SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES

Vol. LXV.—No. 11. ESTABLISHED 1845. NEW YORK, SEPTEMBER 12, 1891. $3.00 A YEAR. WEEKLY.

A NEW TYPE OF FOLDING BRIDGE.

The bridge shown in the illustrations has been recently erected over the north branch canal at Weed Street, Chicago, and is designated by the Board of Public Works of that city as "an entirely new type of draw or lift bridge." Chicago has sixty-one bridges within its limits, fifty-three crossing the Chicago River and its branches, five crossing the Calumet River, and three the canal, but all of them have heretofore been pivot bridges, supported on a center pier standing in the middle of the stream, and dividing the river into two channels, thus reducing its navigable capacity. The construction shown affords a clear passageway for vessels in the center of the stream where the water is deepest, and gives unobstructed dock privileges up to the street line.

The width of the river between dock lines at the bridge site is 150 feet and the clear opening left for vessels by the bridge is 62 feet. As seen by the drawings, each half consists of two sections of girders supporting the floor, hinged together at their points of junction and suspended from the tower by tie rods at the points of junction and the ends of the outer girder sections. When open, the floor assumes the position shown by dotted lines in Fig. 1, and at one side in the perspective view, and not only is the space between piers free for the passage of vessels, but the raised floors form effective guard gates against accidents to the highway travel. To counterbalance the power required to open or close the bridge, a weight is suspended in each tower, the wire rope from said counterweights passing over the pulley, P, and thence to cams, C, which are attached to the horizontal shaft, on which is also the drum, D, which operates the structure in connection with the arcs, A, which form a part of inner or land girder section, by means of wire ropes.

Fig. 1.

