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THE SCIENTIFIC AMERICAN SUPPLEMENT. No. 21.
For the Week ending May 20, 1876
With 65 Illustrations.

III. CHEMISTRY AND METALLUPGY.-Iron Direct from the Blast Fur
nace.-Feromaneanese.-Manufacture of Steel, by GAUTIER.- New
PTocess for Iron
IV. NATURAL HISTORY, ETC. -WIth 6 engravingg.-Fossil Foot Prints,
with 4 engravings.-Flora of New Caledonla, 2 engravinge. - Remarkable
Avalanche.- The Depth of the Sea.
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AMERICAN PROGRESS--I.-.-FROM 1776 TO 1820.
There are few darker pages in history than those whic recount the condition of the thirteen colonies of North Amer ica during the months just previous to the adoption of the Declaration of Independence. A year had elapsed since arms had been taken up against the mother country; and although the colonists had resisted successfully, the very fact carried fresh terror to the doubting, for it augured invasion, not by a few battalions sent to quell a rebellious mob, but by the not extirpation, then reduction beneath a tyranny mor grinding than that against which they had revolted, now grinding than that against which they had revolted, now
menaced the rebels. Congress sat doulting, distrustful, divided in thought, seeing no glimmer of light in the pre divided in thought, seeing no glimmer of light in the pre-
vailing darkness, thinking, as John Adams moved on the 10th of May, 1776, that the colonies should themselves establish separate governments, " adequate to the exigencies." But the stirring eloquence of Thomas Paine was ringing through the land, replete with the suggestion of a hope which none had dared to cherish. The war against England's blind and headlong oppression was fast becoming, through popular sentiment alone, a war against England herself; and i needed but the formal declaration of Congress to elevate the confict from a mere rebellion to that grandest of wars, which ational existence
To turn from the political to the industrial condition of the colonies is but to bring to view fresh evidences to show the fragility of the foundation on which the fabric of our country was reared. Iron and steel works there were none nor woolen nor fiax manufactories: all were suppressed by England. Iron founderies had been started, and in New Eng land hats had been made; but Parliament declared Americ factories " a nuisance," and crushed them ruthlessly. It al lowed the production of pigiron; but the colonist was forced to have the material manufactured in England, and pay an enormous profit to the English founder. Agriculture, hunt ing, fishing, and cutting lumber, England could not check hence these furnished occupations to those who were not engaged in such few trades as were carried on. Probably the most extensive factory in the country was Baron Stiegel's glass house, in Mannheim, near Lancaster, Pa. Operations were conducted in a curious manner, for the owner's idea non wherewith to salute himself on arriving and departing; and when a guest was received, the workmen were sum moned from furnace and foundery to attend the new comer with music and rejoicing. The war cut off the Baron's funds from Europe, and the works were soon after discontinued. Shipbuilding existed in New England, and brick-making in nearly all the colonies. There were but two steam en gines in the territory ; one builtin 1772 , for use in a distillery in Philadelphia; the other had been imported in 1736, for
the Schuyler copper mines, at Passaic, N. J. Both were of the Schuyler copper mines, at Passaic, N. J. Both were of
the Newcomen type. No agricultural machines were known, except, perhaps, the grain drill, no cotton mills existed, and the green seed or staple cotton alone was cultivated. Not a printing press existed west of the Alleghanies; and there were only forty, all hand machines of the crudest type, in the
colonies. Thirty-seven newspapers sufficed to spread in telligence. From Boston to New York was a week's joumey by coach, sloops plied between New York and Albany; and in winter, colonists in Virginia were practically isolated from those in Massachusetts. Certainly no nation ever embarked in so gigantic a struggle worse prepared; for of the material prosperity whence the sinews of war are drawn, the colonies were destitute. Canada, refusing to join them, furnished vantage ground for the invader.
