SCIENTIFIC AMERICAN

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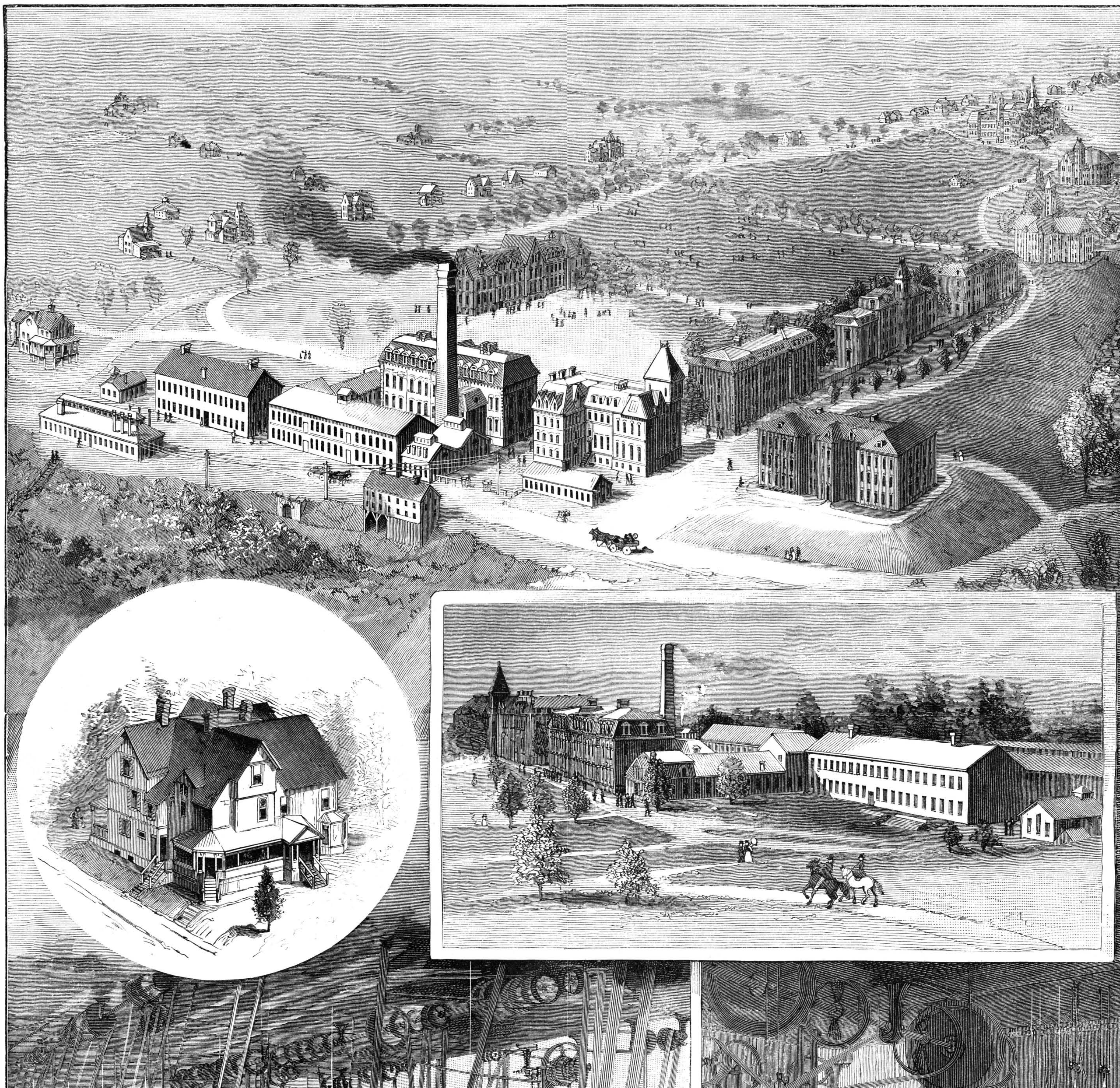

1. University campus and bird's eye view of University grounds. 2. Residence of Prof. Thurston, Director of Sibley College. 3. Sibley College buildings. 4. Machine shop. 5. Electric motor testing room.

ILLUSTRATIONS OF SIBLEY COLLEGE, CORNELL UNIVERSITY, ITHACA, N. Y.—[See page 229.]

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 11, 1890.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 771.

For the Week Ending October 11, 1890.

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MEETING OF THE BRITISH IRON AND STEEL INSTITUTE IN NEW YORK.

During the week commencing September 29, there were assembled in New York City a larger number of representative men connected with the iron and steel manufacture than were ever before congregated in this or probably any other country. The American Institute of Mining Engineers held its sessions here on September 29 and 30, and on Wednesday, October 1, commenced the daily sessions of the British Iron and Steel Institute, which held its fall meeting here this year on the invitation of the American society. In addition to a very large attendance of members of both of these societies, there was a numerous delegation of German and French engineers present, and one of the principal hotels of the city, which had been made the headquarters of the visiting delegates, was crowded to overflowing. The time not taken up by the regular business at the meetings was devoted to sight seeing and social intercourse of the most friendly nature in New York and vicinity, the visitors then departing to inspect the mines, furnaces, and leading industrial establishments of the country, view some of its more notable examples of engineering work, and obtain a more adequate conception of the great wealth of its natural resources, a task to which a number of the visitors will devote themselves for several weeks.

The British Iron and Steel Institute was founded in 1869, two years before the similar societies in America and Germany, and among its original members were Sir Henry Bessemer, Sir J. Lowthian Bell, and Sir William Siemens. The society has included in its membership nearly all who have been in any way prominent in the iron and steel manufacture of Great Britain for the past twenty years, and although it has formerly held meetings in other cities—in Paris, Liege, Dusseldorf, and Vienna—it is peculiarly significant that it should hold its first meeting on this side of the Atlantic in the first year in which the American production of iron exceeds that of Great Britain. Hereafter, the United States will lead the world in this great branch of manufacture, with a constantly increasing production the magnitude of which no one would wisely undertake to predict, but it is rather as co-workers in the same field, than as competitors, that our iron masters met the visiting engineers.

The address of welcome to the visitors by Mr. Carnegie, the president of the American society, was extremely felicitous, and especially so in its generous acknowledgment of what was due from American iron manufacturers to the foreign workers in the same field, concerning which he said: "What the new land owes to you of the old constitutes so vast a debt as to baffle computation. In your own immediate domain of coal, of iron, and of steel, we have been only your pupils. The original inventions were all your own. The American has necessarily been restricted to the development and improvement rather than to the origination of new methods in this department. The genius of Europe has preceded him and invented the processes under which we still labor. The inventions of Cort, Neilson, Nasmyth, Bessemer, Siemens, Thomas, Whitwell, and Gilchrist, the investigations of Bell, Richards, Snelus, Riley, and others of Europe, have made possible the amazing development of our own country."

In replying to this address Sir James Kitson, President of the British Iron and Steel Institute, dwelt particularly on the idea that the progress which had been made in the iron manufacture during the past twenty years had been in a marked degree due to the establishment of scientific institutions, the discussions before which disseminated the truth as to new methods and processes and discovered and made possible the early rectification of errors and mistakes. The second president of their society had been "Sir Henry Bessemer, whose brilliant discovery of a process for the production of steel, with which his name will forever be associated, has revolutionized the trade and led to vast industrial developments throughout the world. Next came Sir Lowthian Bell, described, and justly so, by your Professor Howe, as 'magister magnus in ignibus,' whose interest in our work and proceedings has been maintained with unflagging zeal for one and twenty years, whose scholarly attainments and scientific and practical knowledge have been of infinite service to this institute."

Among the interesting figures given by President Kitson were the following:

"The production of open hearth steel last year was, in Great Britain alone, 1,429,169 tons. This was very largely employed in the building of ships, the gross tonnage of ships launched in the United Kingdom in 1889 having been 1,288,251 tons, of which 1,215,276 tons were of steel—steel made by the open hearth process being the material generally adopted. It is very interesting, too, to note the rapid progress of the basic process, invented and developed by Messrs. Thomas & Gilchrist, materially assisted by other members of this institute, during the twelve months ending December 31, 1889. The total make of steel and ingot iron from phosphoric pig during this period amounts to 2,274,552 tons, being an increase over the make for the previous twelve months of about 321,318 tons, and making the total production of basic steel to this date 10,845,000 tons. It will be noticed that of the above mentioned make of 2,274,552 tons, no fewer than 1,764,639 tons were ingot iron, containing under 0·17 per cent carbon. With this 2,274,552 tons of basic steel were produced some 700,000 tons of slag (containing about 36 per cent of phosphate of lime), most of which was used as a fertilizer."

Perhaps the most notable event of the week was the presentation to Hon. A. S. Hewitt of the special Bessemer gold medal which had been awarded him by the British institute, for distinguished services in the development of the manufacture of iron and steel. In presenting the medal President Kitson said: "Immediately after Sir Henry Bessemer's first experiments were announced, Mr. Hewitt went to England to investigate it, and so rapidly did he work—as all American iron men seemed to work—that he had the first Bessemer converter running in the United States at his iron works in New Jersey within sixty days after English circles knew of this invention of the pneumatic process. Mr. Hewitt was also the first to build an open hearth furnace in America. He was identified with this branch of the steel business from the first announcement of Mr. Snelus' improved basic lining to the perfection of the Thomas and Gilchrist process, which he introduced in the new world."

In accepting the medal Mr. Hewitt made a forcible speech in elucidation of the value of the Bessemer invention to the world, during which he said:

"The whole product of steel of all kinds made prior to his invention was insignificant. To-day the production has reached 10,500,000 tons, being at least one-third of the whole consumption of iron in the world. It is still rapidly advancing upon the domain occupied by the ordinary iron of commerce, and it is quite evident that the time is not far distant when this commodity will be regarded as a relic of the past, although in some special branches its use will survive, serving to remind us of processes which otherwise would have been consigned to history. I do not propose to enlarge upon the practical application of the Bessemer process to the manufacture of steel, but, if you will bear with me, I think it would be well to direct attention to the effects of this invention upon the economic, social, and political condition of the world. A very few considerations will serve to show that the Bessemer invention takes its rank with the great events which have changed the face of society since the time of the middle ages."

Memorial to Alexander L. Holley.

On the afternoon of October 2, the members of the British Iron and Steel Institute joined with the American society in the ceremony of unveiling a memorial statue of the late Alex. L. Holley, in Washington Square, New York City. Previous to the unveiling, a eulogy was delivered by Mr. James Dredge, of *Engineering*, London, who told of Holley's early life, his strong liking for mechanics, and delight in making drawings of engines. He left Yale to take the scientific course at Brown University, and was graduated in 1853 with honors; after which he entered a number of machine shops about the country. He wrote on scientific subjects connected with an engineer's profession for various magazines and papers, and in 1857 became the owner of a paper devoted to railroad matters. He was not successful financially in this venture or in several others of a similar nature, and went to Europe to study the railroads there. He published several books as the result of his experiences, which aroused great interest in the engineering profession. His most conspicuous successes resulted from his association with Sir Henry Bessemer, of whom he purchased the American rights for his invention of the new process for making steel. He became intimate with all the great engineers of the world, who were attracted by his writings and speeches as well as by the records of his work. He was himself an inventor and improved many points in the Bessemer process. He died on January 29, 1882.

The statue is a bust, modeled by Mr. J. Q. A. Ward. It is of bronze, and a perfect likeness of Mr. Holley. The pedestal, of sandfinished limestone, is particularly handsome. The rectangular die rising from two steps is surmounted by a handsome ornate cap, the whole being eight feet high. It is flanked by two wings, jutting out near the back and terminating in rectangular posts five feet high. The inscriptions are:

"In Honor of ALEXANDER LYMAN HOLLEY. Born in Lakeville, Conn., July 20, 1832. Died in Brooklyn, N. Y., January 29, 1882. Foremost among those whose genius and energy established in America and improved throughout the world the manufacture of Bessemer steel. This memorial is erected by engineers of two hemispheres."

Do not spare sulphur from the mixture when you salt your cattle. It will cool and purify their blood, and probably save you from having distemper or bloody murrain. Sulphur is the only remedy I have ever found, says W. W. Hobson, in one of our exchanges.

The Worst Serpent in the World—the Fatal Cobra de Capello.

Portuguese traders found in the East Indies a peculiar serpent in early days, and named it in their own language "the snake of the hood," and even till this day this fatal serpent is generally known as the "cobra," rather than "Naja tripudians," which illustrates the force of a natural appellation.

The "Naja tripudians" belongs to the genus "Najadæ," or hooded serpents, class "Elapidæ," sub-order "Colubriform," and order "Ophidia."

To locate the cobra exactly it may be an assistance to notice that the order "Ophidia" is divided into two great sub-orders, each subdivided:

1. Colubriform. 2. Viperiform.

The second sub-order is represented in India and Ceylon by six genera.

Viperiform serpents are all poisonous.

The first sub-order is represented in India and Ceylon by nine genera of venomous snakes and seventeen genera of innocuous snakes.

Colubriform serpents of the subdivision "venomous" present four genera of "Hydrophidæ," or sea serpents—which we do not wish to consider—and five genera of the class "Elapidæ," or gliding serpents, and to the genus "Najadæ" belongs the species "Naja tripudians," commonly known as the "cobra de capello" or hooded snake, and locally in India and Ceylon and the East Indies, in its varieties, as "gokurruh," "kutiuh" in India, "pariah nahum" and "nulluh nahum" in Ceylon, and by similar localisms in Singapore and other parts of the East Indies.

My observation of the cobra has been limited to Ceylon, and particularly to Jaffna, a Tamil district in the northern province of the famous "pearl and spice isle."

The Hindoo religion prevails there, and the superstitious reverence in which devout Sivites hold this terrible reptile may account in Ceylon as well as in India for some part of the annual loss of life from the bite of venomous serpents.

Tamils speak of two cobras in Jaffna. First "pariah nahum," or low caste furious cobra.

This serpent has the ocellus or spectacle mark upon the back of the hood. In speaking of the hood, the natives—referring to this double mark—say "pardum," or picture. This serpent attains a length of from three to six feet, and is of a medium brown color upon the back, unvariegated, while the ventral surface is metallic in luster and grayish white in color, with two purplish blue bands diametrically crossing at the neck.

The second variety, euphemistically called "nulluh nahum," or good cobra, is smaller and more deadly, if possible, while the ocellus is faint or missing, and the back delicately marked with inverted V-lines of dark brown upon a lighter groundwork of the same color, somewhat intermixed with faint yellow dashes.

This serpent is very beautiful and remarkably perfect in shape, as evinced by a specimen that was killed in Batticotta church upon the evening of September 1, 1889.

All the species of genus "Najadæ" are hooded, but not all ocellated.

The hood is expanded by means of free elongated ribs sidewise.

The cobra only expands its hood when angered, cornered, or struck.

It is very terrifying even to strong nerves and cool heads.

Cobra venom is different from viperine poison, for this serpent is not a viper at all.

The toxic element is venom peptone, according to Dr. Weir Mitchell, and attacks nerve centers at once.

Men who have been bitten by a cobra die in from one to three hours of inability to breathe.

Many antidotes for "venom de Naja" have been suggested, affirmed and employed, but any crucial test shows them to be unavailing.

The conclusion is at present that there is no known physiological antidote, although NH_4OH and $KMnO_4$ are very useful.

There seems to be a wide and dangerous field of discovery open to analysts, physicians, and specialists in this line. Speed the undiscovered!

Amherst, Mass. WM. D. MARSH.

Edison's Accidental Discoveries.

Dr. William D. Gentry, of Rogers Park, Ill., a lifelong friend of Mr. Edison, relates the following interesting reminiscences:

"When I look back to twenty-five years ago, and put Tom Edison as I then knew him alongside of the Thomas Edison of to-day, and note what has taken place, I am prepared almost for anything. Twenty-five years ago, as I sat by Edison in a New York telegraph office, I little thought that there slumbered within that man the fire of a genius that would one day startle the world. There was nothing wonderful about Edison. A plain and unpretentious man, he came and went without troubling any one with his conversation. Perhaps he spoke to me more than to any other man in the place, because we sat at adjoining tables.

"One day his wire gave out or went wrong in some way. He was working New Haven, I was operating Boston. He started to fix it, and while thus engaged his message came back over my wire. I called him. 'Tom, can you explain this?' He looked for a moment, and then remarked, 'Why, that is caused by induction; the two wires are near each other.' He went off, and shortly afterward came back, seemingly lost in thought. 'Yes; that's what causes it,' he repeated. 'I wonder if we could devise a plan like that to make two circuits on one wire, so that two men could send and two others receive at the same time?' And he went back to his instrument.

There is a tide in the affairs of men
Which, taken at the flood, leads on to fortune.

"Tom Edison took it then. Out of that little accident, he devised the duplex telegraph system. Then followed the quadruplex, and these have saved the telegraph company millions of dollars.

"He had been working on a telegraph system, but he discovered that the Wheatstone system—I think that is the name—covered the ground, and he gave it up. You know the rest. Edison's achievements are now no secret.

"The steps leading up to that perfected phonograph, how Edison discovered that the sound waves of the human voice might be so directed as to trace an impression upon a solid substance, are just as wonderful. Edison found it almost accidentally while he was experimenting with a different object in view. In manipulating a machine intended to repeat Morse characters, he found that when the cylinder carrying the indented paper was turned with great swiftness, it gave off a humming noise. That led to several experiments, such as fitting a diaphragm to the machine, which would receive the vibrations made by the voice. The cylinder, when rapidly revolved, caused a repetition of the original vibrations, just as if the machine itself were speaking. That settled the matter, and Edison found that the problem of registering human speech so that it could be repeated by mechanical means as often as might be desired was solved. Yes; Edison is a genius."