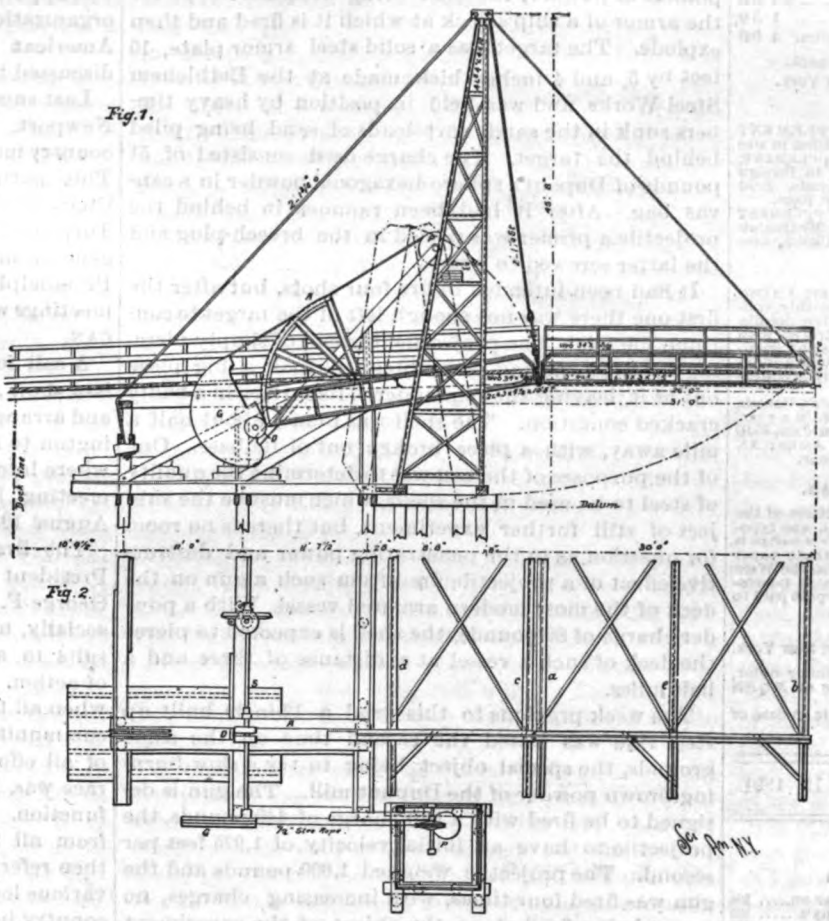
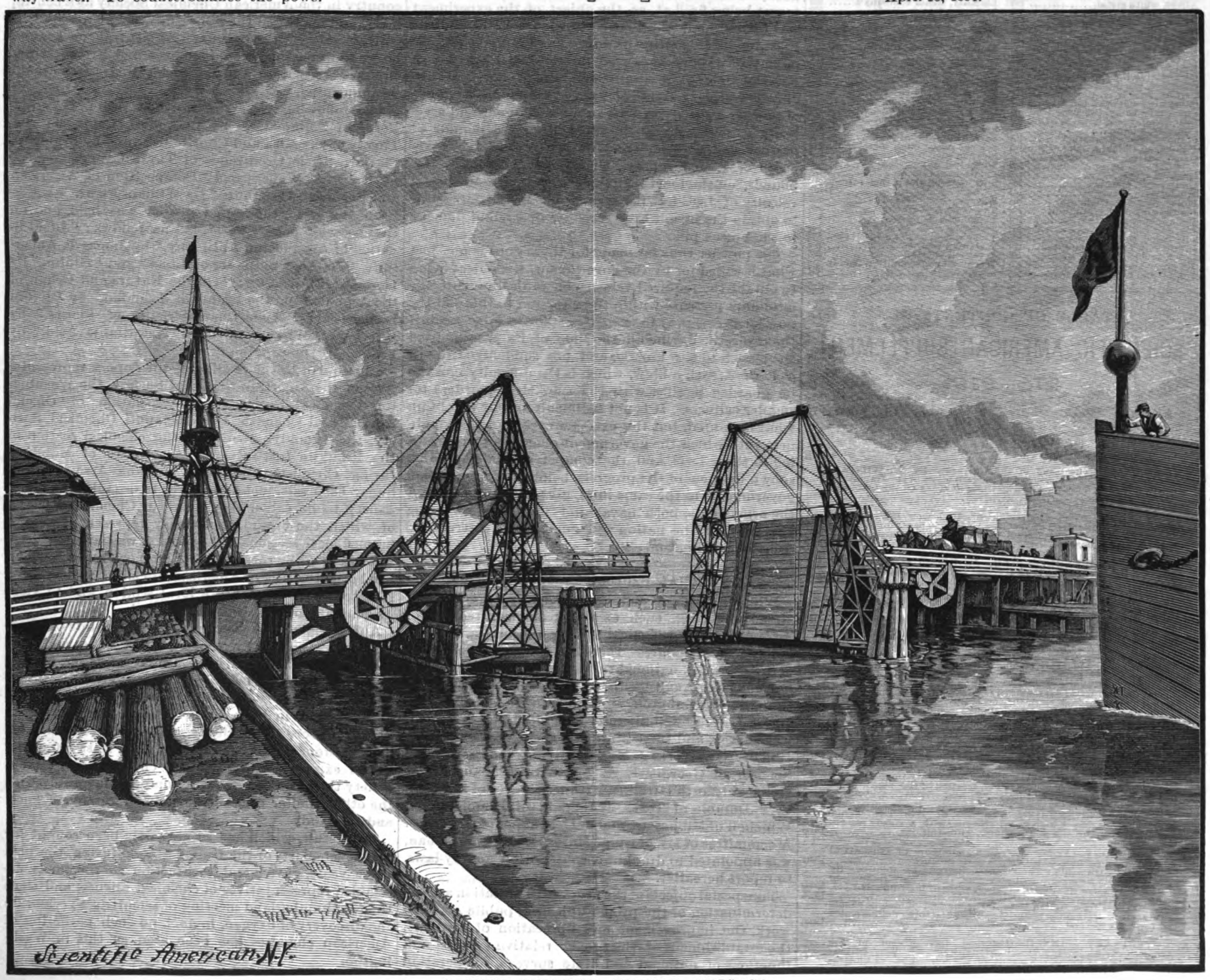


Fig. 2.