The Spaniards along the Mississippi looked with no favor on the rebellion, and the English in Florida were actively hostile. Thus on the 10th day of May, 1776, just one hundred years before the opening day of the Centennial, the few but resolute inhabitants of the thirteen colonies found themselves hemmed around with foes, bankrupt in money and among the Indians on the border wildernesses, disunited in thought and feeling among themselves; and to crown all, a British army was preparing to attack New York, while all the seaboard cities seemed doomed to certain and swift de struction. Yet, in the face of these terrible odds, Indepen
dence was proclaimed, and the nation was born. It is proclaimed, and the nation was born
It is our purpose to present here some brief account of what Americans have accomplished in Science and inventio since the bell in Philadelphia pealed forth " liberty through out the land." Much must necessarily be omitted; of nothing can we take more than a passing glance, so vast and
varied are the achievements which, beyond all else, have varied are the achievements which, beyond all else, have
combined to create a great and powerful nation in the shortest period known to history. To the same ancestry that asserted their rights as freeborn men, an ancestry gathered from the skillful workers of all countries, are due means to and industrious habits, the facility of adopting which characterize the American people; and it is well to remember that in the very restrictions placed upon their efforts toward progress were found the impelling causes of the war of independence.
The industries of the country being practically ruined when the war began, the record of invention and scientific progress up to the close of the confiict is meager in the ex treme. The discoveries of Franklin, the first great contribu
tions of the New World to Science, had all been made; it wa tions of the New World to Science, had all been made; it was
in 1752 that he demonstrated the identity of lightning with in 1752 that he demonstrated the identity of lightning with Early in 1775 he left England, where he had been hon ored and courted, and returned to bide his fortunes with
his native country; but even the engrossing labors im posed upon him as a member of the Continental Congress and a framer of the Declaration were not sufficient to distract his attention from Science; and when sent as Commissioner to Paris, he took advantage of the voyage to make observations of the Gulf Stream and to plot a chart of that great current, which still forms the basis of our maps.
One other name, that of David Rittenhouse, of Phila delphia, may be noted beside that of Franklin, whom he succeeded as President of the American Philosophical Society. Rittenhouse was a clockmaker and carried the per fection of his art into the manufacture of orreries, which still exist, and which show the movements of the heavenly bodies for a period of 5,000 years, and their positions for each year, month, day, and hour, with marvelous accuracy. He made a successful observation of the transit of Venus in made a successful observation of the transit of Venus in
1769 , and on account of his great mathematical attainments 1769, and on account of his great mathematical
was elected a Fellow of the British Royal Society.
After peace had been declared, the country found itself ex hausted in resources and in men as well, and saddled with a debt of forty million dollars, with no system of public revenue wherewith to provide for it. Financial disaster fol owed, and private confidence fell in the wreck of public faith. It was no time to await the slow development of events, and the people recognized the fact. It seemed as i very one worked with a will. The whir of the spinnin wheel and creak of the loom were heard all over the land. Every family became a manufacturing society. In 1784 New Jersey alone had forty-one fulling mills for woolen fabrics and not a woolen factory in the State. In two counties in Virginia, 315,000 yards of fiaxen cloth, 45,000 yards of wooln, 30,000 yards of cotton, and 45,000 of linsey woolsey wer made in one year by household labor. One family completed 1,355 pair of shoes in a year. The inventor's skill was quickly alled into action
In 1785 Oliver Evans, of Philadelphia, first applied steam machinery to the grinding of plaster and sawing of stone and to fiour mills. Then he invented the elevator or bucke chain to raise grain, the conveyer to take it from place to place, the hopper boy to spread it, the drill to carry it by rakes instead of buckets, and the kiln dryer. In 1799 he ttempted to build a steam carriage, and in so doing invented nd constructed the first high pressure steam engine. In 185 John Fitch built the first steamboat, and ran it on the Delaware river. It had reciprocating paddles, and steamed at the rate of eighty miles per day. During the succeeding year James Rumsey propelled a boat on the Potomac by a stream of water driven out through the stern by a steam en gine. In 1790 Jacob Perkins, of Massachusetts, invented a gine. In 1790 Jacob Perkins, of Massachusetts, invented a machine for cutting and heading nails, which produced those useful articles at the unprecedented rate of 200,000 a day. On
he 31 st of July, 1790 , the first United States patent was is sued, the patent and copyright laws being both first enacted in that year; and thereafter a marked increase in the numbe f inventions becomes visible.