Fortunes in Small Inventions.

Every little while the newspapers take up the subject of inventions and tell their readers how many have made fortunes out of small inventions. The Pittsburg *Dispatch* gave the other day a list of small things that have made their inventors wealthy. It commences with the pen for shading in different colors, which yields an income of $200,000 per annum. The rubber tip at the end of lead pencils has already made $100,000. A large fortune has been reaped by a miner who invented a metal rivet or eyelet at each end of the mouth of coat or trousers pockets to resist the strain caused by the carriage of pieces of ore or heavy tools. In a recent legal action it transpired in evidence that the inventor of the metal plates used to protect the soles and heels of shoes from wear sold upward of 12,000,000 plates in 1879, and in 1887 the number reached 143,000,000, producing realized profits of $1,250,000.

A still more useful invention is the "darning weaver," a device for repairing stockings, undergarments, etc., the sale of which is very large and increasing. As large a sum as was ever obtained for any invention was enjoyed by the inventor of the inverted glass bell to hang over gas to protect the ceilings from being blackened, and a scarcely less lucrative patent was that for simply putting emery powder on cloth. Frequently time and circumstances are wanted before an invention is appreciated, but it will be seen that patience at times is well rewarded, for the inventor of the roller skate made over $1,000,000, notwithstanding the fact that his patent had nearly expired before its value was ascertained.

The gimlet-pointed screw has produced more wealth than most silver mines, and the American who first thought of putting copper tips to children's shoes has realized a large fortune. Upward of $10,000 a year was made by the inventor of the common needle threader. To the foregoing might be added thousands of trifling but useful articles from which handsome incomes are derived, or for which large sums have been paid. Few inventions pay better than patented toys. That favorite toy, the return ball, a wooden ball with an elastic attached, yielded the patentee an income equal to $50,000 a year, and an income of no less that $75,000 fell to the patentee of the "dancing jimcrow."

The invention of "Pharoah's serpents," a toy much in vogue some years ago, was the outcome of some chemical experiments, and brought the inventor more than $50.000. The sale of the little wooden figure, "John Gilpin," was incredibly large for many years, and a very ingenious toy, known as the "wheel of life," is said to have produced upward of $100,000 profit to its inventor. One of the most successful of modern toys has been the "chameleon top," the sale of which has been enormous. The field of invention is not only vast and varied, but is open to everybody, without respect to sex or age, station or means.

Two Important Movements.

There are at present two commendable projects under way in this country, and ones that will be the means of imparting to those of our rising generation who are inclined to become thorough mechanics a theoretical and practical knowledge of mechanism.

The first project originated with the noted shipbuilder and philanthropist, William H. Webb, who, since his retirement from the shipbuilding industry, has been seeking a means by which young men may become educated in the art, science and profession of shipbuilding, and also afford free and gratuitous aid, relief and support to the aged, decrepit, invalid, indigent or unfortunate men who have been engaged in building hulls of ships or vessels, or marine engines for such, or any part of either the hulls or engines in any section of the United States.

The new institute to be built will be known as Webb's Academy and Home for Shipbuilders. Real estate located in this city, and valued at over one million dollars, has already been deeded to this home. The cost of grounds, buildings, and additional endowment required will necessitate an investment of two million dollars, all the State law allows.

Notwithstanding he long since ceased to build ships, Mr. Webb has not lost his interest in the profession, as is shown by his exertions to establish a home for old shipbuilders and a school for young ones. There are only two similar institutions in the world—one in London and one in Paris. What a favorable opportunity will this be for any young man who is a native or citizen of the United States, and who may, upon examination, prove himself competent, of good character, and worthy. With these requisites he will be entitled to free and gratuitous education in shipbuilding and marine engine building, together with board, lodging and necessary implements and materials while obtaining such education.

The other project is the opening of the engineer corps of the navy to young mechanics who have shown a special aptitude. Those who are urging these changes seem to be influenced by the consideration that the extensive machinery of the new steamships of the navy requires a greater number of engineers than the old style war ships. The tendency of the naval academy education is toward the theoretical rather than the practical, and the navy draws from its ranks men who are far better fitted to design and construct machinery than they are to stand in the engine room and run the engine.

This matter will receive attention in the coming annual report of the engineer in chief and secretary of the navy, and will be watched for with interest, as it will be the means of affording employment to many competent and worthy engineers.—*American Shipbuilder*.

Bromoform in Whooping Cough.

Dr. Hugo Lowenthal, of Professor Senator's clinic in Berlin, has tried bromoform in the treatment of whooping cough, it having been recommended by Dr. Stepp, of Nurnberg, and he is disposed to agree with him in considering it a very valuable remedy. Dr. Lowenthal says that it exerts an almost specific action upon whooping cough, at all events, if it is used at the commencement. A hundred children were treated with it, varying in age from 8 weeks to 7 years. The doses given were from 2 to 5 drops three or four times a day. The liquid was simply dropped into a tablespoonful of water, and formed a bead floating in the water. The quantity dispensed at once was about a drachm. The parents were cautioned to keep the bromoform from the light, as otherwise it is liable to be decomposed. As a rule, the good effects of the medicine began to show themselves on the second or third day, the vomiting being arrested within a week after the commencement of the bromoform. In cases where complications, such as pneumonia, occurred, they ran a favorable course, and where there were relapses, a return to the bromoform soon arrested the symptoms. In a very few cases the drug appeared to produce sleepiness and lassitude, and in one case, that of a weakly child a little over a year old, where a drachm had been given in the course of three days, a semi-comatose condition was induced. Subcutaneous injections of ether revived the child, who was found to have pneumonia. This, however, ran a rapid and favorable course, and afterward the whooping cough was successfully treated by renewed doses of bromoform.—*Lancet*.

Another Tunnel under the Hudson River.

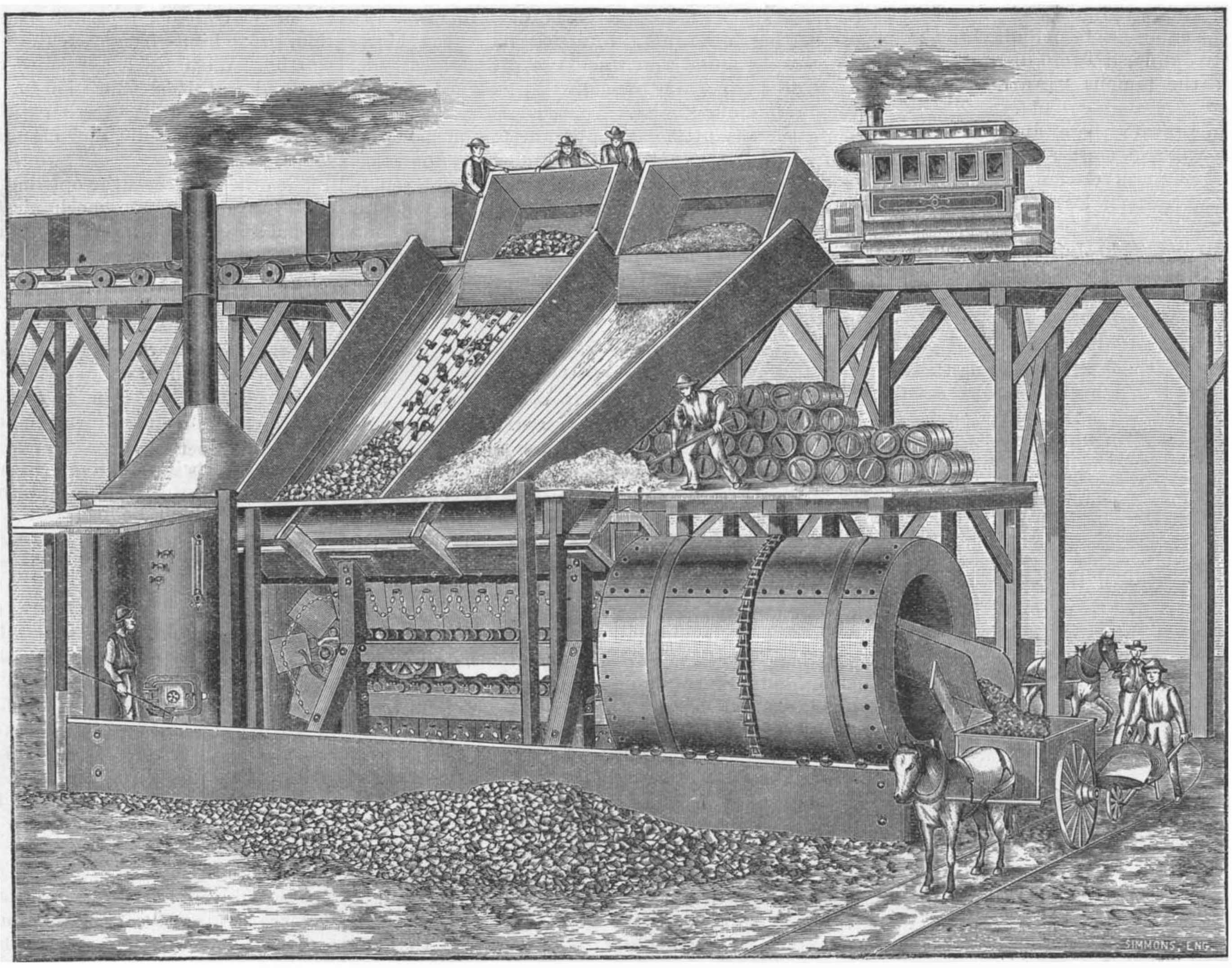
The scheme to connect Staten Island and Long Island by a tunnel under New York Bay at the narrowest point of the channel, near the mouth of the Hudson, is beginning to take definite shape. A bill to authorize the construction of such a tunnel was introduced lately in Congress, and referred to the Committee on Commerce. The concern seeking the franchise from Congress is the New Jersey and Staten Island Junction Railroad Company. The immediate point in view is to give the trunk lines now centering on the Jersey shore a Brooklyn terminus.

THE RANSOME CONCRETE MIXER.

The economic use of concrete has been greatly limited in every branch of construction by the crude and imperfect manner of mixing the materials. Hand manipulation with the shovel and hoe is not only slow and expensive, but is necessarily inefficient in the thorough admixture of the ingredients, and the character of the work suffers in consequence. In almost every other department of building, mechanical appliances, driven by steam, have superseded hand labor. The steam drill, pump, excavator, rock crusher, and elevator, may have only greater speed and efficiency to commend them, the quality of the work not necessarily being any improvement upon the more toilsome methods they have supplanted. But when materials are to be mechanically united and a compound formed, the quality of which depends upon the accuracy of the proportions and the thoroughness of the manipulation, manual labor becomes not only slow and expensive, but also a very inferior and unsatisfactory substitute for the precision and effectiveness of automatic mechanism, driven with ceaseless persistence and untiring force.

Ernest L. Ransome, of San Francisco, has invented and introduced into successful use there a series of easily operated machines for the more accurate handling and rapid and perfect mingling of the various constituents for concrete or monolithic construction. These devices are covered by U. S. patents Nos. 306,522, 322,006, 410,292, and 416,950. No. 1 is a stationary machine, No. 2 is portable, and No. 3, shown in our illustration, works automatically. The last named is the largest and latest of the series, and is designed to meet the requirements of the most extended work. It is perfectly automatic in the feeding, as well as in the process of mixing.

This mixer consists of, First: suitably arranged chutes or bins for the reception and supply of the cement, sand, and broken stone as required. To these are attached independent measuring chambers which automatically determine, by means of easily regulated gates or supply openings, the exact proportions of each to be fed to the mixer. Second: a traveling carrying trough or channel, which receives from the measuring chambers the several constituents, and conveys them to, Third: the rotary receiving drum or cylinder, which, mounted upon rollers or wheels, receives the materials, and perfectly mingles them into one compact mass.



THE RANSOME CONCRETE MIXER.

The rotary drum has upon the inner surface of its periphery directing guides or flanges, and lifting shelves, by means of which the materials are thrown together perfectly commingled and delivered. The water is admitted into the mixing chamber, and the discharge regulated to meet the requirements of the case.

The entire process, including the exact proportions of the constituents, is adjustable by the operator at will, and can readily be so arranged as to insure automatic accuracy and unexampled perfection of work.

The efficiency of this machine is something altogether unapproached by any other known process or device. The first of the No. 3 mixers was employed upon the Academy of Sciences, San Francisco, and the second upon the Piedmont and Fourteenth Street Cable Roads, Oakland, Cal.

Further information relative to these machines may be obtained by addressing the Ransome & Smith Co., 230 Montgomery Street, San Francisco, Cal., or at the office of J. W. Mather, 48 Wall Street, New York City.

The Mediterranean Region.

The British Association address in section E, geography, was delivered by Sir R. Lambert Playfair, K. C.M.G., F.R.G.S., president, who said that for nearly a quarter of a century he had held an official position in Algeria, and it had been his constant delight to make himself acquainted with the islands and shores of the Mediterranean, in the hope of being able to facilitate the travels of his countrymen in that part of the world. What he had to say might be to some a twice-told tale; but still he should like to speak in a familiar way of the "great sea," as it was called in Scripture. It was a well defined region of many parts, all intimately connected by geographical character, geology, flora, fauna, and the physiognomy of the people. To the general statement there were two exceptions—Palestine and the Sahara. The Mediterranean region was the emblem of fertility and the cradle of civilization. The sea, a mere gulf, now bridged by steam, rather united than separated the two shores, modifying their climate and forming a junction between three continents. The Atlas range was a mere continuation of the south of Europe. It was a long strip of mountain land, about 200 miles broad, covered with splendid forests, fertile valleys, and in some places arid steppes. In the east of the range the flora and fauna do not essentially differ from those of Italy; in the west they resemble those of Spain. A conifer (*Abies pinsapo*) and alfa grass or esparto grow in both the Atlas and South Europe. Of the 3,000 plants found in Algeria, the greater number are natives of Southern Europe, and less than 100 were peculiar to the Sahara. The commonest plant on the south shores, the dwarf palm, grows spontaneously on the north shores, but does not occur in Palestine, Egypt, or the Sahara. There are mammalia, fish, reptiles, and insects common to both sides of the sea. Some of the larger animals, such as the lion, panther, jackal, etc., have disappeared before civilization in Europe, but lingered through Mohammedan barbarism in Africa. There was abundant evidence of the former existence of these and other large mammals of tropical Africa in France, Germany, and Greece. It was probable they only migrated to tropical Africa after the upheaval of the great sea which in Eocene times stretched from the Atlantic to the Indian Ocean, making Southern Africa an island. The original fauna of Africa, of which the lemur was the distinctive type, was still preserved in Madagascar, which once formed part of Africa. The trout was found in all the snow-fed rivers which fell into the sea, but not in Palestine south of the Lebanon, or in Egypt, or the Sahara. The fresh water salmonoid was a European type often found in the Atlas. There were newts and tailed batrachians in every country round the sea, again excepting Palestine, Egypt, and the Sahara. The zone of desert called the Sahara was popularly supposed to have been a vast inland sea, in very recent times; but the theory was supported by geological facts wrongly interpreted. It was abundantly proved by the researches of travelers and geologists that such a sea was neither the cause nor the origin of the desert. Rainless and sterile regions occurred in two belts around the world about equal distances north and south of the equator. These corresponded in locality to the great inland drainage areas from which no water can be discharged into the ocean and which occupy about one-fifth of the total land surface of the globe. Some parts of the Sahara (described in detail) are below the level of the sea, and here are formed open depressions without any outlets, inundated by torrents in winter and covered with a saline efflorescence in summer. The salt does not prove the former existence of an inland sea; it is produced by the concentration of the natural salts washed down by winter rains, with which the unevaporated residue of water becomes saturated.

Opening of the River Danube.

An important work in clearing the lower Danube was inaugurated September 15. After being joined by the Save, the Danube forms the boundary between Servia and Hungaria. At Semlin, near Belgrade, it is 1,706 yards wide, but soon becomes contracted by spurs of the Transylvanian and Servian Mountains. Within the space of seventy-five miles there are eight distinct rapids, the shortest (one and one-half miles) and the most difficult being that known as the Iron Gate.

It has hitherto presented a serious and impassable obstacle to navigation. Many attempts have been made to enlarge the channel, Austria having bound herself to do so under the treaty of Berlin, but the first serious effort has only now been made.

On the 15th, the Hungarian minister of commerce fired the first of a series of blasts by means of electricity, intended effectually to remove a portion of the obstruction.

Hitherto two engineering systems have been advocated, the first being urged by French capitalists, and involving the use of locks; the second was presented by an Anglo-American company, which proposes to utilize the plan adopted by the Roman Emperor Trajan, begun by him, but never completed. This proposes to construct a navigable canal round the Gate, blasting minor rocks, cutting channels, building dams and other improvements. It is this plan that has been adopted.

The effect of the present undertaking on the commerce of Europe and the East, when it shall have been completed, will be most beneficial, and can only be described as a most desirable international enterprise.

The Forty-Inch Telescope Objective for the University of Southern California.