The mechanical power required to operate the structure varies at every different position which the girder assumes during the opening or closing process. The cams cause the weights to exert the variable power required for a perfect counterbalance by giving the pull of the wire ropes a variable leverage about the horizontal shaft. By the aid of this device, one man power applied by the ordinary lever attached to the vertical shaft and geared into a horizontal shaft to which the drum is attached, is sufficient to easily operate each half of the structure.

This construction is said to be less expensive than the ordinary style of draw bridge. The cost of the bridge entire, from dock line to dock line, was about $16,000. The bridge is the invention of Mr. William Harmon, manager of the Chicago Towing Company, and the bridge was designed and constructed by Messrs. Shailer & Schniglau, engineers and contractors, of Chicago, who control the patents. The bridge was tested by the city engineer and opened for traffic April 18, 1891.



A NEW FOLDING BRIDGE, CHICAGO.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00

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NEW YORK, SATURDAY, SEPTEMBER 12, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

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No. 819.

For the Week Ending September 12, 1891.

Price 10 cents. For sale by all newsdealers

TESTING OF OUR GREAT GUNS.

There have lately been some interesting trials of heavy ordnance of the latest build at the government proving grounds at Sandy Hook, the most recent being that of a 12 inch breech-loading cast iron mortar. It was made by the Builders' Iron Foundry, of Providence, is steel-hooped and steel-lined, measures 10 feet 9 inches from muzzle to breech, and weighs twelve and a quarter tons. The shell was of steel, said to be tempered to resist 140,000 pounds to the square inch, and weighed 628½ pounds. It was conical, 3 feet long, and in service is expected to carry a bursting charge of 22 pounds of powder, the shell being designed to pierce the armor of a ship's deck at which it is fired and then explode. The target was a solid steel armor plate, 10 feet by 5, and 4 inches thick, made at the Bethlehem Steel Works, and was held in position by heavy timbers sunk in the sand, cart loads of sand being piled behind the target. The charge used consisted of 51 pounds of Dupont's sphero-hexagonal powder in a canvas bag. After it had been rammed in behind the projectile a primer was placed in the breech-plug and the latter screwed to place.

It had been intended to fire four shots, but after the first one there was not enough left of the target to continue the trial. The projectile, instead of simply piercing the plate, as had been intended, took a big piece out of it, leaving the remainder of its surface in a badly cracked condition. The shell was found about half a mile away, with a piece broken out of its base. One of the purposes of the test was to determine the quality of steel to be used in the shells, which must be the subject of still further experiment, but there is no room for question as to the penetrating power and destructive effect of a projectile fired from such a gun on the deck of the most modern armored vessel. With a powder charge of 80 pounds, the shell is expected to pierce the deck of such a vessel at a distance of three and a half miles.

The week previous to this trial a 12 inch built-up steel rifle was tested the second time on the same grounds, the special object being to try a slow-burning brown powder of the Dupont mill. The gun is designed to be fired with a full charge of 440 pounds, the projectile to have an initial velocity of 1,975 feet per second. The projectile weighed 1,000 pounds and the gun was fired four times, with increasing charges, no target being fired at, as the object of the experiment was to determine the velocity of the projectile and the pressure developed in the gun. For the first shot, 150 pounds of powder were used, developing a pressure of 19,000 pounds to the square inch, and giving a velocity of 1,473 feet per second; on the second shot, 200 pounds of powder gave a pressure of 24,660 pounds and a velocity of 1,618 feet; at the third firing, 400 pounds of powder caused a pressure of 80,000, and gave a velocity of 1,750 feet; and with the full charge of 440 pounds, on the fourth trial, the projectile attained a velocity of 1,865 feet per second, but it was impossible to obtain the pressure, on account of a slight damage to the breech plug.

