of the Black Sea. The remainder of the distance is to be traversed by a narrower channel, 160 feet wide and 9·6 feet deep at the Black Sea end, and 16 feet deep at its junction with the broader cutting. This gives a fall of 6·4 feet between the two extremities of the narrower channel, and the total length of both cuttings is about 166 miles. It is calculated that the water from the Black Sea would flow, along the slope above mentioned, at the rate of ome 7·2 miles per hour, and that, if the channels remaineds at their original dimensions, it would take four hundred years to bring the Caspian to a level with the Black Sea. As, however, the action of the rapid stream would infallibly soon deepen and increase the width of the passage, Mr. Spalding estimates that in forty years the levels of the two seas would be so nearly the same that the channel would be navigable. This new Mediterranean could be traversed by large ships from the borders of Persia to about the fiftieth parallel of north latitude, along the estuaries of the Ural and Volga, and to a much greater distance by ships of small burden.

The importance of the work, judging from the results expected, is not exceeded by that of the Suez Canal. The world is none too large for its population; and to reclaim the hundreds of square miles of arid Russian steppes would be to add territory and natural resources of inestimable value, not only to the Russian empire, but to all humanity.

FRENCH ARTISANS AT THE CENTENNIAL.

It is to be regretted that a meeting, recently held in Paris for the purpose of raising a fund to enable one hundred and twenty French artisans to visit the Centennial, should have been made the scene of wild communistic harangues by such firebrands as Louis Blanc and Victor Hugo. The circumstance tends to put the workmen, who may be sent here with the funds obtained through such arguments, in the light of representatives of a cause which is the embodiment of demagoguery, and with which American workmen, proud as they are of our republican institutions, have no sympathy. We had a sufficiency of agitation of the communistic character during the strike of 1872; and to the credit of our working men be it said that, even when partisan feeling ran highest, they turned away in contempt from the blatant incitors who prated of "blood and bayonets" and denounced the authority of law.

If the French artisans come here simply as workmen seeking to learn, they will find their fellow craftsmen ready to welcome and to instruct them. If, on the other hand, they visit us as apostles of the doctrines of Rochefort, Hugo, and Blanc, while no one will challenge their right to their opinions, any attempts on their part to inculcate them will encounter a rebuff so emphasized as to leave no doubt as to its signification.

THE OPENING OF THE CENTENNIAL.

The simple but impressive ceremonies which marked the opening of the Centennial passed off in a way that must have satisfied the most sanguine anticipations. In the hurry of preparation some things are forgotten, and others are apt not to fall in their proper places at the specified time; but on this occasion the great machine started off with wonderful precision. The day in Philadelphia dawned wet and cloudy. During the previous twenty-four hours there had been heavy rains, and many remembered with some dismay the depressing effect of the drenching showers which fell during the opening of the Vienna Exposition. Long before the appointed hour, however, the clouds broke away and the sun burst forth, and the predictions of the "probabilities" that fair weather was at hand, to the relief of all concerned, were verified. As early as nine o'clock the gates were opened; and thousands of people surged into the grounds, flocking to the front of Memorial Hall, where every inch of space commanding a view was in a few moments occupied. By the time the ceremonies began, over one hundred thousand persons had assembled, packing an area fully half a mile in length by 250 yards in width. While the people were thronging in at one portal, the orchestra of two hundred musicians and the nine hundred singers were admitted at other entrances. Later, the invited guests began to arrive; and as the dignitaries, both national and foreign, took their places, the expectant throng vented its enthusiasm in prolonged cheering. A tempestuous burst of applause greeted the Brazilian Emperor, who, with the Empress, occupied seats on the platform; and when the President, accompanied by his military escort and by his cabinet ministers, arrived, the shouts were deafening. Quiet was not restored until the ceremonies were fairly opened by the orchestra playing the famous Centennial March, written by Richard Wagner. Musical critics speak highly of the composition; but it was generally conceded that it was not adapted for outdoor performance, as it contained very many passages wholly inaudible except to the few hundred in the immediate vicinity of the performers. This being over, Bishop Simpson advanced to the front of the platform and delivered a lengthy prayer, the immense throng, though but few could hear the speaker, maintaining perfect stillness and decorum. A magnificent burst of music followed, in which a thousand voices, accompanied by organ and orchestra, sang Whittier's Centennial Hymn, in the last portion of which nearly the whole audience joined, producing a volume of sound of indescribable grandeur. Hon. John Welsh, President of the Board of Finance, then formally presented the buildings to the Centennial Commission. The cantata written for the occasion, by Sidney Lanier, was next sung. The senseless words of this production were happily compensated for by the superb musical setting given them by Mr. Dudley Buck.