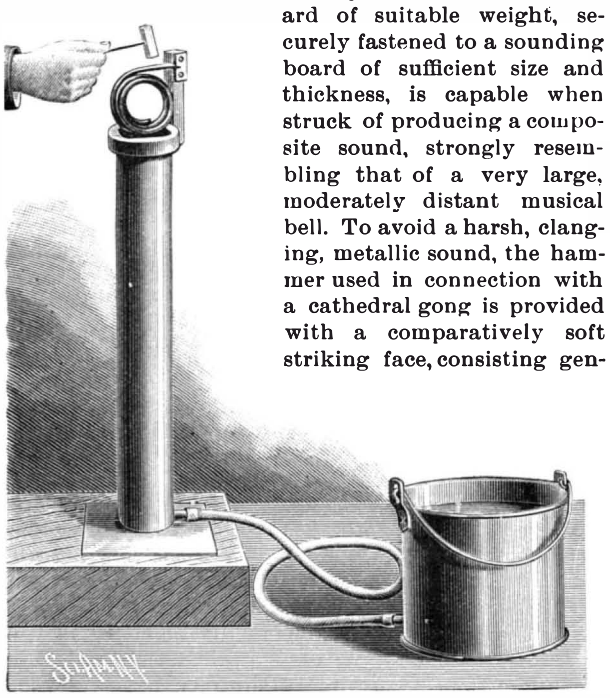
The glass for one part of the great forty-inch objective for the new Southern California observatory has been received by the Clark Brothers, of Cambridgeport, Mass. They were the makers of the thirty-six inch objective of the Lick telescope, which is now the largest in the world. The new one is to be of four inches greater diameter. The telescope is to be mounted in an observatory upon Wilson Peak, of the Sierra Madre Mountains, 12 or 15 miles back of Los Angeles, Cal. The site is about 6,000 feet above sea level, and will be favored by an unusually clear atmosphere.

PAPER and pulp making stands thirteenth among the sixty-three industries of Wisconsin, and new plants to the value of $243,775 were erected last year.

AN EXPERIMENT IN RESONANCE.

BY GEO. M. HOPKINS.

Nearly every one must have heard the cathedral clock gong. Some time since it was applied only to fine French and English clocks, but at present it is largely used in the better class of American clocks. There is, however, a great difference in these gongs and in the way in which they are mounted, and a corresponding difference in the sounds they emit when struck. A gong of uniform temper attached to a standard of suitable weight, securely fastened to a sounding board of sufficient size and thickness, is capable when struck of producing a composite sound, strongly resembling that of a very large, moderately distant musical bell. To avoid a harsh, clanging, metallic sound, the hammer used in connection with a cathedral gong is provided with a comparatively soft striking face, consisting generally of a firm piece of sole leather. If one listens intently to the sound of one of these gongs, he will be able with little difficulty to detect a few of the many tones which form the very complex sound. He can readily distinguish a very grave, subdued note, also a sound of high pitch, and a discord, but no approximation to the number of sounds produced by the gong can be made without a resonator which will select out the different sounds in succession. An instrument of this kind is shown in the annexed engraving. It consists of an upright tube closed at the bottom, open at the top, and furnished with a small lateral tube at the bottom for receiving a flexible tube for conveying water. In the present case the flexible tube is connected with an ordinary tin pail having a lateral tube at the bottom. The upright tube is elevated above the level of the table so that its full length may be utilized as a resonator. The cathedral gong used in this experiment was a small one formed of a rod of steel one-eighth inch wide, one-sixteenth inch thick, and about thirty inches in length, formed in a spiral of about three turns, the outer end being secured to an arm projecting upward from a heavy metal cap resting on the top of the resonator. The hole in the cap is somewhat smaller than the mouth of the resonator.



EXPERIMENT WITH THE CATHEDRAL CLOCK GONG AND RESONATOR.

The gong being struck at a point near its fixed end by a small soft rubber mallet, is set in vibration. As the striking is repeated at frequent intervals, the pail containing the water is raised, causing the water to flow quietly into the resonator, gradually diminishing the length of the column of air contained by the tube. When the length of the air column is such as to respond to any particular note, that note is re-enforced so as to become prominent. In this manner one note after another is brought out until the last and highest is heard.

By lowering the pail and allowing the water to return to it from the resonator, the re-enforced sounds will be heard in reversed order. As many as eight tones will be heard prominently, while with more care still others will be heard, thus showing the complex character of the sound produced by the gong, and showing clearly the reason of the harmonious and pleasing effect which has made them so popular.

By skillfully using the mouth as a resonator, most of the tones may be separated out so as to be readily distinguished by the operator.

Employer's Liability—Safe Machinery.

The measure of an employer's liability in the matter of providing machinery for his employes was defined as follows by the Supreme Court of Pennsylvania in the recent case of the Lehigh & Wilkesbarre Coal Company *vs.* Hayes: "An employer is not bound to furnish for his workmen the safest machinery, nor to provide the best methods for its operation, in order to save himself from responsibility for accidents resulting from its use. If the machinery be of an ordinary character, and such as can with reasonable care be used without danger to the employe, it is all that can be required from the employer; this is the limit of his responsibility and the sum total of his duty."

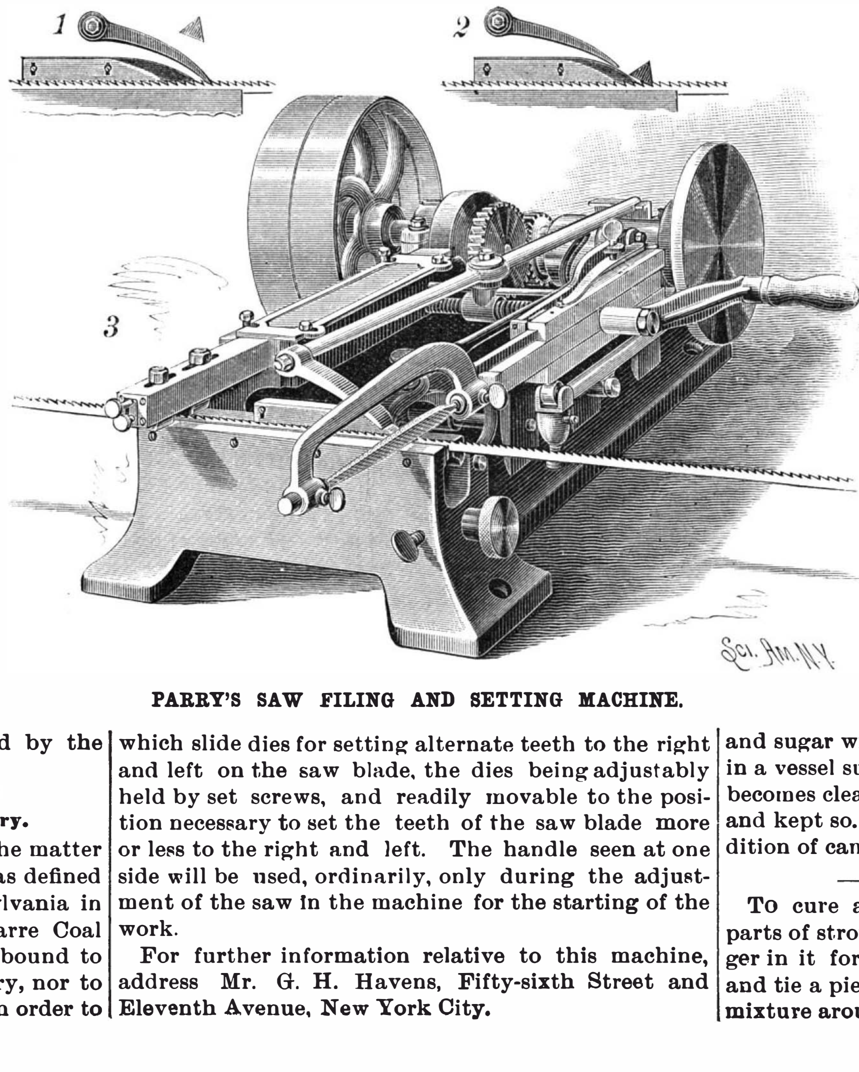
A MACHINE TO SET AND FILE SAWS.

In the machine herewith illustrated the saw is alternately clamped and released, and moved the distance of one tooth during the reciprocation of the file by means of a holder sliding in a guideway, the teeth being at the same time automatically set by an adjustable mechanism, whereby the work is effected with unfailing accuracy, and the teeth appear uniform when filed. It is a patented invention of Mr. W. H. Parry, New York City.

On the power shaft in one end of the frame of the machine is a crank disk which operates a slide moving in a longitudinal guideway, a file holder on the outer end of the slide having adjustable bushings by means of which different sized files may be readily supported therein. The guideway is pivoted at its inner end on the main frame, while its outer end is supported upon a friction roller adjustable upon a lever, there being on the rear end of the lever a friction roller engaging a cam, whereby, when the slide moves outward, the file remains in a horizontal position, but on its return stroke the file is raised from the saw. A spring whose tension can be readily regulated holds the outer end of the guideway in contact with the friction roller.

The saw is held on a transversely extending bar held between the fixed and movable jaws of a clamping device, the transverse bar being connected with vertically arranged racks whereby it may be adjusted according to the width of the saw blade. The fixed jaw of the clamp is formed on the main frame, and the movable jaw is made in the form of a lever fulcrumed on the main frame. The movable jaw has a tail piece carrying a spring whose free end rests on a cam fulcrumed on a pin on the main frame, and the cam has an arm carrying a friction roller engaging a cam on the main driving shaft, whereby a releasing and clamping movement is given to the movable jaw. On the top of this jaw is held a block whose front face is in line with the face of the jaw, and carrying a guide bar adapted to engage the top of the teeth of the blade, holding the latter in place as it is fed along. Over the rounded front edge of this block the feed pawl is adapted to travel in feeding the saw forward to bring new teeth successively in line with the reciprocating file. The feed pawl is pivoted on the outer end of a feed lever whose other end has a pin engaging a cam on the main driving shaft, each revolution thereof moving the pawl backward and forward, while the feeding forward of the blade is regulated by means of a stud on which the pawl lever is mounted. Fig. 1 represents the position of the pawl as the blade is being fed forward, while Fig. 2 shows its position during the forward stroke of the file.

The saw-setting mechanism has a longitudinally extending bar operated from the main shaft to make a forward and backward stroke to two full strokes of the file. In the front of the bar is a vertical slot in which slide dies for setting alternate teeth to the right and left on the saw blade, the dies being adjustably held by set screws, and readily movable to the position necessary to set the teeth of the saw blade more or less to the right and left. The handle seen at one side will be used, ordinarily, only during the adjustment of the saw in the machine for the starting of the work.

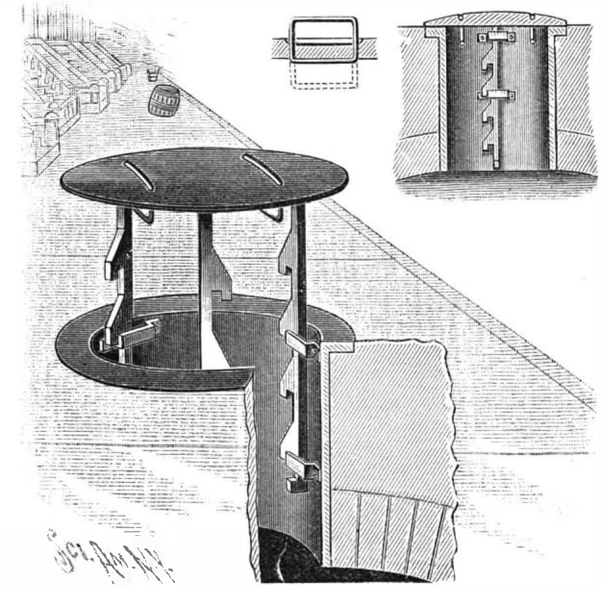


PARRY'S SAW FILING AND SETTING MACHINE.

For further information relative to this machine, address Mr. G. H. Havens, Fifty-sixth Street and Eleventh Avenue, New York City.

A VAULT COVER FOR SIDEWALK OPENINGS.

The illustration represents a device designed to afford for vault openings a cover which may be conveniently lifted and held in elevated position, for purposes of ventilation and the introduction of coal or other material into the vault below, without entirely removing the cover from the opening it is designed to close. It has been patented by Mr. Henry W. Sauer, of No. 207 Tenth Avenue, New York City. The lining thimble or shell inserted in the vault hole, and permanently fixed in its arched roof, has secured in its sides vertically arranged keepers or rectangular loops, adapted to engage toes integral with downwardly projecting limbs on the under side of the cover. The handles are made of rectangular links, loosely secured to slide in perforations in the cover, which, in use, may be raised to the height desired and then held in such position by a slight lateral turn, whereby the toes on the limbs may be placed in engagement with the keepers. A reverse movement of the cover will permit it to be lowered upon its seat in the top of the vault opening.



SAUER'S VAULT COVER.

Horned Dinosaurs.

At the late meeting of the British Association, in the Geological Section, Prof. Marsh gave an interesting account of his discoveries with regard to the gigantic Ceratopsidæ, or horned Dinosaurs. During the last two years Prof. Marsh has been working in the far West of America, near the Rocky Mountains, at certain beds called Laramie. It was formerly doubted as to whether these beds were tertiary or cretaceous, and it has now been found, by examination of the flora, that the lower part is true cretaceous and that the upper part is tertiary. In the true cretaceous these saurian remains have been discovered. They are of great size, and the blocks in which they are embedded sometimes weigh as much as two tons. Securing them has been a work of great difficulty, and has called for the exercise of much engineering skill. The remains, of which the professor exhibited diagrams, particularly of the skull, differ from those most familiar to European workers. The skull is of great size, and is characterized by two large horn cores near the eyes, and by one smaller horn core on the nose, like the rhinoceros, the latter extending a considerable way backward, where it appears to be armed by rudimentary cores. The teeth also are peculiar in having two fangs implanted crosswise. In the adult, the length of the skull is quite eight feet. The brain is relatively very small. To bear this enormous weight there are peculiar modifications of the neck vertebræ and of the four limbs. Prof. Marsh is disposed to refer this Ceratopsida to a distinct order of the Dinosaurs.

A Paste which will Stick Anything.

A paste which will stick anything is said by Professor Winchell to be made as follows: Take two ounces of clear gum arabic, one and a half ounces of fine starch, and half an ounce of white sugar. Dissolve the gum arabic in as much water as the laundress would use for the quantity of starch indicated. Mix the starch and sugar with the mucilage. Then cook the mixture in a vessel suspended in boiling water until the starch becomes clear. The cement should be as thick as tar, and kept so. It can be kept from spoiling by the addition of camphor or a little oil of cloves.

To cure a felon, says a correspondent, mix equal parts of strong ammonia and water, and hold your finger in it for fifteen minutes. After that withdraw it and tie a piece of cloth completely saturated with the mixture around the felon and keep it there till dry.

Cements of Rubber and Gutta Percha.*

The number of rubber cements in use all over the world is something remarkable. Almost all of them have as the base either gutta percha or India rubber, and some cheap solvent. Gutta percha tissue, to be sure, is used as a cement without the addition of any solvent, its sticking properties being brought out by the application of heat. This may be noticed in the application of the bindings that go around the bottoms of trousers and the stamp marks in hats, and other work of a similar nature. In making a cement, one should know pretty thoroughly what is to be expected of it before they could advise upon it. For instance, an ordinary rubber cement will hold on a host of different surfaces and with the best of success, except where there is continued dampness. For holding to damp walls, or surfaces where there is a constant presence of moisture, there is nothing equal to Jeffry's marine glue, the formula for which has been published and republished all over the world. It consists of; India rubber, 1 part; asphaltum, 2 parts; coal tar, 12 parts.

The rubber, after having been massed, is dissolved in the undistilled coal tar, and the asphaltum is then added. This glue, as its name indicates, is oftentimes used for mending articles at sea, or patches, for instance, that are to be laid on surfaces that are to be under water, and it has been found to be a most excellent thing. Of glass cements there are a great many, the rubber as a rule being dissolved in some very volatile solvent and some hard drying gum is added. . . .

A gutta percha cement for leather is obtained by mixing the following. It is used hot; gutta percha, 100 parts; black pitch or asphaltum, 100 parts; oil of turpentine, 15 parts. An elastic gutta percha cement, especially useful for attaching the soles of boots and shoes, as on account of its great elasticity it is not liable to break or crack when bent. To make it adhere tightly the surface of the leather is slightly roughened. It is prepared as follows: by dissolving 10 parts of gutta percha in 100 parts of benzin. The clear solution from this is then poured into another bottle containing 100 parts of linseed oil varnish, and well shaken together.

Davy's universal cement is made by melting 4 parts of common pitch with 4 parts of gutta percha in an iron vessel, and mixing well. It must be kept fluid, under water, or in a dry, hard state.

A very adhesive cement, especially adapted for leather driving belts, is made by taking bisulphide of carbon, 10 parts, oil of turpentine, 1 part, and dissolvin this sufficient gutta percha to form a paste. The manner of using this cement is to remove any grease that may be present in the leather by placing on the leather a piece of rag and then rubbing it over with a hot iron. The rag thus absorbs the grease, and the two pieces are then roughened and the cement lightly spread on. The two pieces are then joined, and subjected till dry to a slight pressure.

A solution of gutta percha for shoemakers is made by taking pieces of waste gutta percha, first prepared by soaking in boiling water till soft. It is then cut into small pieces and placed in a vessel and covered with coal tar oil. It is then tightly corked to prevent evaporation, and allowed to stand for twenty-four hours. It is then melted by standing in hot water till perfectly fluid, and well stirred. Before using it must be warmed as before by standing in hot water.

A cement for uniting India rubber is composed as follows: 100 parts of finely chopped rubber, 15 parts of resin, 10 parts of shellac; these are dissolved in bisulphide of carbon.

Another India rubber cement is made of: 15 grains of India rubber, 2 ounces of chloroform, 4 drachms of mastic; first mix the India rubber and chloroform together, and when dissolved the mastic is added in powder; it is then allowed to stand by for a week or two before using.