At this period, the growing cotton industry of the country eemed to have encountered an obstacle, which bid fair to be a serious one. Hand-cleaning of cotton was slow and costly; and unless mechanical means could be devised, the new staple could never become a source of wealth. It so happened that there then came to the house of Mrs. General Greene a poor student, from Yale College, named El Whitney, who, in various ways, showed himself possessed f considerable mechanical skill. While some officers, he guests, where one day regretting the absence of the machine above noted, Mrs. Green laughingly suggested that Whitney hould invent one. The young man overheard the word nd remembered them. He had never seen cotton in his ife; but making his way to Savannah, he obtained a smal quantity and, shutting himself up in a room, went to work It is said that the saw gin was suggested to him by the accidental use of a toothpick to try the tenacity of the seed Within ten days after he began experimenting, he made model which was capable of cleaning 50 lbs. of green seed cotton daily. Thus was completed one of the greatest nventions of modern times, and one which theinventor lived to see result in increasing the cotton production from 5 000,000 to $215,000,000 \mathrm{lbs}$.
In 1796 the great scientific discovery of the non-materi lity of heat was made by an American, Benjamin Thomp son, Count Rumford, then residing in Munich. He had de erted his country during the war, and accepted servic ander a foreign prince. This discovery lies at the founde tion of the mechanical theory of heat, and directly led to the grandest doctrines of modern Science, the correlation of force and the conservation of energy.
We may note the establishment of broom-making as a new industry, and the invention of broom-making machinery in 1797, by the Shakers located along the Mohawk river. In the same year Amos Whittemore, of Massachusetts, devised the first machine for the manufacture of wool and cotton ards; this device punctured the leather and set the wires This proved of great value to the industry, and highly re munerative to the inventor. During the following year Robert McKean patented the first steam sawmill.
At the opening of the nineteenth century the signs of re markable progress were everywhere discernible. In ten year the population had increased by nearly two millions. The exports for 1799 were $\$ 78,665,522$ against $\$ 79,069,148$ imports, and during the previous decade 306 patents had been granted.
In 1801, the oxyhydrogen blowpipe was invented by Dr Robert Hare, of Philadelphia, one of the greatest as well a the earliest of American scientists. It occurred to him that a flame produced by the combustion of oxygen and hydrogə gaaes ought to be attended with a higher heat than that gnn
erated by burning charcoal. But the two gases mingled in certain proportion produced a dangerous explosive mixture, and Dr. Hare was thus led to adopting the expedient of storing the gases in separate vessels, and bringing the together by tubes which met at the point of ignition.
Now followed one of the most important advances in steam navigation, although the fact was not recognized for
years after. It was the practical demonstration of the efficacy of the screw propeller, by Colonel John Stevens of Hoboken, who in 1804 built a boat containing a Watt engine, a tubular boiler of his own invention, and the bladed screw. It was a pirogue some fifty feet long. The machine itself is still in existence, and was illustrated in these columns some time ago. During the same year, Oliver Evans ran an amphibious, stern paddlewheel boat on the Delaware and Schuylkill rivers. This was driven by a double action high pressure engine-the first of its kind-which rotated wheels when the craft was ashore, and operated the stern paddle when
afioat. In 1806, Thomas Blanchard, of Massachusetts, invented a machine which made 500 tacks per minute, with perfectly finished heads and points. Soon after, he devised an apparatus for turning gun barrels throughout their entire work which culminated, twenty two years later, in the magnificent invention of the lathe for turning irregular forms. Blanchard's inventions are now applied to many operations in making musket stocks, and comprise no les than thirteen different machines for making different por tions of the weapon.
The following
The following year, 1807, witnessed the triumphal voyage of Robert Fulton's steamer, the Clermont, from New York to Albany. Fulton at that time was already an inventor of repute, both in England and in the United States. He had devised a mill for sawing marble, machines for spinning fiax and making ropes, an excavator for canals, and he had successfully tried, probably, the first submarine torpedo boat It was in relation to the latter that he returned to this appropriation, and made some successful experiments in blowing up vessels ; but ultimately Commodore Rodgers reported the system impracticable. Later, he obtained the exclusive right to navigate the Hudson river in his steam ment the first steam war vessel, a heavy and unwieldy mass ment the first steam war vessel, a heavy and unwieldy mass,
capable of making about $2 \frac{1}{2}$ miles per hour. The war of 1812 , in capable of making about $2 \frac{1}{2}$ miles per hour. The war of 1812 , in
which she was designed to be used, terminated before her which she was designed to be used, terminated before her
completion. Fulton died during the construction of the complet
vessel.