The powder thus far made for these guns is not just what is called for by the government, the object being to obtain the required velocity of projectile with the minimum pressure within the gun, and to this end the powder is designed to exert its explosive force against the projectile during all the time of its passage from the breech to the muzzle, and not suddenly strike it, as it were, with a blow, which is the difficulty most to be guarded against with the smokeless powders for smaller calibers. It is not a difficult matter to obtain what is wanted, but the extreme care and thoroughness with which the government officials are proceeding in these tests, and the competent understanding shown by them of the progress being made by foreign governments in the same lines, give good promise that the armaments, both naval and military, now being provided for the nation will not be any discredit to American genius and skill.

AN OFFICIAL GEOLOGICAL ORGANIZATION.

While important ends are gained by organizations already existing, such as the geological section of A. A. A. S., the Geological Society of America, and the International Congress, there is need of a closer union of the State and national surveys. A preliminary meeting was held, August 29th, at the rooms of the Cosmos Club, in Washington, D. C., at which were present Major J. W. Powell, director of United States Geological Survey, and these State geologists, namely, James Hall of New York, J. M. Safford of Tennessee, J. W. Spencer of Georgia, E. A. Smith of Alabama, J. A. Holmes of North Carolina, Arthur Winslow of Missouri, E. T. Dumble of Texas, J. Lindahl of Illinois, N. H. Winchell of Minnesota, and J. C. Brauner of Arkansas. A committee of six, of which Major Powell is chairman, was appointed to draught a constitution and by-laws, to report hereafter.

The special objects of the proposed association are the determination of the proper objects of public geologic work, the improvement and unification of methods, the establishment of the proper relative spheres and functions of national and State surveys, co-operation in works of common interest and the prevention of the duplication of work, the raising of the standard of public geologic work and the appreciation of its value, and the inauguration of surveys by States not having such at present.

THE AMERICAN CHEMICAL SOCIETY.

At the second Cleveland meeting of the American Association for the Advancement of Science, held in 1888, the desirability of a national organization of chemists was considered by the various representatives of that science in the chemical section. A committee was appointed to report on the feasibility of such an organization, and at each of the gatherings of the American Association since then the matter has been discussed in the chemical section.

Last summer a so-called general meeting was held at Newport, R. I., when chemists from all over the country met and discussed papers of scientific interest. This gathering, originally suggested by Professor Charles E. Munroe, the chemist of the United States Torpedo Station, proved so successful that a second general meeting of American chemists was held in Philadelphia, at the close of the year. Both of these meetings were fully reported in the SCIENTIFIC AMERICAN.

A call for a third general meeting of chemists was issued on August 5 by the American Chemical Society and arrangements were made by the chemists of Washington to secure rooms at the Columbian University, where later the American Association convened. The meeting included sessions held on August 17 and August 18.

The first session began with an address by the President of the American Chemical Society, Professor George F. Barker, who said that, in science as well as socially, man was a gregarious animal. The best results in any direction were obtained by community of action. The world fondly looked forward to the day when all the people of the earth would form one great community. The annihilation of time was the goal of all efforts. The great misfortune of the human race was, he said, the fact that existence is but a time function. Perhaps in a future state we would be freed from all these irksome restraints. Professor Barker then referred to the movement for the inclusion of the various local chemical societies scattered all over the country in the American Chemical Society as a central body, and expressed the hope that the plan would be carried out. United under one central or general body, the members would be benefited by the larger circle of association and the society's strength would be augmented.

The following papers were then read: "A New Form of Soltameter," by George C. Caldwell; "A Theory of the Mica and Chorite Groups," by Frank W. Clarke; "The Occurrence of Tin in Canned Goods," by Henry A. Weber; and "Composition of American and European Chestnuts," by William Frear.