Cement for sticking on leather patches and for attaching rubber soles to boots and shoes is prepared from virgin or native India rubber, by cutting it into small pieces or else shredding it up; a bottle is filled with this to about one-tenth of its capacity, benzin is then poured on till about three parts full, but be certain that the benzin is free from oil; it is then kept till thoroughly dissolved and of a thick consistency; if it turns out too thick or thin, suitable quantities must be added of either material to make as required.

An elastic cement is made by mixing together, and allowing to dissolve, the following: 4 ounces of bisulphide of carbon, 1 ounce of fine India rubber, 2 drachms of isinglass, ½ ounce of gutta percha; this cement is used for cementing leather and rubber, and when to be used, the leather is roughened and a thin coat of the cement is applied. It is allowed to completely dry, then the two surfaces to be joined are warmed and then placed together and allowed to dry.

Cement used for repairing holes in rubber boots and shoes is made of the following solution: *a*. Caoutchouc 10 parts, chloroform 280 parts; this is simply prepared by allowing the caoutchouc to dissolve in the chloroform. *b*. Caoutchouc 10 parts, resin 4 parts, gum turpentine 40 parts; for this solution the caoutchouc is shaved into small pieces and melted up with the resin, the turpentine is then added and all is then dissolved in the oil of turpentine; the two solutions are then mixed together to repair the shoe with this cement. First wash the hole over with it; then a piece of linen dipped in it is placed over it; as soon as the linen adheres to the sole, the cement is then applied as thickly as required.

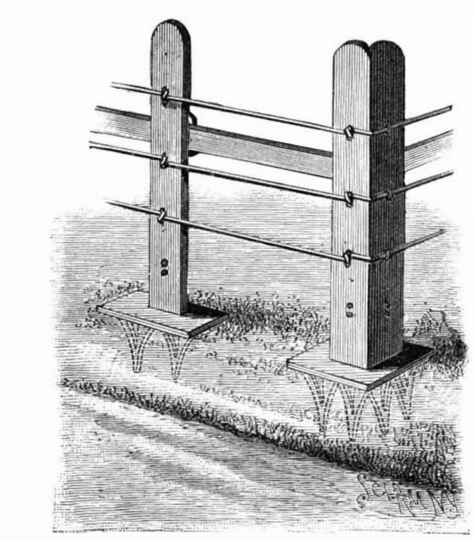
* *The India Rubber World.*

POST FOR WIRE FENCES.

The engraving shows an improved fence post recently patented by Mr. Henry Adams Peabody, of Santa Ana, California.

Two forms of this post are made, one for the division of the panels in a straight fence, and the other for turning angles. The single post consists of a bar of iron cast integrally with the base piece, and perforated with a series of pairs of holes, each pair of holes being designed for receiving the tie wire which binds the fence wire to the post, the wire being passed through the post in the form of a staple, and twisted or bent to retain it in the post. The base piece is provided with triangular projections which extend downward into the earth and form efficient anchors for holding the post in an upright position. The back of the post is furnished with an angled arm for receiving a wooden rail whenever it is desired to use a rail in connection with the wire in the construction of the fence.

The corner post is formed practically of two posts similar to that already described, arranged at the required angle and cast integrally with the base piece.



PEABODY'S FENCE POST.

In this case the base plate is furnished with a greater number of anchoring points for insertion in the ground. A fence constructed according to this improvement may be used anywhere, but it is especially designed for use upon farms, ranches, etc.

"Experimental Science"—What is Thought of It.

The *American Engineer*, referring to Hopkins' "Experimental Science" in flattering terms, and naming the subjects treated under the twenty-three chapters which the work contains, concludes by saying: "Each of these chapters contains beautiful engravings of devices and apparatus, methods and means, that illustrate the instructions. Like the celebrated Faraday, the instruction is conveyed and the experiments described without recourse to mathematics. The majority of students have little taste for the intricacies of numbers and the higher formulæ of mathematics. Most of the apparatus illustrated and described can be constructed and used by any one having ordinary mechanical skill. The work bears the stamp of a thorough scientist, a writer who writes nothing but with certainty of action and result, and of a teacher who imparts scientific information in an attractive and fascinating manner. Like all productions from the publishers of the SCIENTIFIC AMERICAN, this admirable work contains engravings and typography of the highest order. It should find a place in every technical institute and in every engineer's library."

The Consumption of Salt.

According to some statistics recently published in France, the annual consumption of salt per head in England exceeds that of any other country in Europe. For while in France the amount is estimated at about 30 pounds, Italy 20, Russia 18, Austria 16, Prussia 14, Spain 12, Switzerland 8, the Englishman requires no less than 40 pounds. The *Hospital Gazette* thinks that perhaps this is the secret of British thirst. If so, it offers an easy solution to the drink question, which the temperance party should not be slow in adopting.—*N. Y. Med. Rec.*

[The large consumption of salt in England is due to the extensive manufacture of soda, bleaching powders, etc., which are made from salt.—ED. S. A.]

Loss in Keeping Manure.

In order to make some observations bearing directly on the changes which take place in the amount of fertilizing elements between fresh manure and well rotted old manure, this trial was made.

From the top of a pile of fresh manure from the cow stable one-half cord was taken, weighed, sampled for analysis, and piled into a close conical heap January 4, 1889. This was the mixed excrement from cows as thrown out of the stable twice daily, and cut corn stover which was being fed freely and the waste used for bedding and to absorb the urine.

At the same time a half cord of an old compost, of which muck was the leading ingredient, was treated in the same way, *i. e.*, was weighed, sampled, and piled in the same manner close by the pile from the stable.

Both piles were reweighed April 13, and returned to the same places, and as carefully piled as before. This was equal to a complete forking over, the piles having been handled twice with a fork in the operation.

On January 21, 1890, both piles were weighed, measured, and again sampled for analysis. The results were:

	Manure. Lb.	Compost. Lb.
January 4, 1889	3,298	2,376
April 13, 1889	2,376	2,130
January 21, 1890	1,148	1,810
Per cent of lost weight in one year	65·19	29·61
Per cent of lost bulk in one year	50·00	28·6

The weights, when drawn out January 4, were for half cord fresh manure, 3,298 pounds; and for one-half cord compost, 2,376 pounds. By April 13 these piles had decreased in weight to 2,376 pounds and 2,130 pounds respectively.

On January 21, 1890, the manure had shrunk from one-half to one-fourth cord, and weighed only 1,148 pounds; the compost had diminished two-sevenths of its bulk to five-fourteenths of a cord, and weighed 1,810 pounds. To compare these losses of weight and bulk in one year:

	Manure. Per ct.	Compost. Per ct.
Loss of weight in one year	65·19	29·61
Loss of bulk in one year	50·00	28·6

Below is given the composition as found on analysis of the above named samples, the first analyses being by Mr. Ladd and the later ones by Mr. Whalen:

	Manure		Compost	
	Fresh. Jan. 4, 1889.	One Year Old. Jan. 21, 1890.	Jan. 4, 1889.	Jan. 21, 1890.
Per cent of water	84·42	75·118	68·195	61·42
Analysis of the dry matter of each sample.				
Total dry matter	513·17	285·65	755·69	698·3
Nitrogen, per cent	1·96	2·06	2·13	1·81
Potash (K_2O)	4·08	2·88	....	trace
Phosphoric acid (P_2O_5)	0·13	0·28	....	0·30

Calculating the total amounts of these fertilizing elements in the manure and compost at the times noted above gives the following:

	Lb.	Lb.	Lb.	Lb.
Nitrogen	10·06	5·884	16·096	12·64
Potash	20·94	8·227	.....	trace
Phosphoric acid	0·67	0·80	.....	2·095

These figures show a loss from the weathering in every particular, except the phosphoric acid, of which a somewhat larger amount was obtained from the later analysis, but the apparent gain is so small that it could easily have occurred within duplicate determinations on so small an amount.

In calculating the actual money loss, Prof. Roberts' estimate on the value of the fertilizing elements has been adopted.*

FRESH STABLE MANURE.

Nitrogen	10·06 lb. at	$0.17,	$1.71
Potash	20·94 lb. at	4,	.838
Phosphoric acid	0·67 lb. at	7,	.047
Value of one-half cord			$2.595

SAME AFTER WEATHERING ONE YEAR AND 17 DAYS.

Nitrogen	5·884 lb. at	$0.17,	$1.00
Potash	8·227 lb. at	4,	.329
Phosphoric acid	0·80 lb. at	7,	.056
Value of above reduced by weathering to one-fourth cord			$1.385

Lost on one-half cord, $1.21, or per ton, $0.734.

Per cent of loss, 46·6.

This lost portion was, of course, the easiest soluble, and hence most available and valuable part of the manure.

As no ash determinations were made on the compost at the first analysis, the full value cannot be calculated.

Nitrogen in compost	16·096 at	$0.17,	$2.736
Nitrogen in compost after weathering one year	12·64 at	17,	2.149
Lost from close pile by one year and 17 days' weathering			$0·587

Per cent. of loss from a rather stable fertilizer, 21.45.

It will be remembered that the season of 1889 in this locality was exceptionally cloudy and wet.† Great losses of nitrogen from manures are generally associated with drying and burning out. Hence we must consider these results to be under, rather than over, what may be expected in average years. Hence this condition helps this experiment to show more plainly that stable manure should not be piled up uncared for for any length of time.—*Bulletin N. Y. Ag. Station, Geneva.*

* Cornell University Agricultural Experiment Station, xiii., Art. i.

† Eighth Annual Report, N. Y. State Agricultural Experiment Station, article "Meteorology for 1889."

SIBLEY COLLEGE, CORNELL UNIVERSITY.

FIVE YEARS OF GROWTH.

Five years ago we published an account of the then new schools of the mechanic arts and of mechanical engineering, which had just been established by the formal organization of four of the departments of Cornell University into one, known as the Sibley College of Mechanical Engineering and the Mechanical Arts. Sibley College had been, for some years, the department which, in accordance with the fundamental U. S. land grant act, and the charter of the University, the University and the State of New York were to found in order that the institution might pursue as its "leading object," in the words of the law, the plan of promotion of the useful arts, which was the initial and main purpose of the land grant bill. It had been named after Mr. Hiram Sibley, who had supplied those funds which the act made the State responsible for, to put up buildings and to furnish equipment, a responsibility which the State has thus far failed to assume, in any direction. Ezra Cornell undertook this, the obvious duty of the State, as respects the University generally; while Sibley took in hand this special part of the work, in which he was most interested. He retained his interest until, two years ago, he died, leaving some $200,000 worth of property as the testimony of his philanthropic zeal in behalf of technical education.

In 1885, the demand having indicated the wisdom of the move, the trustees reorganized this side of the University in the manner described in our earlier account, placing the organization in charge of a "director," with instructions to plan the system, lay out proper courses of study, and suggest desirable changes and improvements in studies, methods, buildings, equipment, and whatever should seem desirable. This was done, the suggested changes were approved, and the college was given the form and character indicated in the SCIENTIFIC AMERICAN five years ago (October 17, 1885).

We now propose to indicate what five years have brought forth. At that time it was estimated that the buildings and equipment were ample for 200 students, the University, however, supplying all non-professional instruction, as in pure mathematics, languages, the physical sciences, and general academic studies, as far as called for. A remarkable growth at once began. The number graduating the first year, 1886, was 5; the next year 16 took the first, and 3 the higher degree of master in mechanical engineering. The third year 19 took the first degree and 6 the higher one. In 1889, 27 took the first degree and 5 the higher one; and in the fifth year, 1890, 54 took the degree of mechanical engineer and 6 that of master—the latter including a number of distinguished professors and instructors from other colleges; while among those taking the first degree were many graduates of classical and other academic courses and of many other colleges. During this period the total numbers rose rapidly until, in the academic year just passed, there were over 400 students crowded into accommodations intended for 200, and instructed by the smaller force organized for that number; while there were 1,300 in the University. The result has been that the authorities have been compelled to choose between enlarging their buildings and equipment and their teaching force or rigidly excluding the excess in numbers of students applying for entrance. Notwithstanding the fact that the income of the University is seriously taxed, the former course was decided upon, and the changes now going on will enable the college to work 600 students more conveniently and profitably than they formerly could handle 200.

In the college year 1890–91, about to commence, the shops, laboratories, and experimental departments of the college will be about doubled in extent. The new chemical laboratory will give similarly enlarged accommodations, and the physical laboratory will fill Franklin Hall, and occupy also a large dynamo room adjacent to the engine and boiler rooms of Sibley College, thus more than doubling its extent. As this department supplies the instruction in electrical physics, and all the introductory and much of the advanced work in the course in electrical engineering, its extension and improvement constitute an important gain to Sibley College. Other improvements about the University add also greatly to the facilities for advanced study, which will be appreciated by the increasing numbers coming to pursue semi-professional with their professional studies, as in technical reading, advanced mathematics, political economy, patent law, etc.

Our first illustration shows the university campus as it would appear from a balloon over Cayuga Lake, at the N.W., and a mile from the grounds. It is seen that the half mile square of campus now includes a dozen great buildings, and about thirty professors' houses, most of the older members of the faculty residing within the beautiful park. At either end is a deep gorge, Cascadilla and Fall Creek, full of beautiful cascades and magnificent falls of from a few feet to sixty feet descent in the half mile abreast the campus. The Fall Creek Falls supplies power for the water supply department and for the wheels driving the shop and other machinery when required. Steam engines also abound for the purposes of the electric lighting department and the laboratory. The largest buildings in the "Professors' Row," crossing the middle distance in the picture, are those of ex-President White and President Adams; while directly in the vertical line, over the great library building, is that of the director of Sibley College.

The "technical side" of the University is seen in the foreground at the left, where are grouped the buildings of the College of Civil Engineering, Sibley College, the two great chemical and physical laboratories, the shops and the laboratories of the department of mechanical engineering. The Sibley College group is distinguished by the tall chimney, at the foot of which are the 600 horse power boilers supplying heat to the whole University. Fall Creek gorge drops a hundred feet or more beside it, and a thousand feet of steel wire is there in operation bringing up the energy of the fall below to turn the machinery of the shops and laboratories.

The second picture shows the house of Director Thurston, and the next one to the right represents the Sibley College buildings, with the recent additions which have been made to them. The department of physics occupies the largest building, at the right. The trees about the buildings are removed to give a better view. These buildings are from 150 to 165 feet long, and from 40 to 60 wide, yet, in the working season, are crowded with busy and interested students, some under instruction, the older ones engaged in verification of data and formulas of engineering, and advanced students in researches in a thousand interesting and important departments of applied science. The professors and instructors also make time, despite their long working hours and fatiguing duties in instruction, to pursue those investigations which have a special charm for the man of science familiar with the higher walks of his profession. The small building at the right is the magnetic observatory of the department of physics, containing the famous great tangent galvanometer; that next it is the mechanical laboratory. At the left follow the Sibley College main buildings, the physical laboratory, and the chemical laboratory, just completed and perhaps the finest of its kind yet built.

The equipment of the college is as interesting and remarkable as are the buildings. All students have access to the great library, which will hereafter expend $15,000 or $18,000 annually in the purchase of books, having accommodations for a half million, nearly, with facilities for doubling conveniently. The new laboratories are filled with the needed apparatus for instruction, of the standard sorts, and, in addition, are provided with very extensive collections for research, partly secured by purchase, largely by construction at the University. The physical laboratory, besides the usual lecture room illustrative apparatus, contains working instruments for several hundred students, and special apparatus for research is constantly in use and continually being made. The great structure is occupied from top to bottom. In electrical engineering apparatus the outfit is something peculiarly impressive. There are collected here, and in Sibley College proper, in the departments of physics and of electrical engineering, representatives of all the well known systems of dynamo, motor, and distribution. There are two or three dozen, and of all sizes, as well as all kinds, ranging from the "pony" alternators of Westinghouse and the half horse power Edisons to the machines for 400 and 600 lights, for lighting the campus and, ultimately, the larger buildings and groups of buildings about the campus. Ball, Edison, Brush, Mather, Gramme, Stanley, Thomson-Houston, Westinghouse, Weston, Tesla, Sprague, the various storage batteries, and various sizes and forms of dynamo built in the University, crowd the rooms to overflowing; in fact, some could not be set up until the extension of this summer was made, in consequence of lack of space.

The dynamos are grouped in large rooms adjacent to the boilers, and near them are also placed the various engines employed for experimental and other purposes. There are a half dozen of these, large and small, and more to come.

These are usually fitted up with Prony brakes for tests, and a surface condenser is so arranged that those to which it can be attached may have their efficiency measured by the Bryan and Donkin system. A dozen sorts of indicators—all the well known and many unfamiliar kinds—usually in pairs, permit a large amount of this kind of work to be carried on at once. The boiler room is also intended to offer special facilities for boiler trials and measurements of efficiency and of quality of steam, including in its outfit all the "calorimeters" for the latter purpose. Transmission, as well as the various forms of absorption, dynamometers are employed, and include among the former the Norin, built in the shops, and among the latter the Halpin and the Alden forms. The testing machines, of all the usual and some unusual forms, are only less numerous than the dynamos. They include all the best makes, and range from a little Brown & Sharpe "yarn tester" to a 5 ton transverse machine, and from a small impact apparatus to 40,000, 50,000, and 100,000 pound machines made by Fairbanks, Olsen, and Riehle. Oil testing machines and an "autographic" machine, mainly of the Thurston forms, as built by the Pratt & Whitney Co., and other apparatus too numerous for cataloguing, fill these laboratories.