During the year 1807, oil cloth for fioors was invented and manufactured in Philadelphia, and John Bedford of the same city devised the first metal-bound boots and shoes. The first breech-loading military arms ever offered to troops, and likewise the first fire arm made on the interchangeable system, were invented by John H. Hall, of Massachusetts, in 1811. Some of these old weapons were captured at Fort Donelson in 1862.
In 1812, anthracite coal was for the first time successfully utilized. It appears that Colonel George Shoemaker, of Pottsville, took nine wagon loads of the " black stones" to Phila delphia, and there sold two wagon loads to Messrs. White Hazard, wire manafacturers. White and his firemen worked
faithfully for half a day, but the stones refused to burn whereupon at noon they slammed the furnace doors shut in disgust, and went to dinner. On their return the doors were red hot and the furnace in danger of melting. Meanwhile the Colonel had sold his other seven loads to less successful experimenters, and was by t
selling thèm rocks for fuel.
During the war of 1812 but very fewmilitary inventions appear. Probably the most important was the columbiad, long-chambered cannon capable of projecting shot and shella high angles and with heavy charges. It was devised by Colonel Bomford. In 1813, Francis C. Lowell invented numer
ous important improvements in the power loom, notably the stop motion for winding on the beams for dressing, and the stop motion for winding on the beams for dressing, and the
double speeder to regulate the movements of the fiy frame in filling the spools. The first important American improve ment in printing presses appeared in 1817, and was the Columbian press, invented by George Clymer of Phila delphia. The power was applied to the platform by a com pound lever consisting of three simple levers of the second order. The first transatiantic voyage made by a steam vessel was accomplished by the Savannah in 1819 . The vessel was of 380 tuns burden, and was driven by paddles In the year last mentioned, Jacob Perkins invented engrav ing on steel as a substitute for copper.
During the period from 1800 to 1820 , just reviewed, the commerce of the country passed through a season of terrible stagnation, owing to the orders in council of England and Napoleon's Berlin and Milan decrees. In 1808, import cline continued to 1814 , when an to $\$ 22,430,590$. This de given to trade, and imports went up to amounts excessive of the wants of the country. Subsequently, the average o imports and exports remained uniform at about $\$ 78.000,000$ From 1800 to 1810, only 1,086 patents were allowed; an from 1800 to $1,820,1,748$. The population of the country had, however, increased to $9,638,131$, and with it the number and extent of manufacturing industries augmented, thus
providing for the season of renewed prosperity which folprovidi

The rapid growth of this country in population, wealth, and culture since the year 1820 is now a just cause for pride and congratulation; and in our next two issues, we shall note the prominent incidents in this interesting and important

## THE GRAS8HOPPER SCOURGE OF 1876

There is cheering news for Western farmers, con veyed in Professor C. V. Riley's recent statements, in the Colorado Farmer, relative to the probable numbers of the grasshop pers during the coming summer. Some one, it appears, has asserted that the soil of the region in the northwest portion of the country lying east of the Rocky Mountains is cov ered with prodigious numbers of grasshopper eggs; and this disagreeable announcement has gone the rounds of the press,
through the length and breadth of the land. Professor Riley gives it its quietus in so characteristically effective a that we are half inclined to be grateful to the mendacious individual who set the story afioat, since it has been the means of obtaining such welcome intelligence from probably Fre best entomological authority in the country.
From personal observation, Professor Riley states, so far as Missouri and Kansas are concerned, the report is wholly groundless. In Minnesota, a State commission has deter mined that the eggs have mostly perished from excess of moisture, which dissolves the glutinous substance which normally protects and hold them together. In some parts of ward the north, eggs have been deposited in numbers by the swarms which left the lower and more fertile country devas tated last spring; but in that region, such is the case every year, for it is the native home of the swarms which occasionally extend to the upper Mississippi valley. In Missou. ri, Kansas, and Nebraska, however, the number of eggs, lai by the few straggling insects that passed over those States last fall, will not equal that laid in ordinary seasons by in digenous species. In Colorado there is every hope that th protracted rains have destroyed the eggs.