On August 18, the second session was held, and on that occasion papers were read as follows: "Identification of Arsenic and Antimony," by James T. Anderson; "On Acid Sulphate of Lime" and "Gluten," by Hermann Endemann; "On the Nature and Origin of the Asphalt from the Island of Trinidad," by Clifford Richardson; "Some Characteristics of Picrite," by Harvey W. Wiley; and "On Metatitanic Acid," by Francis P. Dunnington.

Subsequent to the reading of the papers, representatives of the American Chemical Society, the Washington Chemical Society, the Association of Official Agricultural Chemists, the Cincinnati Chemical Society, the Brooklyn Institute, the chemical section of the Franklin Institute, the Association of Manufacturing Chemists, and the Louisiana Association of Sugar Chemists, met and agreed to organize a general society to be called the American Chemical Society, of which the organizations they represented were to become local sections. This action was largely the result of the willingness of the New York society, which has borne the title of American Chemical Society since 1876, to resolve itself into a local section, and to yield its general name to a national organization.

Appropriate resolutions covering the points of agreement were passed by the delegates assembled, who now report back to their respective societies, and on the ratification of their action a final meeting will be held, at which the American Chemical Society, with local sections in New York, Brooklyn, Philadelphia, San Francisco, New Orleans, and elsewhere, will come into existence. A membership of at least 500 chemists is expected, and then the chemists will have a society that in strength will compare favorably with the other similar organizations in Germany, France, and England.

This result, which has so earnestly been sought for by the chemists of the United States during the past three years, gave great satisfaction to the many assembled representatives of chemical science, and since the Northumberland meeting of scientists to celebrate the discovery of oxygen, in 1874, no such gathering of American chemists has been seen as this in Washington.

CONDITION OF WORKINGMEN IN MICHIGAN.

The Bureau of Labor and Statistics of the State of Michigan has just completed a most interesting investigation. A personal canvass has been made of 8,838 workmen in 201 shops and manufacturing institutions in 25 villages and cities. The industries covered in the investigation were manufactories of agricultural implements and iron-working establishments, and the information was obtained, not by sending out blanks nor by special canvassers, but by the regular employes of the Bureau of Labor, who visited each workman in person and secured the facts desired. When it was necessary each question was fully explained to the person interrogated, in order to place him in a position to give an honest and intelligent answer.

In the industries canvassed the best of feeling is reported as existing between the workmen and proprietors. With the exception of the carpenters' strike in Detroit, there were no serious labor troubles in Michigan in 1890, and the good feeling now prevailing promises to continue.

Of the 8,838 employes, 57 per cent were born in the United States and 43 per cent in foreign countries. The total amount of earnings for the year was $4,127,591.20, average per man $467.02. The lowest annual wages was $312.46, and the highest $653.54. The average weekly wages of married men is $11.50, single men $8.12, all employes in the canvass taken together, both married and single, $10.06 per week, or $1.67⅔ per day.

There is no "child" labor in the industries canvassed, but 235 boys are employed between 11 and 15 years of age. According to law, all boys under 14 years of age are prohibited from working more than 9 hours a day and must attend school 4 months in the year. The total family expenses for the year is given as $2,550,521, making per capita $122.48. Scotchmen, Englishmen, and Americans in the order named are the best livers, and have the highest per capita of family expenses. The Polanders and Germans spend the least money.

Two thousand three hundred and twenty-eight employes own homes, of which 2,242 are married men, the percentage of married men owning their own homes being 46. The Germans are the home-owning nationality. The percentage of those who own their house and lot is 37, Hollanders 35 per cent, Irishmen 33 per cent, Scotchmen 30 per cent, Polanders 28 per cent, Englishmen 25 per cent, Americans 23 per cent, and Canadians 18 per cent. The total value of homes is $3,055,965—which gives an average value for each home of $1,312.70.

One thousand three hundred and forty-two homes are mortgaged, which is 58 per cent. The total value of the mortgaged homes is $1,630,360, amount of mortgages $614,485, which is 37 per cent of the valuation. In the towns and cities outside of Detroit the average age of those who own homes and have them paid for is 41 years.