The shops of the Department of the Mechanic Arts now occupy two large buildings, one, 150 feet by 40, devoted to foundry and blacksmith shop, the other, 165 by 40, and two stories high, to the machine shop on the lower floor, and the wood-working shop above. They are well fitted up with machinery and hand tools, and will be of ample capacity for six hundred students. The toilet rooms, with their hundreds of lockers, and the tool rooms, are hardly less interesting, as exhibiting the extent of this great institution, than are the shops and laboratories themselves. The skilled workmen here employed and the pupils vie with each other in the construction of apparatus and tools for the University and for the various purposes of the college. Besides the machinery built here, there are good examples of the best work of all the great tool builders of the country, and lathes and planers, milling machines, drills and shapers of all the standard kinds, are made useful in giving a practical instruction such as every good citizen desires his son to obtain. When these young men attain to positions of responsibility, it is found that this part of their education is of enormous advantage to them and to their men, not only in facilitating the application of the best methods of work, but in giving them a good idea of what constitutes good work, and enabling them to deal fairly by those working under their direction.

The course of instruction includes four years of work in drawing rooms and shops, a continuous course in mathematics, pure and applied, the modern languages, and the sciences. Two years are given in part to the course in chemistry, including a certain amount of analytical chemistry; and two years of physics in lecture room and laboratory. Advanced work in physics is also given, the electrical engineers devoting much time both to electrical measurements and the theory of the dynamo, and to electrical engineering, construction of stations and of machinery and distributing apparatus. With these students, the last year is mainly given to work directly needed and characteristic of their special calling. Two years of work in the mechanical laboratory, in learning the use of apparatus, in testing metals and other materials of engineering, engines and boilers, and other machinery, and in pursuing various lines of scientific and professional research, give the young engineers most attractive as well as practically useful knowledge. The lecture room work in machine designing, in the principles of construction, and in the theory of the prime movers, places the graduate in these courses in a position to profit admirably by his later opportunities.

A large amount of work is now done by graduate students, most of whom are candidates for advanced degrees, and intend to pursue, as a rule, the vocation of instructors in science and in technical schools. Many professors of engineering go to Cornell and Sibley College to secure an experience in laboratory work and to make scientific and engineering researches such as their earlier opportunities failed to offer them. Facilities for this branch are here exceptionally great and are continually improving.

The standard of requirements for admission to the courses leading to degrees is higher than is usual, even in technical schools of high standing, and is steadily advancing; but the number who are found competent to enter is, nevertheless, continually increasing, and the authorities are constantly embarrassed in their endeavor to find funds for erection of buildings and to enlarge the teaching force. Particulars can be obtained by addressing either President Adams, the dean of the University, or Dr. R. H. Thurston, director of Sibley College, Ithaca, N. Y. The opportunities here for those who desire and are able to aid higher education are exceptionally great, and the larger the endowments and the larger the income of the University, the more widely do the opportunities in this direction open.

Trial Trip of the Steamer Plymouth.

The steamer Plymouth had her trial trip on Wednesday, October 1, and it was in all respects a success. With a numerous party of guests representing the steamboat and general mechanical interests of this city, she ran up the Hudson River as far as Spuyten Duyvil Creek. There the steamer was turned in various directions to adjust her compasses. When this was in a measure attended to, she turned and proceeded down the river and bay to Sandy Hook, where the adjustment of the compasses was completed. Meanwhile the guests had partaken of a banquet in the grand saloon, which was followed by some speeches. The engines were started by their designer, Mr. Andrew Fletcher. They showed to great advantage, working up to twenty-six revolutions. The control over them was remarkable, and they worked with perfect smoothness, and, in connection with the feathering paddles, propelled the boat with great steadiness. The entire absence of a dead point was very noticeable. A speed of nearly twenty miles an hour was developed without any effort and at a low boiler pressure.

THE PITCHER AUTOMATIC REPEATING RIFLE.

Since the advent of the Spencer and Henry rifles of 1863–64, thousands of inventors have been striving to accomplish some decided and radical improvements thereon, or to do the same thing in a different way, and disappointment has been the result in far the larger number of cases. Rapidity of fire for a limited number of shots, combined with accuracy, are at this day the principal elements worthy of any considerable attention with a view to improved fire arms construction. The first Henry rifle would fire as rapidly and accurately as the repeating rifle of to-day, and to increase the powder charge and facilitate the manner of recharging the gun have been the most considerable improvements since. In the piston recoil system, of which Dr. Pitcher is the inventor, and which forms the subject of the accompanying illustrations, the degree of efficiency of the gun is practically only limited to the ability of the shooter to aim, while no considerable expertness in the manipulation of the gun is required.

This result is obtained by the application to a barrel and lock mechanism of a cylinder, *a*, as shown in Fig. 1, in which is a piston, *c*, and in front of which is a spiral spring, *m*. A small vent or opening, *e*, extends from the interior of the barrel to the interior of the cylinder, *a*, through which a small portion of gas passes at each discharge. The energy of recoil is stored in the spring, *m*, at the instant of discharge and operates upon the lock immediately as the explosive force leaves the barrel. It will thus be seen that it is only necessary to place the cartridges in the magazine and load the gun for the first charge by hand. When the trigger is pulled, the explosive force operating upon the piston through the vent, *e*, presses it forward against the spring, *m*, carrying forward the drive rod, *g*. The explosive force having left the barrel, the piston, *c*, and drive rod, *g*, are forced back by the spring to their former position. The drive rod, *g*, when at its forward limit engages with a notch in the segment, *i* and thus it will be seen that when the piston is pressed to the rear by the drive spring, *m*, it also forces the segment, *i*, to the rear, unlocking the abutting arm, *y*, through the link, *a'*, and carrying the breech block, *k*, with it. When the utmost rear limit is reached, a knock-off disengages the drive rod and permits the recoil spring to close and lock the gun. The entire operation of extracting the shell, cocking the hammer, replacing a fresh cartridge, and closing the breech is performed automatically, leaving but the one operation of pulling the trigger to repeat at pleasure.

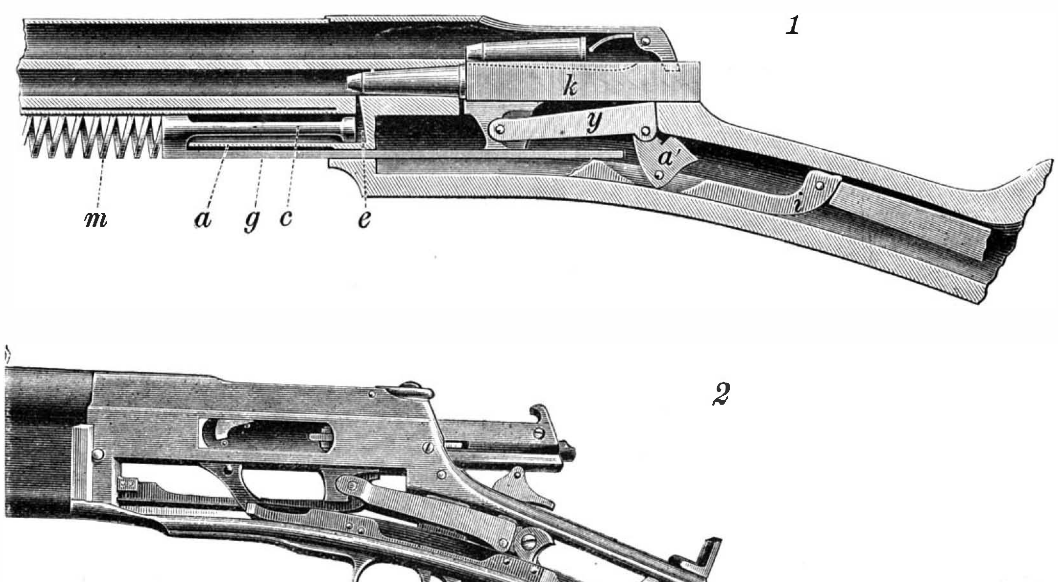
The magazine is on top of the barrel. The cartridges are fed into the receiver through an opening on the right hand side, near the rear upper edge, as shown in Fig. 2, and not on top of the receiver.

A tubular magazine, with spiral spring and follower, is used in the guns constructed, but for military purposes the gun is equally well adapted to use the Lee, Mannlicher, or other form of box magazine. The tilter, which takes the place of carrier or lifter in other guns, is constructed of one piece, and is pivoted in line with the magazine tube. The cartridge remains stationary until the shell is ejected. It is then pressed down and held in alignment with the barrel.

The cartridge is drawn from the barrel by a spring hook extractor and ejected by a positive "stop" ejector. The gun is operated by hand, by a bolt or button upon the right hand side of the frame. But one motion is required to load by hand, viz., to press the bolt to the rear and release the hold, allowing the recoil spring to operate the breech block to place.

The gun is entirely operated by hand, when desirable, by turning a thumb piece or valve upon the side of the frame which closes the vent.

It is claimed that with this gun four shots may be fired per second with a considerable degree of accuracy, no time being lost in reloading and recovering the aim, while the safety blocking is effective and positive. The sights are placed upon the magazine, and firm with the barrel, being higher than ordinary, making it unnecessary to bend the neck to any considerable extent, while at the same time a straighter stock may be used. The facility of charging the gun is somewhat increased by the absence of a spring cover. A slide cover is used instead, and after it is once pushed forward—and it is usually carried and fired in this position—the cartridges may be entered through the opening almost by their own weight.



THE PITCHER AUTOMATIC REPEATING RIFLE.

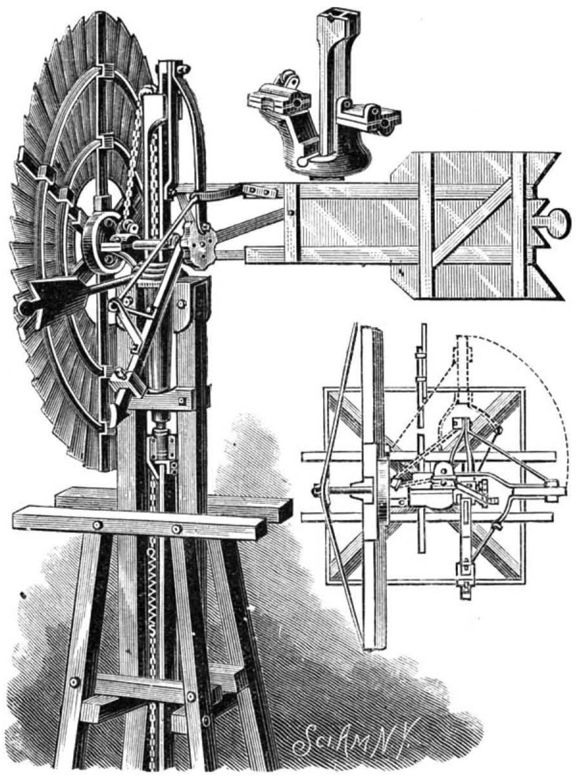
The gun as constructed, of which a perspective view is shown in Fig. 3, weighs ten and one-half pounds, is of 0·38 caliber, the cartridge carrying 50 grains powder, 190 grains lead. The barrel is 26 inches long, and the whole is well balanced. The magazine upon top of the barrel and the form of the stock lends to the arm a first impression of oddity which is soon dispelled when one becomes more familiar with its capabilities. The weight of gun for the cartridge used, it is said, may be reduced to nine pounds or less. The last gun constructed has fired more than three thousand shots within six weeks, and is said to be in smoother working condition, after this amount of work, than at first. No spring or part has required to be replaced from breakage since the gun has been in operation. The operative power to extract or replace a cartridge is greater than can be applied by hand, and is universally positive.

For further information relative to this gun, which forms the subject of several patents issued to Dr. Henry A. Pitcher, address the Pitcher Automatic Repeating Fire Arms Co., Neillsville, Wis.

AN IMPROVED WINDMILL.

In the windmill shown, which has been patented by Mr. George D. Hawley, of Urbana, Iowa, the tower consists of two parallel spaced upright masts, connected at the top by a cap having a central opening surrounded by a collar on its upper side, the cap being bolted to the masts, and preventing their heads from warping or splitting. Below the cap, and held horizontally between the uprights, is a cross piece with central opening, forming a bearing plate. The main casting, or turn-table, is of novel form, and is shown in one of the small views. Centrally from the bottom of its disk body portion, a tubular and preferably tapering stem extends downward and is journaled in the cross piece. From the top of the disk body, and at one side of the vertical opening therein, a guide standard extends upwardly, there being a transverse bar at the bore of the guide standard through which the shaft of the governor vane is passed.

The windwheel is mounted on one end of a shaft having bearings in the turn-table, and on the shaft is a crank disk with a series of apertures at different distances from the center, to receive a detachable wrist pin for connection with the pitman, whereby the plunger may be made to make any one of six different lengths of stroke. The lower end of the plunger is attached to the upper end of the pump piston by a swivel connection. The tail vane has at its inner end, on the side facing the windwheel, a brake shoe supported by stay rods. The vane is carried into the wind to stop the wheel by a chain secured at one end to the brake shoe or its stay rods, and passing around a pulley held on an arm of the turn-table, thence over another pulley in the upper portion of the standard, and down through a tubular section of the plunger. To carry the vane quickly from one position to another when the chain is slackened, a weighted arm is connected to the vane and pivoted upon the main casting, its pivot bolt being surrounded by a coiled spring, the combined action of the weight and spring greatly accelerating the movement of the vane. In the plan view, partly in section, shown in one of the figures, the positive lines indicate the working position of the vane and the dotted lines its position when carried out of the wind to stop the movement of the wheel. The position and length of the wheel shaft of this windmill minimizes friction and wear, and enables the wheel to be fitted close to the tower, as the shaft runs in two boxes, one at each side of the vertical center, by which also the wheel is enabled to ride steadily, and the side leverage of the mill is lessened when thrown out of gear during a storm. The moment the wheel is thrown out of gear, the brake operates to stop its revolution and hold it quiet until again thrown into gear.



HAWLEY'S WINDMILL.

The Speed of a Horse.

While the public is still marveling over Salvator's wonderful performance in running a mile in 1.35½, there are few who have, through comparison and analysis, sought to realize what a terrific burst of speed this is. It is nearly forty miles an hour—a rate averaged by very few of our fastest railway trains. There are 5,280 feet in a mile, so that for every one of these ninety-five seconds—for every beat of a man's pulse—this wonderful horse covered fifty-five and three-tenths feet of ground. The shortest space of time noted by the turfman's watch is a quarter of a second—an interval so brief that the eye can hardly observe, the mind can hardly appreciate it. Yet in every one of those 382 quarters of a second that magnificent creature leaped sixteen and three-tenths feet. Such are the amazing results of careful breeding as exhibited in the American race horse. Is the human race improving in the same ratio? Scarcely.—*Cincinnati Enquirer.*

AT Scranton's rail mill, Scranton, Pa., beginning with cold pig iron, 1,800 men turn out one finished steel rail every sixteen seconds. The men are aided by fuel and the most effective machinery. Each rail is 30 ft. long and weighs 60 to 70 lb. per yard. The pig iron is melted, converted into steel, sent through the various rolls, is sawed into proper lengths, punched and delivered, all in one continuous operation. 350,000 tons of steel rails is the annual product of the establishment.

A BALLOON ACCIDENT.

An ascension of the balloon Patrie took place from the Avenue de la Defense de Paris, at Courbevoie, at four o'clock on the afternoon of Sunday, August 31. Mr. Paul Leprince, the aeronaut, and Mr. George Dumuit, one of his friends, both of the age of 19 years, were in the car. The ascent was very rapid. The spectators who were present saw the balloon assume suddenly a peculiar shape. First it flattened out, then it assumed the shape of a spindle, then that of a ball. They supposed at first that the balloon was a dirigible air ship; but the real facts became apparent by the swaying of the balloon, and then by the awful drop that followed.

"The balloon has burst, and the poor unfortunates are lost!" cried the spectators. This is what took place, as narrated by Mr. Paul Leprince, who has been good enough to give us the facts of the case:

"There was nothing unusual about the inflating operations. For a moment, however, the balloon was carried by the wind against the branch of an acacia tree by the side of the road, but I only heard the rustling of the branches, and I did not think of the incident again. My friend and I embarked and in a short time reached an elevation of 1,500 feet, when we began to hear a peculiar whistling sound. I looked in the space about me, but seeing nothing, I climbed on to the ring and then discovered a tear of a few inches in length, partially filled by a branch of acacias which had penetrated the interior of the balloon. At this moment the sun dispelled the clouds and shone with all its luster upon the balloon. This produced such an expansion of the gases within that the gas was not able to escape sufficiently rapidly from the valve. The fabric was stretched to its utmost, with a dry, cracking sound, and I at once knew what would follow.

"George," I cried, "the balloon is torn and will not be able to bear the strain of the expansion, and will explode!"

I had scarcely uttered the words before the tearing of the fabric like the rustling of leaves could be heard, and a blue cloud appeared about the opening where the gas was pouring through in great volumes.

"We are lost!" cried George.

"The ballast!" I cried, "the ballast!"