These preliminaries concluded, the first important speech was made, by General Hawley, President of the Centennial Commission. After reviewing the inception of the project of an international exposition, and briefly referring to the labors of those charged with its preparation, he concluded as follows:

"It has been the fervent hope of the Commission that, during this festival year, the people from all States and sections, of all creeds and churches, all parties and classes, burying all resentments, would come up together to this birthplace of our liberties, to study the evidence of our resources; to measure the progress of a hundred years; and to examine to our profit the wonderful products of other lands; but especially to join hands in a perfect fraternity, and to promise the God of our fathers that the new country will surpass the old in the true glories of civilization. And furthermore, that, from the association here of welcome visitors from all nations, there may result not alone great benefits to invention, manufactures, agriculture, trade, and commerce, but also stronger international friendships and more lasting peace.

"Thus reporting to you, Mr. President, under the laws of the government and the usage of similar occasions, in the name of the United States Centennial Commission, I present to your view the International Exhibition of 1876."

On the closing of this speech, President Grant began the reading of his address. It very briefly referred to the objects of the Exposition, and to the vast progress of the nation during the past century. At the words "I declare the International Exposition now open," the signal was given, and the national flag was run up on the great tower of the main building. The bells and steam whistles all over the city burst into a chorus of noises, with which were mingled the thunder of the saluting batteries. The orchestra, organ, and singers pealed forth the Hallelujah Chorus, and the procession of invited guests, headed by the President and Emperor, was then formed, and the march through the Main Building began.

During the morning, the two great engines had been started at intervals, and every bearing had been freshly oiled, so that no possible obstacle could exist to prevent their formal beginning of work at the proper time. Mr. Corliss stood by his gigantic offspring, waiting the arrival of the President. As the head of the procession reached the engines, General Grant and Emperor Dom Pedro stepped forward; and instructed by Mr. Corliss, each grasped the bright lever of a throttle valve. There was a moment's delay for the dignitaries to gather, and then, at 1.20 o'clock, Mr. Corliss waved his hand, the signal for admitting the steam to the cylinders of the gigantic machines. It was a scene to be remembered; and perhaps for the first time in the history of mankind, two of the greatest rulers in the world obeyed the order of an inventor citizen.

The Emperor, with his characteristic energy, was the quickest to move his lever, but the President was but a second behind; and as the motion was completed, the steam hissed into the great cylinders, the mighty arms of metal slowly began their movement, pulleys answered to the strain of belts, and the mechanism of the vast building started into life and activity. The Empress of Brazil meanwhile visited the Women's Pavilion, and there pulled a golden cord which set in motion the engine that drives the looms Thus ended the ceremonial part of the opening, and the people scattered themselves over the grounds and through the buildings, while throngs visited the restaurants, and literally devoured every ounce of food which had been supplied; and by four o'clock, when President Grant and the Emperor returned to the grounds and sought to dine at the principal restaurant, they found several thousand hungry American sovereigns had been there before them, and they were obliged to go elsewhere for their dinner.

The interiors of some of the buildings, by dint of day and night work of a multitude of workmen during the past week, have been partially reduced to order; but here and there, and almost everywhere, a wilderness of packing boxes and rubbish is to be met with, and it will be some time yet before every department will be in perfect order.

It is impossible, at the present writing, to form any adequate idea as to the variety and novelty of the exhibits. The objects are there, but they are yet to be arranged and classified; and until this is done, a description of them, and a comparison with what we are used to seeing, must be deferred.

Government Provision for Mechanics at the Centennial.

We learn that a bill has been introduced in the House of Representatives, directing the President to appoint six skilled mechanics from each Congressional district, "whose duty it will be to attend the Centennial International Exposition at Philadelphia, carefully study the arts, industries, and products there exhibited, and make full report in writing of all that, in their judgment, is important and useful to the practical and scientific industries of this country." It is further provided that they shall be paid for their work "such sum as the Secretary of the Treasury shall deem a fair compensation." There are 292 Congressional districts, so that the corps of skilled mechanics will number over 1,750 persons. If they all attend the exhibition every day, a very comfortable addition will be made to its daily receipts at the expense of the government.

The constitutional authority to incur this expenditure will probably be found, says the *Evening Post*, just where the authority to establish a department of agriculture and an education bureau was found. Most persons will agree, however, that, if the enlightened people of this country do not take the trouble to learn for themselves what there is important and useful in the exhibition, they do not deserve to have a paternal government do it for them.

Publishing the English Patents.

The London Patent Office is about to adopt our Patent Office system of producing copies of drawings of patents by the photo-lithographic process, in place of the large lithographic sheets which now accompany the printed specifications of all English patents. Considerable opposition to this change was made by the London patent agents; but we believe it only arose from abhorrence of change, which is the national characteristic of the Englishman. But the British public will soon find our mode of producing copies far better than their old plan of lithography.