The average weekly wages of those employes outside of Detroit who own homes upon which there is no incumbrance is $12.29.

During the year 1890, 1,390 employes made payments and improvements upon homes amounting to $175,470, and 2,477 saved $329,880 in money; 264 of the 1,390 who made payments and improvements on homes also saved money and are included in the 2,477 above stated. The total number of persons who saved something during the year, including payments and improvements upon homes and money, is 3,603, which is 40 per cent of the total employes canvassed.

The total present worth of 7,474 employes (1,364 not reporting) is $3,461,164, average $950.98. Eighty-eight employes are reported to be worth over $5,000.

Two thousand one hundred and sixteen workmen carry life insurance, which is 23 per cent of the total employes. In Battle Creek 51 per cent of the lives of the workmen are insured, and the amount for which all the workmen canvassed are insured is $1,945,706; average $1,488.80. Two thousand two hundred and forty-three, or 25 per cent of total employes, belong to benefit societies paying an average weekly sick benefit of $6.41.

One thousand and forty-six foreigners brought money with them when they came to the United States amounting to $176,354; average $168.57. Total present worth of foreigners, 3,293 reporting, $2,693,610; average $817.98. Total increase over the entire amount brought to this country, 1527 per cent.

Three thousand six hundred and twenty-seven persons own sewing machines, which is 69 per cent of those who support families. One thousand eight hundred and seventy-five own musical instruments, which is 21 per cent of total employes. Number of musical instruments owned, 2,046, of which 709 are organs, 314 pianos, and 299 violins.

There were found to be 5,949 persons who took newspapers and magazines, which is 67 per cent of all the employes canvassed. In the city of Tecumseh 87 per cent of the employes covered by the investigation take newspapers and magazines. The number of newspapers and magazines taken among the 8,838 workmen is 9,924, as follows: Dailies 5,103, or 51 per cent; story papers 443, or 4 per cent; magazines 343, or 3 per cent. Only about 5 per cent of the workmen cannot read or write.

Among the questions asked the workmen by the representatives of the Labor Bureau was this: "Has your labor organization been of any financial benefit to you?" and only 1,212 persons were willing to reply to the question, 778, or 64 per cent, of these answering yes, and 434, or 35 per cent, saying no.

Two thousand four hundred and twenty-one men, or 27 per cent, work at hand work, and 5,816, or 65 per cent, at machine work, and 601, or 6 per cent, at both.

Prehistoric Man and the Horse in North America.

The genealogy of the horse has been most admirably worked out in various publications, and the fact has long been established that the genus originated on the North American continent. The question, however, as to whether prehistoric man in America had the horse as a contemporary has been a disputed point. This question may now be considered set at rest by the discovery of a skull of an extinct species of horse in strata with human implements. This discovery was announced by Prof. E. D. Cope, at the meeting of the American Association for the Advancement of Science, held in Washington the past month (August). A skull of a horse was exhibited to the members by Prof. Cope, who pointed out the characters of the teeth and who stated it would be impossible for any one to separate the fossil teeth from those of the quagga and zebra if the three were all thrown together. In minor characters, such as those of the size of the bones, the differences are perceptible. So there is no doubt the skull represents an animal different from any now living. That it was a horse, however, any one could see.

The most curious thing about the skull was its condition. The frontal bone had been crushed in exactly as we see in the case of animals slaughtered for food. The friable bones protecting the eye sockets were intact, as were also the long nasal bones. Found in the same bed with the skull was a stone hammer that bore evident marks of having been fashioned by the hand of man.

What inference was to be drawn from this? In the first place it has been suspected and considered probable that early man on this continent had been contemporaneous with *a* horse, though not the present living species, but no direct proof had hitherto been found. When Europeans landed on the new continent, the horse was an unknown animal to the natives. So it had evidently long been extinct. All the horses now found in either North or South America came from stock originally brought over by Europeans. But here we had evidence in the association of a human implement and a horse's skull that man and horse had lived together: and the peculiar fracture of the skull of the latter leads to the belief that the animal had met its death at the hands of man.