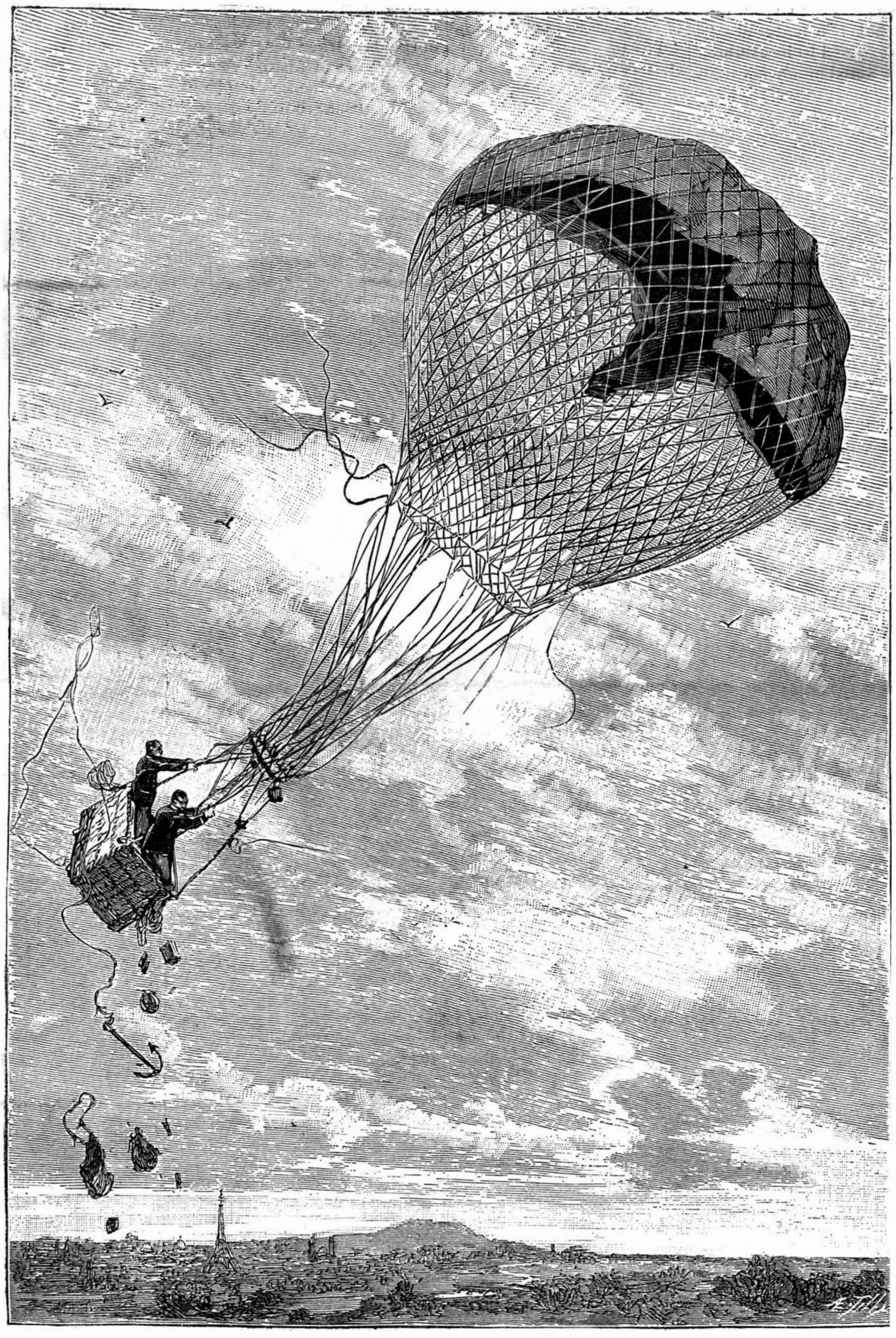
Fortunately he did not lose his head, and in an instant two bags were thrown out. I glanced at the barometer and saw that we were 4,740 feet from the ground, and the fall commenced.

Without losing an instant, and without relying at all upon my equipment, I cut off the anchor, I threw out the rope and my overcoat, in fact everything of any weight, and we prepared to throw off our clothes and to cling, at the moment of striking, in the netting above.

I notice that, fortunately, there is a strong wind blowing, which is carrying us along in an oblique line at the rate perhaps of 35 or 40 miles an hour. We were falling at an angle, and this perhaps would break the fall somewhat.

The balloon was violently shaken in its flight, and kept swinging and swaying in a horrible manner, but it was this that saved us. During one of the most violent of these swinging movements the lower part of the balloon was thrown to the upper part of the netting and rested there against the valve in the form of a dome, forming an immense improvised parachute. At once the fall was arrested sensibly. Still we were only about one hundred yards from the earth. I cried to Dumuit to throw out more ballast, and about 150 lb. more ballast in the form of sand was passed over the side. Now for our clothes. But there was no time. Scarcely had we reached the ropes attached to the ring when a terrible shock was felt, and we and the basket and the balloon and all were rolled over on the ground together. We were not injured, nor did we even lose consciousness. This fall of nearly a mile was accomplished in less than four minutes, during which period, as may be seen, no time was wasted.

I believe that our safety is due to the fact that neither of us lost our presence of mind. The conclusion to be drawn is that, even in an accident as serious as the bursting of a balloon in mid-air, the stuff out of which the balloon is made is likely to be formed into a sort of parachute by the upward current of air during the downward flight of the balloon. The other lesson is that however near death any one may be, it is always necessary to keep one's courage.—*Paul Leprince, Aeronaut, in L'Illustration.*



A FALL OF NEARLY ONE MILE THROUGH THE AIR.

Snakes in Banana Bunches.

Banana bunches brought from tropical America sometimes contain snakes of the family Boidæ tightly wound round the central stem. A specimen of this kind was taken in Savannah, Georgia, and was sent to the United States National Museum. I identified it as the *Epicrates augulifer*, a native of Cuba. More recently a snake was found in a similar situation in a lot of bananas in Chicago, and was sent by Dr. J. L. Hancock to the National Museum. Dr. Stejneger has identified it as the *Boa imperator,* the common species of Central America and Mexico. The specimens are always young, as adult boas of the genera named could not be concealed in so small a space.—*E. D. Cope.*

Dying Usually a Painless Experience.

The signs of impending death, says the *Medical Journal*, are many and variable. No two instances are precisely identical, yet several signs are common to many cases.

Shakespeare, who observed everything else, observed and recorded some of the premonitory signs of death also. In the account of the death of Falstaff the sharpness of the nose, the coldness of the feet, gradually extending upward, the picking at the bedclothes, are accurately described.

For some time before death indications of its approach become apparent. Speech grows thick and labored, the hands, if raised, fall instantly, the respiration is difficult, the heart loses its power to propel the blood to the extremities, which consequently become cold, a clammy moisture oozes through the pores of the skin, the voice grows weak and husky or piping, the eyes begin to lose their luster.

In death at old age there is a gradual dulling of all the bodily senses and of many of the mental faculties, memory fails, judgment wavers, imagination goes out like a candle. The muscles and tendons get stiff, the voice breaks, the cords of the tabernacle are loosening. Small noises irritate, sight becomes dim, nutrition goes on feebly, digestion is impaired, the secretions are insufficient, or vitiated, or cease, capillary circulation is clogged. Finally the central organ of the circulation comes to a stop, a full stop, and this stoppage means a dissolution. This is the death of old age, which few attain to.

Many people have an idea that death is necessarily painful, even agonizing, but there is no reason whatever to suppose that death is a more painful process than birth. It is because, in a certain proportion of cases, dissolution is accompanied by a visible spasm and distortion of the countenance that the idea exists, but it is as nearly certain as anything can be that these distortions of the facial muscles are not only painless, but take place unconsciously. In many instances, too, a comatose or semi-comatose state supervenes, and it is altogether probable that more or less complete unconsciousness then prevails. We have, too, abundant evidence of people who have been nearly drowned and resuscitated, and they all agree in the statement that after a few moments of painful struggling, fear and anxiety pass away, and a state of tranquillity succeeds. They see the visions of green fields and in some cases hear pleasing music, and so far from being miserable, their sensations are delightful. But where attempts at resuscitation are successful, the resuscitated persons almost invariably protest against being brought back to life, and declare that resuscitation is accompanied by physical pain and acute mental misery.

Death is a fact which every man must personally experience, and consequently is of universal interest, and as facts are facts, the wiser course is to look them squarely in the face, for necessity is coal black and death keeps no calendar.

To clean iron parts of machinery, tools, etc., two to three cents' worth of paraffine chipped fine are added to one liter petroleum in a stoppered bottle, and during two or three days from time to time shaken up until the paraffine is dissolved. To apply it, the mixture is well shaken, spread upon the metal to be cleaned by means of a woolen rag or brush, and on the following day rubbed off with a dry woolen rag.

Photographic Dyeing and Printing.

In the section of chemical science at the recent meeting of the British Association a paper was read on the action of light on the diazo-compounds of primuline and dehydrothiotoluidine. It was prepared mainly by Mr. A. G. Green, with the aid of Messrs. Cross and Bevan.

It has long been observed by Mr. Green that the diazo compound of primuline is very sensitive to the action of light, being readily decomposed thereby and losing its property of combining with phenols and amines. On this fact has been founded a photographic process by means of which designs can be produced in fast colors on cotton, silk, wool, linen, and other fabrics. The process can also be applied to wood, xylonite, celluloid, paper, or to gelatine films upon glass, thus affording a very wide range of employment. The process, which is a very simple one, merely depends upon the fact that if a material containing diazotized primuline be exposed to light under a design, those parts which are acted upon by light will be decomposed, while the parts protected from the light will remain unaltered, and, consequently, on subsequent development with a phenol or amine will produce colors, while the decomposed portions will not. The details depend somewhat upon the material to be treated. As an instance, the production of a design upon cotton cloth, cotton velveteen, etc., was taken. The material is first dyed with primuline from a hot bath containing common salt until the required depth is obtained. It is then washed and diazotized by being immersed for a quarter of a minute in a cold bath containing about one-quarter per cent of sodium nitrate, and strongly acidified with sulphuric or hydrochloric acid. The material is washed again, and exposed damp (or if preferred after having been dried in the dark) to the action of light beneath leaves, ferns, flowers, or other natural objects, or beneath glass or transparent paper upon which may be painted or printed any design which it is required to copy. Either the arc electric light or daylight may be employed. In the latter case the time of exposure will vary with the intensity of the light; under half a minute is required in bright sunshine, and nearly half an hour in very dark, cloudy weather. When the decomposition is complete, which may be readily ascertained by means of a test slip exposed simultaneously, the material is removed from the light, and either passed into the developing bath at once or kept in the dark until it is convenient to develop it. The developing bath consists of a weak solution (one-quarter to one-half per cent) of a phenol or amine made suitably alkaline or acid, the phenol or amine employed depending upon the color in which it is required to produce the design, thus—

For red, an alkaline solution of *b*-naphthol.

For maroon, an alkaline solution of *b*-naphthol-di-sul-sulphonic acid.

For yellow, an alkaline solution of phenol.

For orange, an alkaline solution of resorcin.

For brown, a solution of phenylene diamine hydrochloride.

For purple, a solution of *a*-naphthylamine hydrochloride.

If it is required to produce the design in two or more colors, the respective developers, suitably thickened with starch, may be applied locally by means of a brush or pad. After development the material is thoroughly washed and requires no further fixing. Linen, silk, and wool are treated in exactly the same way. Paper for copying drawings, etc., is coated on the surface with primuline by means of a brush or roller. For the production of galatine films upon glass the primuline is incorporated with the gelatine before being applied to the glass. In place of ordinary primuline the homologues already mentioned may be used. For silk and wool the primuline may be replaced by dehydrothiotoluidine-sulphonic acid, by means of which colorless backgrounds may be obtained. Concerning the reaction which occurs when the diazo-primuline or the diazo-dehydrothiotoluidine is decomposed by light, nothing definite can yet be said except that the diazo group is completely destroyed, for on treatment with sodium hydrosulphite (true hyposulphite) it cannot be converted into the amido group (re-forming primuline or dehydrothiotoluidine). The reaction may consist in a replacement of the N_2 group by OH or by H, or may be even more complex. The diazo compounds of this group of bodies possess an extreme susceptibility to light, far greater than that of other diazo compounds, while at the same time they are far more stable to heat. It is thus possible that this property may depend in some way upon the sulphur which they contain.

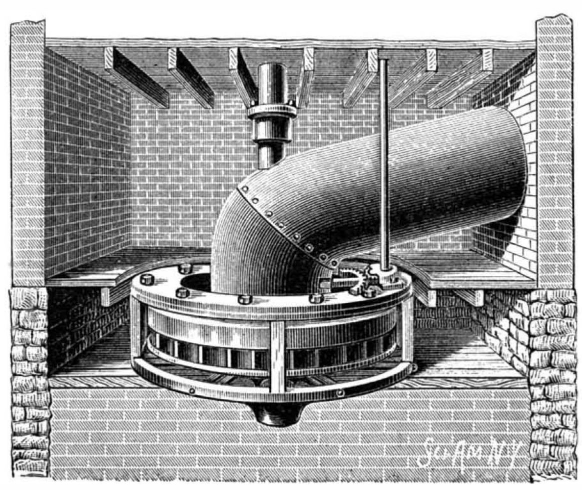
Mr. J. Spiller said that Mr. Green had kept him informed of the progress he had made since he discovered primuline, and he (Mr. Spiller) had worked on the paper basis a good deal. He found that he was dealing with a material which was extremely sensitive to light; indeed, he should be inclined to describe it as sensitive as the ordinary chloride of silver. At one time he thought it would be worth while to endeavor to use it in the camera, but his patience became exhausted when at the end of ten minutes he failed to secure the images. Of course, unless it was sensitive enough to take an impression in that time, it was not of much use in that direction. It was, however, interesting to find that when leaves and ferns or any object from which copies could be made by transmitted light were employed, according to the length of the exposure impressions either merely surface deep or which penetrated the whole paper were obtained, and the impressions were wonderfully permanent. They were not destroyed or injured in any way by the vast number of chemical bodies to which he had submitted them. He had tried almost everything he could think of, and nothing would destroy the impressions except the hydrosulphates to which Mr. Green had referred. He should like to hear whether Mr. Green and his colleagues had succeeded in getting a white basis by employing some agent to dissolve the unaffected portion of the material operated upon.

The president (Professor Thorpe) remarked that Mr. Green's discovery was another instance of history repeating itself. The old process of reproducing architects' and engineers' plans on a blue background with white lines was likely to be run very hard by the one they had unfolded to them by Mr. Green. When Sir John Herschel occupied the post he (Professor Thorpe) now filled, on the occasion of the previous meeting of the British Association in Leeds, the blue background process was in full vogue. Now they were likely to have another in its place.

Mr. Green stated that as yet he had not succeeded in getting absolutely white background, but he believed that it would ultimately be obtained.

THE NEW "PATRICK" TURBINE WATER WHEEL.

A water wheel of inexpensive construction, which cannot easily get out of order, and which is designed to give the greatest possible percentage of power from the amount of water used, is shown in the accompanying illustration, and has been patented in the United States and Canada by Mr. Adolphe Patrick.



THE NEW "PATRICK" TURBINE WATER WHEEL.

In this wheel the principle of outward horizontal discharge is combined with an upward discharge, and to this end the water is conducted into the inner or central portion of the wheel, whence it flows between fixed partitions and intermediate regulating gates, by which it is directed against the buckets of the wheel immediately outside of the guides. The mode of regulating the flow of water on to the buckets of the wheel is simple, avoiding all interfering mechanism and giving the way clear to the water from the penstock into the wheel case, whence it flows out between the partitions and the regulating gates on to the buckets of the wheel. The latter is supported by a central pivot which carries both the wheel case and the penstock, which is attached to it.

This turbine has been largely employed in Canada during the past three years, and is said to have given the greatest satisfaction to all parties using it. For further information regarding it address Mr. J. A. Grenier, Manager, Patrick Water Wheel Co., No. 204 St James Street, Montreal, Canada.

New Zealand Flax.

The purchase of New Zealand flax by the United States, in 1889, largely exceeded that of any other country. It is really a species of hemp, and costs, laid down in this market, from 5¼ to 6⅜ cents per pound for good Wellington and Auckland brands, as compared with 9c. for manila, 6c. for sisal and 6½c. for American hemp. It is used extensively by the cordage mills in mixes with sisal and manila hemp in making low grade rope and binder twine. The flax for export is usually cut from the swamps, marshes and river banks. It is in its wild, uncultivated state, and it is cut down and run through the machines without any attempt at selection. The persons usually employed to cut the green flax are paid by the ton, and, in order to get as much weight as possible, they cut as close to the ground as possible. The lower end of the leaf is thick and fleshy, containing a large amount of gum and vegetable matter, and weighs heavily as compared with upper portions of the leaf; besides, the fiber obtained from the butt end is very much inferior in texture.

To imperfect machinery and carelessness in the selection of green plants may be ascribed the coarseness and inferiority so often complained of in the flax exported from certain portions of New Zealand. But with improved flax-dressing machinery and proper care in the selection of the raw material, our consul at Auckland states that a very superior article can be produced. The hand-dressed article prepared by the natives is as fine as silk compared with the modern machine-dressed flax of to-day, which demonstrates the fact that the fiber may be reduced to a much finer quality if an improved machine can be invented, but the requisite machinery is lacking.

Many who profess to understand the toughness and durability of the fiber believe that if it could be properly reduced, it would enter largely and successfully into the manufacture of valuable textile fabrics. It is thought that the plant (*Phormium tenax*) would flourish in many parts of the Southern States.

Some Uncommon Metals.

There are quite a number of metals which are very sparingly distributed over the earth, and which few people have ever seen, but which have some exceedingly useful applications in the arts, and, in small quantities, are in almost constant use. Hydrogen, the lightest of all the elements, was discovered by Cavendish in 1766, and is considered by the best authorities to be a gaseous metal, just as mercury is a liquid metal at ordinary temperatures. Very few persons have ever seen solid hydrogen. Mercury becomes solid at —40°, but, according to Professor Pictet, hydrogen gas requires a temperature of —140°, and pressure of over two tons to the square inch, before it liquefies even. By suddenly removing the pressure from this liquefied hydrogen, the cold produced by its evaporation is so great that a part of it solidifies into a state resembling metallic grains, which remain visible for several minutes. Its metallic nature is also rendered probable by its directly uniting with a metal resembling platinum, and known as palladium, to form a sort of alloy. The weight of a single molecule of hydrogen has been calculated not to be greater than one ten-thousand-millionth of a gramme, and a cubic centimeter of the gas contains at least twenty-one trillions of such molecules. Although these figures are quite incomprehensible to the human mind, they must be approximately correct, and represent actual and existing magnitudes.