Professor Riley gives it as his conclusion, in addition to the above, that, compared with other parts of the country those States ravaged by locusts in last spring and early sum mer will enjoy the greater immunity during the same sea son of 1876, not only from locust injuries, but from the in juries of obnoxious insects, except the wood borers. In short, the people of the ravaged section have every reaso to be hopeful rather than gloomy.

## FIRE INSURANCE

The address of Mr. H. A. Oakley, President of the Nation al Board of Fire Underwriters, delivered before that body a its recent session in this city, contains many useful sugges tions relative to fireproof building, which, however, here a least, appear to be "more honored in the breach than in
the observance;" and the speaker's impressions of European fireproof construction may well be contrasted with the way in which late edifices are built in this city. He remarked he says, the universal use of concrete fioors, of oak, and other hard woods instead of pine as finish, the entire separa tion of stories from each other, the absence of wooden or lath and plastered partitions, the solid backing given to the exterior of fronts, the thickness of division walls, the ab sence of wooden staircases, the isolation of fiues from beam or woodwork, the hight of the buildings (not exceeding sixty five feet), and the covering of the roofs with iron and slate laid on beds of plaster. To compare this excellent resume of what fireproof building ought to be with the fiimsy af fairs built in this country is to adduce at once the reason of the
gigantic confiagrations with which even the best organized of fire departments are unable to cope. A building even now in process of erection on Broadway is exteriorly a mer shell of thin iron which towers above the adjacent struc tures, while within it is a network of wooden beams and partitions, its present exposed skeleton showing no trace o fireproof fittings. There are many other structures of the same description in New York city.
Mr. Oakley tells us that the solid character of its build ngs alone saved Paris from destruction at the hands of the he communists; and he states that he witnessed the burn ing of entire fioors in houses, involving the destruction of ferything in them, without perceptible damage to the stori
The percentages of losses paid to premiums received a gregates $47 \cdot 16$ per cent for 1875 against $42 \cdot 50$ per cent for 1874. The loss rate for the first three months of the pre ent year is largely in excess of the like period in 1875; and generally speaking, Mr. Oakley considers that the outlook for the insurance business is not good. He further says that despite all the modern appliances for the prevention of fires, the fact still remains that there is a steady increase in their number, and from causes too often within the control of the owners or occupants of the property. We pointed ont this state of affairs some time since as one of the disadvantage of the insurance system, disadvantages sufficiently great to excite the question as to whether, after all, insurance not more injurious than beneficial to the community. The carelessness on the part of owners, of which Mr. Oakley complains, seems to us the legitimate consequence of the isk of loss being taken off their shoulders; and for the ame reason, they have little interest in availing themselve property.
Moreover, buildings have very often been burned, and life and adjacent property been imperiled, merely to obtain in surance money; and certainly few edifices are better adapted to the practice of this crime than those of the type which we which effaces all evidence of the deed. It may be added that at the present time, when real estate has greatly depre ciated in value, such incendiarism might well be most prevalent; and this is in significant accordance with Mr. Oakley' hers of fires.

## PROGRESS AT THE CENTENNIAL

Contrary to the general expectation, the Exposition will e nearly complete on the opening day. Nine tenths of all he exhibits are in place, and there is every indication tha every department will be further advanced than has been he case on the first day of any previous World's Fair Machinery, Agricultural, and Horticultural Halls will be filed; and from the rapid manner in which the work is now progressing, it appears that the Art Department will like wise be in readiness. The condition of affairs at the present time is in marked contrast with the disorder prevalent two weeks ago; and the wonderful celerity with which the thou sands of contributions have been arranged is another instance f that peculiar American characteristic which delays matter o the last moment, and then accomplishes herculean task in incredibly short periods of time.