Lithium is a quite rare mineral, which occurs in some varieties of mica, and also in small quantities in the waters of certain mineral springs. It is considered to possess a distinct medicinal value by some physicians, and is probably taken into the system, at least, as we have detected it by spectroscopic analysis in the blood of a person who had been drinking a strong lithia water.

Barium is a metal closely allied to calcium, the metallic base of lime. It is never used in the metallic state, but the sulphate of barium is quite extensively used—either honestly or dishonestly—as a substitute for white lead in paint. It is cheaper than white lead, and is not changed in color by the sulphur compounds often present in the air, but possesses less covering power than lead, and is less permanent in other ways. The peroxide of barium is used in the preparation of peroxide of hydrogen, and the phosphorescent sulphide of barium is a constituent of some varieties of luminous paints. The green fire used in pyrotechny is also due to the presence of this metal in the form of a nitrate.

Selenium is not a metal, but belongs to the sulphur group of elements. We must mention, however, the wonderful property by which its electrical conductivity varies according to the amount of light falling upon it, just as the chemical relations of silver are altered by the same means. By this power Professor Bell was enabled to construct an optical telephone, and actually transmitted words and sentences between two distant points which were not connected in any way except by a beam of light, which faithfully carried the vibrations of his voice to a selenium disk, by which they were transformed into electric energy and reproduced in an ordinary telephone. Whether we shall ever be able to see our friends at a distance, as we now talk with them, is exceedingly problematical; but if we ever do so, it will doubtless be through this mysterious connection between light, electricity, and the element selenium.—*Popular Science News.*

To give a brilliant white light, a lamp needs a thorough cleansing every little while. The oil should be poured out of the fount, leaving no dregs on the bottom. The fount should then be washed in strong soapsuds, rinsed in warm water, and dried. It should then be filled with fresh oil. The burner should be boiled in soda and water until the network that crosses it is freed from dirt and dust. If the wick has become clogged with the sediment, replace it with a new one.

CENTENNIAL OF THE COTTON MANUFACTURE IN AMERICA.

December 20, 1790, marks the date of the real birth of the cotton-spinning industry in this country, and in commemoration of that fact the town of Pawtucket, R. I., where the event occurred, held a centennial celebration, lasting through the week from September 29 to October 4, inclusive. The programme was an elaborate one, as for that of an occurrence whose importance it would be difficult to overestimate, and included parades by the militia and Grand Army men, firemen's and trades organizations, and an immense procession of Sunday school children, largely attended meetings at which suitable commemorative addresses were made, and a great industrial exhibition designed to illustrate the progress of the cotton manufacture during the last one hundred years. The military pageant on one day of the celebration is said to have been greater than had ever before been seen in Rhode Island, and it is estimated that more than one hundred thousand visitors were present.

The main features of the celebration, as of the event itself, have clustered around one name, that of Samuel Slater, who arrived in Pawtucket in 1789, and was the first to bring to this country a clear understanding of the system which had been perfected by Arkwright for the carding and spinning of cotton by machinery operated by power, with the practical knowledge necessary to construct and operate such machinery. Previous attempts had been made to build an operative spinning jenny, with the machines working the raw cotton therefor, both in Massachusetts and Rhode Island, in 1786-87-88, and like efforts in this and other branches of the manufacture were at the same time being made in New York and Pennsylvania, but the first to undertake the business were everywhere unsuccessful. At the same time the English cotton manufacture, mainly through the inventions of Hargreaves, Arkwright, and Samuel Crompton, of Bolton, with the contributions of many lesser inventors, had become established on the modern lines along which it has since shown such wonderful development, and all who were interested therein were reaping rich harvests. Every effort was made to keep the secrets of English machinery from the knowledge of the outside world, an act of Parliament prohibiting the exportation of such machinery, and great care was taken to prevent the departure of any one having knowledge of the manufacture. Admission to the factories and workshops where the new business was carried on was everywhere jealously guarded, and manufacturers were also extremely watchful of each other.

It was at this time that Samuel Slater landed in New York City, in the year 1789. He was twenty-one years old, and had only just completed an apprenticeship of six years with Jedediah Strutt, of Belper, England. Mr. Strutt was a partner of Sir Richard Arkwright, and by the terms of the indenture, which is a very quaint and peculiar document, the young apprentice was to be taught all the mysteries of the cotton manufacture, as it was then known, in what was probably one of the best factories in England at the time. On his arrival here he had no measurements, patterns, or designs of the great amount of new and complicated machinery he had been studying during his whole apprenticeship to familiarize himself with, for he deemed it would have been unsafe to have attempted to leave England with such property in his possession, and his departure was kept a secret from his friends and family, a letter to his mother after he had boarded the ship to bear him away being the first intimation he gave of his intended departure.

After working in New York for a short time for the New York Manufacturing Company, the young cotton spinner made the acquaintance of the captain of a vessel sailing to Providence, R. I.—sailing vessels then being the most convenient means of communication with Eastern cities—and through him learned of the efforts that had been made to establish the cotton manufacture in Rhode Island. Moses Brown, a Quaker, of Providence, the direct predecessor of the great cotton manufacturer whose name has since become famous as a member of the firm of Brown & Ives, had invested some money in machinery for making yarns for the weft of mixed linen and cotton goods, but the attempt to carry on the manufacture had broken down. To Moses Brown, therefore, young Slater applied for the position of manager, saying it was a business in which he flattered himself he could "give the greatest satisfaction in making machinery, making good yarn, either for stockings or twist, as any that is made in England." A favorable response came immediately, and early in January, 1790, Slater arrived in Providence, and was thence taken to Pawtucket, where the machinery had been set up. The contrivances he was here shown were at once declared useless, but the young mechanic added that he could "make machines that will do the work and make money at the same time."

An arrangement was finally agreed upon by which the young mechanic was to build a set of machines according to the Arkwright system, and receive therefor all the profits over the interest of the capital invested, Mr. Brown pointing out that to the young Englishman would belong "the fame as well as the advantage of perfecting the first water mill in America"—the terms "water mill" and "water frame" being then used to designate machinery run by water power. The reply was, "If I do not make as good yarn as they do in England, I will have nothing for my services, but will throw the whole of what I have attempted over the bridge." The agreement under which work was commenced was with the firm of Brown & Almy, who were to turn in their old machines at cost price, furnish materials for the construction of two new carding machines, a breaker and a finisher, a drawing and roving machine, and enlarge the spinning frame capacity to one hundred spindles, Mr. Slater to contribute his time and experience to building the machines, and, when built, to operating them, his compensation to be one-half of the profits.

FOUNDER OF THE COTTON INDUSTRY OF THE UNITED STATES.

To commence the work of building the machinery necessary to make cotton yarn with the limited appliances then at hand, and with the necessary knowledge in the mind of only one individual, was a task which would have daunted any but the most courageous. It required nearly a year to complete the first frame of twenty-four spindles, because everything was to be made, even tools to work with, but Mr. Slater was a worker, and is reported to have said in after life that he had labored sixteen hours a day for twenty years successively. His greatest perplexity was in making the cards, concerning which an erroneous report has been widely published that he was extricated from his embarrassment by means of a dream. Such, however, was not the case. The truth of the matter is related as follows in White's "History of the Rise and Progress of the Cotton Manufacture," published in 1836, the author having personally obtained the particulars of Mr. Slater: "After his frames were ready for operation, he prepared the cotton and started the cards, but the cotton rolled up on the top cards instead of passing through the small cylinder. This was a great perplexity to him, and he was for several days in great agitation. The family in whose house he boarded have since described his trial to me. When leaning his head over the fireplace they heard him utter deep sighs, and frequently saw the tears roll from his eyes. The family had become interested in his favor. He said but little of his fears and apprehensions, but Mrs. Wilkinson perceived his distress, when she said to him, 'Art thou sick, Samuel?' When he explained to the family the nature of his trial, he showed the point on which he was most tender, saying, 'If I am frustrated in my carding machine, they will think me an impostor.' He was apprehensive that no suitable cards could be obtained short of England, and from thence none were allowed to be exported. After advising with the maker of the cards, it was perceived that the teeth were not crooked enough; as they had no good card leather, and the holes were pricked by hand, the puncture was too large, which caused the teeth to fall back from their proper place. They bent the teeth with a piece of grindstone, which gave them a proper crook, and the machinery moved in order, to his great relief and to the joy of his friends."

When Mr. Slater came to Pawtucket, he was introduced to the family of Oziel Wilkinson, as a suitable home, and afterward married one of the daughters of Mr. Wilkinson. The latter had five sons, all of whom were brought up as blacksmiths, and had more or less to do in aiding Mr. Slater in building his machines. One of the sons, Smith Wilkinson, afterward became the principal owner of the Pomfret, Conn., factory, and David, another son, bore a prominent part in the early development of the manufacturing business of Cohoes, N. Y. The lately deceased Robert Johnson, for nearly half a century the superintendent of the Harmony Mills, at Cohoes, was also a worker with Mr. Slater.

From the successful organization and starting of the factory at Pawtucket, in 1790, dates the real commencement of our cotton-manufacturing industry upon a permanent foundation. It is believed that nearly all the establishments put in operation, up to 1805, were started under the direction of men who had learned the business in that factory, or had some connection with it, and for many years Slater's mill was the point to which nearly all English mechanics seeking employment in this country first directed their footsteps, afterward finding their ways to the various other factories which began to spring up soon after. Up to 1817 the operations of the factories were confined to spinning yarn only, which was put out in webs and wove by hand loom weavers. Mules for spinning filling had not then been introduced. The cotton used to be put out to poor families in the country and whipped on cords, stretched on a small frame, the motes and specks being picked out by hand at four to six cents per pound. In 1810, however, there were nearly one hundred factories in operation, with over eighty thousand spindles, and England had a competitor in the business of cotton manufacture whose enterprise and resources she has not since ceased to feel.

It is claimed for Samuel Slater, also, that to him belongs the credit of having started the first Sunday school in America. It is certain that this was a work entered upon by him very soon after his arrival here, and in which he was always greatly interested. During the centennial week there was an immense Sunday school procession, and in his remarks on this occasion Governor Davis, of Rhode Island, said: "The welfare of his employes and the wants of the poor were ever before him, and for them he established a Sabbath school and a secular and a ragged school, and as a great benediction upon Samuel Slater's Sabbath school, planted in this humble town, now nearly one hundred years gone, a son of his, John W. Slater, has given $1,500,000 to endow schools, and to scatter scholars, teachers, and learning broadcast among the poor freedmen of the South—children of the very toilers who once produced the cotton which the father here taught the scholars to spin."

The exhibition was arranged as a display of the products of the genius and skill of American labor, in memory of Samuel Slater, "the father of American cotton manufacturers."

Many thousands of spindles were idle throughout the State to allow operatives to participate in the celebration, and in Pawtucket but little else was done for the entire week but make the most of the occasion.

Rothschild's Wish.

A story is related of one of the Rothschilds which may never have been said by him, but which nevertheless is true, as every successful business man will testify.

"I hope," said a friend to Rothschild, "that your children are not too fond of money and business. I am sure you would not wish that." "I am sure I should wish that," replied Rothschild. "I wish them to give mind, soul, heart, and body to business—that is the way to be happy. It requires a great deal of boldness and a great deal of caution to make a great fortune, and when you have got it, it requires ten times as much wit to keep it."

URANIUM was unknown a century ago, but a lode has been found in a mine in Cornwall, England. It sells for $12,000 a ton.

RECENTLY PATENTED INVENTIONS.

Engineering.

POINT FOR WELL SINKING MACHINES.—A new point, adapted for well sinking or prospecting machines, has been patented by Messrs. Joseph R. & Wm. B. Coffin, of Bliss, Nebraska. This point is constructed so as to permit a free downward flow of water while the well is being sunk and a free upward flow of water when the well is completed. It consists of a perforated tube, carrying at one end a drilling tube containing a pipe provided at the top and bottom with valves.

AUTOMATIC CUT-OFF.—Henry Beddoe, Rolla, Mo. This invention covers a spring-pressed wheel mounted to oscillate and connected with the cut-off valve, but controlled from the main valve, being simple and durable in construction, and adapted for reversing or non-reversing engines, to cut off the supply of steam to the cylinder in proportion to the work required at a given speed.

ORE ROASTING FURNACE.—Simon B. Dexter, Glendale, Montana. This furnace has a vertical roasting chamber with an outlet on top for waste gases and products of combustion, side fire chambers near its lower end, with updraught flues from below the fire chambers discharging into the top outlet, with other novel features, for treating ore dust by passing it through the furnace in the direction of the draught of the fire, thereby insuring a thorough treatment of the ore without appreciable waste.

Railway Appliances.

CAR COUPLING. — William H. Harris, Newberry, S. C. This is an automatic coupler in which each drawhead is made with a rigid and a movable jaw, the movable jaw being articulated about a vertical axis and having locking devices for holding it in position, the coupling being designed to be simple and inexpensive, and to effect the coupling and uncoupling in a certain, safe, and convenient manner.

SNOW PLOW. — John H. Pielert, Triumph, Md. This is a machine arranged to be fitted to a locomotive, as a double ender of powerful capacity, to cut out and throw away the snow to either or both sides of the track, and is provided with means whereby so much of the snow as may be required can be led to the water tank of the locomotive to supply water for boiler use.

Electrical.

ELECTRO OSTEOTOME. — Dr. M. J. Roberts, New York City, has recently patented an improved electrical apparatus for conducting operations in bone surgery. The various implements used are operated rapidly, smoothly and positively by means of a small electric motor arranged in the handle or carrier of the instrument. By means of this improvement the operator's attention and strength may be directed solely to guiding and controlling the instruments.

Mechanical.

WHEEL OR PULLEY. — David C. Frazeur and William J. Davis, New Market, N. J. In this wheel or pulley mechanism, combined with a supporting frame is a bored hub having a loose interior axle, an endless chain of rollers between the axle and the wall of the bore, end plates for the hub secured to the frame, and bolts adapted to the hub and end plates, whereby the strain of working is not taken at one place along the bore, but at opposite sides or all around it.

WRENCH. — David V. Cash, Johnson City, Tenn. The handle of this wrench turns upon a socketed hub, there being a pair of ratchet disks having their teeth arranged in reversed directions between the handle and hub, and a rotatably reversible pawl pivoted to the handle and having oppositely disposed prongs adapted to engage their respective ratchet disks, the tool being designed to be simple, durable and safe.

PACKING RINGS.—Charles L. Eastman, Brooklyn, N. Y. This invention relates to cylinder packing rings, and making them as expansible rings designed to fit accurately in place as well as if each were made from a single piece, the ring being formed with radial slots crossed by transverse slots, filling the slots with melted metal, and after cooling cutting the ring into segments.

CALCINING GYPSUM. — James Sickler, Salina, Kansas. This invention covers an improved process, which effects the retarding of the setting of plaster of Paris by incorporating a retarding agent in the plaster prior to the complete calcining, and whereby the retarding agent is uniformly and homogeneously mixed with the finished plaster without deterioration to its final setting qualities, and giving the workman more time to apply and fasten it into the desired forms.

WIRE DRAWING DRUM.—William W. Shearer, Port Angeles, Washington. By means of this invention the wire is seized at the die by automatic pinchers attached to a chain or wire rope secured to the sheave within the drum, the sheave revolving independently of the drum and drawing the chain and pinchers holding the wire entirely within the drum through an opening in its side, thus drawing the wire from the die and attaching it to the drum with one continuous motion.

Agricultural.

CORN PLANTER AND FERTILIZER DISTRIBUTER.—Jacob W. and William C. Duryea, Blawenburg, N. J. This is a machine adapted to operate one or two seed-dropping mechanisms and corresponding fertilizer distributers, located at suitable distances apart according to the space between the rows of corn to be planted, and, while simple and durable in construction, is designed to permit an accurate check planting of the seed and marking of the hills.

CHURN POWER. — John S. Dickey, Blanket, Texas. This invention relates particularly to a vertical single-dasher reciprocating churn, providing a construction therefor which is designed to be simple and durable and give a maximum length of stroke, while always keeping the dasher elevated where not in operation.

MEASURING BUTTER IN MILK.—John T. Riley, West Union, Iowa. This is a device for determining the butter value of milk or cream of different qualities, providing an inclined guide with a scale carrier at its lower end, a lever pivoted at the upper end of the guide, and a sample tube carrier adapted to slide along the guide.

VINE SECURING DEVICE. — John Stangl, Harlem, Mo. This is an improvement on a former patented invention of the same inventor, providing a slotted hoop or band with a spring projecting through the slots in such a manner that the vine will be held between the spring and the hoop or band, to hold vines upon a trellis in such a manner that the tendrils will not indiscriminately clasp the support, and the vine may be readily removed at the approach of winter.

BEE SWARMER. — Francis D. Lacy, Nirvana, Mich. This is a device designed for use in connection with any kind of hive, and provides means whereby an empty and an occupied hive may be so connected when the bees show inclination to swarm that they will be forced to take possession of the empty hive without incurring any loss in numbers and with safety to the operator.

PEANUT CLEANING MACHINE.—James M. Williams, Petersburg, Va. This invention relates to a machine having a revolving cylinder in which the good nuts are separated from the dirt, which is positively drawn from the cylinder, so that the nuts will polish each other, with simple means for separating the pops and shells from the good nuts and produce a finer quality thereof, with a minimum degree of waste.