The Centennial Commission has likewise indulged in tardi ess in disposing of some of the more important question before it, and in making many material alterations in exist ing regulations. We allude elsewhere to its action in closing he Exposition and grounds on Sunday. The temperanc question has recently been discussed, the point being whether to approve of the contracts, made by the Doard of Finance, licensing the sale of intoxicating liquors in the rounds. The Commission arrived at no conclusion, and indefinitely postponed the whole subject, leaving the liguor men to sell their beverages under the concessions and the temperance advocates to carry the matter, if they so elect, to the decision of another tribunal. Some important changes in the jury arrangements, we notice, have already been made. Owing to the immense number of applications for made. Owing to the immense number of applications for positions on the American Committee, some 4,000 in all, the names of appointees have been kept secret, and it is only ately that any of those who, it is desired, shall serve have been notified of the fact. The total number of jurors has been increased from 200 to 250 ; one half of the membersare oreigners, to be chosen by the foreign commissioners, and the other half Americans. Ninety-six of the latter, we learn, have been selected, fifteen of whom are from New York, and fourteen from Pennsylvania, other States having a smaller epresentation. The pay of the American jurors has been reduced from $\$ 1,000$ to $\$ 500$, a proceeding of questionable isdom, in view of the fact that elaborate professional ports are to be required in lieu of medals or other more pasily settled a required, in lieu of medals or other more fford the time and labor, which are involved ints who can fard the time and criticism which are in careful coming six months, in return for a sum of money hardly coming six months, in return for a sum of money hardly
sufficient to meet their necessary expenses. It would have sufficient to meet their necessary expenses. It would have
been better to have abolished free passes, and increased the been better to have abolished free passes, and increased the
revenue in that way, than to have reduced the jurors' pay revenue in that way, tha
to such a small amount.
The Centennial Bank has been opened, and doubtless will prove a great convenience to exhibitors and visitors. Krupp's 1,600 pounder cannon has been removed from the steamer and set up in the grounds, A magnificent series of indusrial art productions has recently arrived from Italy; and a boat load of young alligators, from Florida, are disporting hemselves in one of the ponds
The President of the Commission has issued the final ad ress, or rather invitation, to the public. He says

The sanitary condition of Philadelphia is good; rational musements have been provided ; arrangements for protecion from fire, thieves, etc., are as nearly perfect as it is pos sible in a great city. Within the Exhibition every precauion has been taken for the safety, comfort, happiness, and pleasure of the public. The buildings of the Exhibition are in order. The Exhibition will promptly open on May 10, and is an assured fact. All preparations have been made on a gigantic scale. Bhiladelph and her citizens have spent millions in preparation for the reception and care of guests. There is no disposition to nor evidence of extortion. Increased business at usual rates is considered sufficient compensation or the vast amount of capital and labor expended. Living is as cheap as, if not cheaper than, in any large city in America. The accommodations are unsurpassed. All grades of society can be accommodated. Railroad and transportation facilities are unequaled."
There is no doubt, it now appears, of Philadelphia being able to entertain, at reasonable prices, 150,000 and possibly 200,000 persons. The hotels will charge from $\$ 5$ to $\$ 1.50$ per day, boarding houses $\$ 1$ to $\$ 2.50$, and the Centennial Agency will provide breakfast,lodging, and supper for $\$ 2.50$. By steam and horse cars, 20,000 persons per hour can reach the Exposition from any part of Philadelphia. One minute after the arrival of trains on all main lines, passengers can be within the Centennial Buildings. There is a good prospect of still further reductions to railway fares being made, n order that every one may visit the Exposition at a comparatively small expenditure.
By the time our next number is issued, the opening cere monies will have taken place, and the long-looked-for Cenennial will be fairly under way. We shall give full descriptions of the proceedings; and when the various departments are in a condition to admit of proper examination of their contents, we shall make our readers acquainted with whatever seems to us novel and interesting.

A SOLUTION of iodide of potassium is slowly decomposed by he action of light; but when some cane sugar is added, it turns yellow, owing to the liberation of iodine. If starch is present blue color is produced. If a sheet of starched paper is soake in a solution of iodide of potassium and sugar in the dark, and then exposed under a photographic negative to light, a blue positive print is obtained, which is fixed by washing in