CALF WEANER. — Ernst H. Geisler, Deshler, Neb. This is a device formed of a number of rods bent to constitute a halter-like frame and united at a point near their forward ends, and form prongs, in connection with a re-enforcing plate which holds the prongs from spreading or becoming loosened.

Miscellaneous.

TYPE WRITING MACHINE.—Henry R. Kennedy, New York City. This machine has 29 keys, 26 of them bearing alphabetical and other characters, while three central keys are specially marked, one to be depressed when a capital letter is to be made, another when a figure or special character is wanted, and another being the spacing key, the machine being designed to be light, compact, inexpensive and efficient.

PRINTING ADDRESSES.—Hugo Lewinsohn, Bromberg, Germany. This invention is for a printing press adapted to print addresses or other matter upon envelopes, wrappers and parcels, etc., the invention covering a novel construction, combination and arrangement of parts.

REED ORGAN. — Jarvis Peloubet, Bloomfield, N. J. The wind chest of this organ is provided with two resonating chambers located one above the other and provided with a flexible top and bottom, these chambers being located below and above the key board, and being more resonating than the remaining parts of the wind chests.

FRAME BARS FOR GLAZED STRUCTURES.—Willard F. Mills, Kalamazoo, Mich. This invention covers an improved metallic setting or glass supporting bar especially adapted to retain stained glass of different contours used in the production of ornamental artistic designs in windows or similar works of art, the object being to make a light, strong and handsome bar out of sheet brass or other metal, and one which will be economical.

ROTARY MEASURE. — William C. Wells, Chicago, Ill. A casing with vertical sides has a graduated wheel journaled therein operating an indicator disk by means of a cam, disk, lever, and pawl, whereby straight, curved or compound lines and distances of all descriptions may be measured, such as the inside measure of boxes, rooms, etc.

BALING PRESS.—Henry Kile, Marshall, Ill. This invention is intended to provide an improved press, simple and durable in construction and very effective, specially designed for pressing broom corn, hay, cotton, etc., into compact bales for storing and shipping.

ASH LIFTER. — Henry D. Wendt, 29 Union Square, New York City. This is a machine for lifting ashes, etc., from the holds of vessels, and similar uses, working in a vertical position with adjustable chutes or spouts by means of endless chains, the machine requiring but little space and being designed to work very economically; it is also applicable for conveying coal from barges into ships and ore out of mines.

FLOATING BREAKWATER. — John M. White, Long Branch, N. J. This invention consists of a series of pontoons pivotally connected with each other, and each composed of longitudinal and transverse hollow cylindrical tubes and projections extending upwardly therefrom, for the protection of coasts from the action of heavy waves.

CAMERA SHUTTER.—Henry W. Hales, Ridgewood, N. J. This invention covers an attached arm and spring made capable of swinging to actuate the shutter from opposite ends in either direction, whereby the shutter is always self-setting, as regards its closure of the lens aperture, to admit of the withdrawal of the plate holder of the camera, without risk of exposure of the plate till the shutter is shot.

BEER COOLING APPARATUS.—Joseph Peter, Bucyrus, Ohio. A refrigerating chamber through which water constantly circulates and through which pass the beer pipes is provided, a cabinet containing the refrigerating chamber, with storage compartment for bottled liquors and a water cooler, all communicating with each other and cooled by the circulating water.

MECHANICAL FOG HORN. — Frank E. Dyer, Mount Desert, Me. Connected with the horn proper is an air pump, with flexible tube leading therefrom to a receiver provided with shoulder straps, the receiver being connected by another flexible tube with the mouthpiece of the horn, making a device which can be readily carried about and sounded with full blasts.

COUNTER GUARD. — George C. Peck, Pawtucket, R. I. A series of perforated brackets are secured on the edge of the counter and bent to extend over it, while wires are strung through the perforations and secured therein at spaced intervals, to protect goods exposed for display on counters and shelves, the appearance being neat and the cost moderate.

TRICYCLE ATTACHMENT. — Daniel Dennett, Brookhaven, Miss. This is a chair attachment to especially adapt velocipedes, tricycles, etc., for occupancy by babies or small children, the chair being conveniently and safely secured to or suspended from the rear axle of the vehicle.

KNOCKDOWN TRUNK.—Monroe Green, Brooklyn, N. Y. This invention provides a trunk designed to be quickly and easily taken apart to be packed in small compass, while it may be as quickly put together, and will be as strong as if the parts were permanently fastened in the usual way.

GAS STOVE. — James Gibbons, Jersey City, N. J. Combined with a stove body which has an interior fire and mixing chamber, closed at the front by a transparent outer wall, are upper and lower partitions, a superheating chamber for air supplied for combustion, and other novel features, making an inexpensive and efficient stove designed to present a cheerful appearance and insure a maximum radiation of heat with a minimum supply of fuel.

CARVER'S FRAME. — James M. H. Frederick, Akron, Ohio. This is an adjustable supporting frame for poultry or other cooked meats, to hold them in position upon a platter, whereby the operation of carving will be facilitated, the frame being of metal, and having supporting standards to engage the article to be carved and hold it in position.

WATER CLOSET INDICATOR. — John Dihrberg, Visalia, Cal. This is a device of prominent and permanent character, to be attached to the outside of the closet door, and controlled by a cord or string from the interior, to signify when the closet is occupied.

FLY FRONT GARMENT. — Charles Dusenberry, Jr., Tuckahoe, N. Y. Combined with the front fabric and attached fly facing is a cord re-enforce held to the fabric and facing, and crossed at places between or adjacent to the button holes of the fly, the improvement being adapted to all classes of fly front coats or garments, but especially to rubber goods.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(2479) S. B. writes: 1. What is the name of the best gas to sustain human life in a submerged boat? A. Air; the oxygen of the air is the sustaining agent, and its proper dilution with nitrogen is essential. 2. What quantity of said gas would be ample to sustain 10 adults for 24 hours? Length of boat inside 95 feet, width 12 feet, depth 15 feet, tapering from the center to both ends. A. The same air will last a long time if properly treated. Caustic soda or freshly slaked lime should be used to absorb the carbonic acid gas, and a strong solution of permanganate of potash should be used to destroy organic emanations. These agents must have a good surface exposed to the air, and should be occasionally agitated or stirred. The motion of the boat should do this. Then for each person 15 to 20 cubic feet of oxygen should be added to the air during the 24 hours.

(2480) G. F. D. asks: 1. Is the skull of the negro formed of the same number of bones as the skull of the white man, the suture between the parietal bones being present in the negro? A. Yes. 2. Please give process of preparing absorbent raw cotton. A. Boil best quality of cotton with 5 per cent solution of caustic soda or potash for one-half hour. Wash thoroughly and press out all water as far as possible, and immerse in a 5 per cent solution of chloride of lime (bleaching powder) for 15 or 20 minutes; wash with a little water, then with water acidulated with hydrochloric acid, then with water. Boil once more for 15 minutes with caustic soda solution and wash with acidulated and plain water as before. 3. Please give receipt for a good counterfeit detecter. A. The ring, feeling, weight, size, and appearance are the most practical tests.

(2481) W. H. W. asks: 1. In what way is the dry plate used in photographing prepared? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 272 and 541. 2. In what way is the albumenized paper prepared before the silver nitrate is added to it? A. It is coated with the white of eggs containing a small quantity of salt. It is easier and cheaper to buy it ready coated than to do it yourself. The prepared paper is sensitized by floating on a nitrate of silver bath. 3. What is the best way to separate sulphuric acid and water, after they have been mixed together, so as to retain all of the acid? A. Boil off the water. 4. In what way is the metal aluminum got from clay? A. We refer you to our SUPPLEMENT, Nos. 679, 554, 617, 706, and others.

(2482) O. T. D. writes: 1. Can you answer this question, what is electricity, just the same as if asked what is steam? A. It is not known what electricity is. Human knowledge has not yet gone far enough to define it with certainty. 2. What is the reason storms from the west seem to generally blow harder than from the east? A. Dry winds come from the west. Water is an equalizer of temperature, and the ocean should be expected to act as such an equalizer. At the same time it would take some examination of records to ascertain the relative violence of east and west winds.

(2483) C. E. A. asks how to make rubber stamps. A. Rubber stamps are made from rubber unvulcanized, but mixed with the vulcanizing material. The letters, etc., are set up in metal and a mould in plaster of Paris is taken from them. This is brushed over with ground talc. The sheet of prepared rubber is placed on it and pressed down in a small screw press. The whole is then exposed to heat in a vulcanizer. For general manipulation of India rubber we refer you to our SUPPLEMENT, Nos. 249, 251, and 252. Even what is known as "pure gum," a kind of vulcanized rubber, may be made to work as above described without any addition of vulcanizing material. 2. What is the process of zinc etching, and is there any publication on the subject? A. There are many of our SUPPLEMENTS that treat of photo-zincography, Nos. 438, 584, 587, 656, etc. Plain etching may be done with sulphuric acid.

(2484) A. H. H. asks: 1. Where can I get a book on photo electrotyping? A. We have published a great many SUPPLEMENTS on this and related subjects, and refer you to our index for their titles. 2. Is there any good printer's ink eraser that will take print off paper? A. No. 3. Is Edison incandescent light suitable for photo-printing? If so, what candle power is required? A. No. Use Edison arc light on incandescent circuit with nitrate of silver to make the prints black and imitate black print? A. Tone the prints with the borax and gold toning bath. See SCIENTIFIC AMERICAN, April 3, 1889, page 225.

(2485) G. S. E. asks: 1. In speaking of alloys as so many parts, do you mean parts by weight? A. Yes. 2. Will alloys stand violent treatment, such as violent churning, pumping, compression, etc., while in the liquid state, without breaking up into their constituent parts? A. Yes. 3. About what per cent of the current is used by the meters to measure the current flowing from the dynamo? A. It varies with different instruments, but is very small. 4. Will magnetic lines cross one another at right angles in a mass of soft iron? A. No. 5. Will they in a mass of steel, *e. g.*, if the poles of a permanent horseshoe magnet were to be placed at the center on each side of a straight permanent magnet, would magnetic lines cross the center of the straight magnet? A. No.

(2486) E. B. asks: 1. How many grains of carbonate of soda and how many of caustic soda will it take to soften one gallon of water of 15° hardness (carbonate of lime 15 grs.)? A. If the lime is present as bicarbonate, add 12 grains caustic soda. If common caustic soda is used, add about 20 grains to allow for impurity. If the lime is present as hydrate, add 15 grains of dry carbonate of soda. This can be made by drying washing soda at a strong heat (short of red) or use 25 grains baking soda. The last is best. 2. Also is there any precipitate? A. Yes. Decant or filter, or pay no attention to the precipitate.

(2487) J. T. F. asks: What are the colors used in making solid black photogravure ink? A. The best lampblack is the basis of black printing inks. We can supply you with books containing formulæ, for printing inks, but success and their composition is not disclosed.

(2488) F. L. W. asks (1) how to make a good leather cement, such as is used by cobblers on invisible patches. A. It is a solution of gutta percha in bisulphide of carbon. 2. Will oiliness of the leather affect the adhesion? A. The leather has its surface cut or buffed off, so as to bring clean leather surfaces together.

(2489) C. B. asks: How can lantern slides, made on Carbutt's gelatino albumen plates, be colored? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 423, and Hepworth's "Book of the Lantern," price $2.75. Aniline dyes slightly diluted, put on with a camel's hair brush, are largely used.

(2490) A. G. T. writes: I have an electric bell, and have been trying different things with it, and have found that the electricity after having gone through the magnets makes a brighter spark than it does before it goes through them, when connected and rubbed on iron (that is, the wire); could you inform me why that is? A. This is due to induction. The coil of the bell magnet with its iron cores acts as a "spark coil," and increases the potential or sparking power of the current.

(2491) G. L. S. asks: How can a meerschaum pipe be colored rapidly? A. There is a process used by the makers to do this, but it is a secret. The only satisfactory way is to smoke the pipe and produce the color naturally. Queries No. 2364 and 2474 may be referred to in this connection.

(2492) A. S. B. asks for a recipe for fixing drawings made with carbon pencils, that the drawings will not rub out or be spoiled if touched. A. Immerse the drawing in skimmed milk. A special fixative is sold for the purpose by dealers in art materials.

(2493) S. M. H. asks: Will a man of ordinary intelligence, but without a knowledge of chemistry, be able to learn the art of assaying gold and silver ores by studying a manual, such for instance as the one you sell by Walter Lee Brown, of Chicago? A. Practice is the great teacher for assaying; chemical knowledge is not absolutely essential for the ordinary work. In volumetric work considerable manipulative power is needed.

(2494) E. E. writes: Wishing to preserve the color of the red bronze hinges of small white metal cases which get discolored (oxidized) by exposure, I would ask you kindly to inform me of any powder or solution answering the purpose. A. Varnish with linseed oil and japan if bronzed; if of real bronze, apply lacquer.

(2495) G. A. S. writes: I have had given me recently the following problem: Given the chord and rise of an arc, to find the radius. I have had also given me the following rule whereby to find the quantity desired, but my man tells me it is not accurate and practical. To four times the square of the rise add the square of the chord, and divide this sum by eight times the rise; the quotient will be the radius. Is this rule correct? A. The rule is correct.

(2496) T. J. W. asks (1) the cause of the blackening of the globes of incandescent lamps. A. No really good theory has been advanced. The successive dissociation and new formation of carbonic acid gas may have something to do with it, if there is any oxygen in the globe. 2. Has the minute quantity of oxygen that it is impossible to get out anything to do with it? A. Possibly, yet some lamps contain probably no oxygen whatever. 3. What is a good paste to cement the carbon filament to the platinum wire? A. Use a fine screw or electro soldering, viz., the deposition of copper about the joint by means of a battery.

(2497) J. S. W. asks whether there are any valves used in a calcium light burner. A. Not in mixed gas burners; sometimes there are cocks on blowthrough burners.

(2498) G. M. D. asks how to make the mixture which is put on the edge of pads of paper to keep the sheets together? A. For fifty parts dry glue take nine parts glycerine; dissolve in water, first soaking the glue alone; color to suit with cochineal.

(2499) E. R. asks (1) a receipt for something to kill fleas on a cat or dog without injuring the animal. A. Use buhach or weak mercurial ointment. Essence of pennyroyal will drive them off. 2. The address of a technological school, not north of Baltimore. A. The Johns Hopkins University, Baltimore, Md.; the University of Virginia, Charlottesville, Va.

(2500) E. S. McG. asks for a receipt for sticking glass together so that it will hold water. A. Use Canada balsam or dammar varnish.

(2501) J. A. asks: Is there a liquid which will dissolve sulphur and keep it in solution after water is added? A. No, unless a solution of an alkali which combines with the sulphur be considered such a liquid.

(2502) G. M. asks: How can porcelain be cemented to wood? A. Sealing wax might answer, or Davy's cement, made by melting together equal parts of pitch and gutta percha, might be better. The following diamond cement might be tried: Soften eight parts isinglass in a very little water, add 1 part spirit of wine. Dissolve in 3 parts spirit of wine 1 part gum ammoniacum and 1 part galbanum. Mix. Apply hot.

(2503) D. N. asks: 1. Give a short simple method for finding the area of circle. A. One-quarter of the diameter multiplied into the circumference gives the area. The circumference is found by multiplying the diameter by 3.1416. 2. A recipe for a good liquid shoe polish not injurious to leather. A. The following is said to be a good formula for liquid shoe blacking. Boil 1 part of extract of logwood, 30 of gall nuts coarsely powdered, with 25 of their combined weight of strong vinegar. Filter, add 8 parts of green vitriol. Allow it to settle for twenty-four hours; stir in 8 parts of gum, 100 of sugar, and 80 of sirup. Strain and add 50 parts of spirits of wine, 40 of shellac solution, and 40 of pulverized indigo.—*Techno-Chemical Receipt Book.*

(2504) Bristol asks: 1. How to make a good imitation or substitute for horn. A. Try a solution of glue mixed with one-tenth its weight of bichromate of potash, boiled down in the dark, and exposed to the sun. 2. How to dissolve aluminum palmitate. A. It dissolves slowly in benzine, kerosene, turpentine, etc. Heating facilitates solution, but a return condenser must be used. A 10 per cent solution in turpentine is quite thick.

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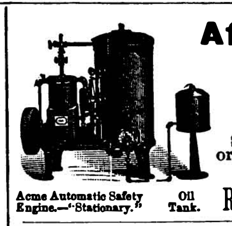

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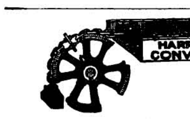

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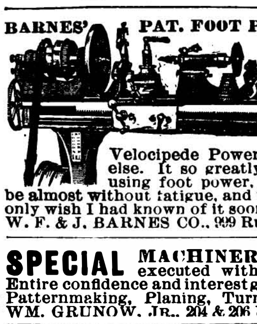

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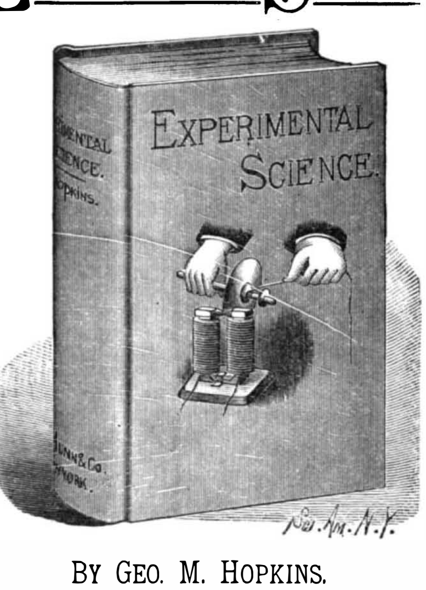

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