This fact opens several questions. What became of the race of horses that once lived on the continent? Were they exterminated by savage man as civilized man has exterminated the bison? Did they once serve as beasts of burden or were they used only as food? Were they wild or domesticated?

It seems probable that they were not used for any other purpose than as food, and that they existed only in a wild state, for it is scarcely reasonable to suppose that having once been used by man and so domesticated, their use would ever have been forgotten or the breed allowed to die out. Neither is it probable that they were exterminated solely by the agency of contemporaneous man, for we know that in spite of the use of the bison by the Indians of North America, their numbers did not decrease to any great extent. It was only when civilized (?) man began his destructive work that the bison began to disappear.

What, then, was the cause of the disappearance of the horse? The age of the beds in which the remains are found is prior to the Ice Age that once prevailed in North America, and in this period of cold it is possible we have a factor to account for the extinction of the horse. The intense cold coming on forced the animals to migrate from their homes in the northwest of the United States, and retreating southward, they probably found many competitors for existence. The scanty vegetation of New Mexico, Arizona, and Northern Mexico probably did not suffice for the support of the great herds of animals coming from the north. New conditions of existence may have weakened the vitality of the species; starvation may have decimated their numbers; competition with other races must have cut off a large supply of food, and the hand of man may have hastened the struggle to its inevitable end. All we know, however, is that the race became extinct. That man lived previous to and of course during the Ice Age is now well established. That he lived at the same time with a species of horse is made known by the discovery of Prof. Cope. His influence in the extermination of many of the large mammals at one time inhabiting North America is as yet undetermined.

JOSEPH F. JAMES.

Washington, D. C.

FOR a good stove polish in the form of a powder, use good quality plumbago, applied with a stiff brush.

The Latest Facts about the Megalonyx.

BY H. C. HOVEY.

Perhaps the most grotesque of all living animals is the sloth of South America. Buffon and Cuvier thought Nature must have made such an animal merely to "amuse herself." It can neither walk nor stand; but it is perfectly at home amid tangled tropical forests, where it travels for many miles merely by swinging from bough to bough, while feeding on the foliage. When weary, it curls up for sleep in the fork of a tree. Unless attacked, it is a harmless creature; but when put on the defensive, its great claws are dangerous weapons.

Extinct sloths have been found larger than the elephant, and so numerous that Darwin describes the whole area of the pampas of Uruguay as "one wide sepulcher of these gigantic quadrupeds." These are known to the naturalist by the names Megatherium, Mylodon, and Skelidotherium, of which there are several species, with whose habits and peculiarities we are not concerned in writing this article.

What we have now to deal with is the giant sloth of North America, first described by President Jefferson, and named by him the Megalonyx, on account of its enormous claws. The typical specimen was found in some one of the fifty caves in the Greenbrier valley of West Virginia, and its huge bones are now in the cabinet of the Academy of Natural Sciences at Philadelphia. Other specimens have since been found in the White Cave, half a mile from the Mammoth Cave, Ky., at Big Bone Lick, Ky., at the mouth of Canoe Creek, Ky., in the vicinity of Millersburg, O., in McPherson Co., Kansas, in a locality in Mississippi, and in Big Bone Cave, Tenn. These specimens have been very fully described by Dr. Harlan, Prof. Leidy, Prof. Cope, Prof. Claypole, Prof. Orton and others.

The latest contribution to Megalonyx literature is from Prof. J. M. Safford, of Vanderbilt University, Tenn., whose communication to the Geological Society of America, at its meeting in August, 1891, was especially interesting, because he exhibited what had never previously been found, namely, the pelvis of the Megalonyx Jeffersonii, along with other bones, from the Big Bone Cave, of Tennessee. These relics were purchased from the owner, Mr. A. J. Denton, and now belong to the Vanderbilt University.

They were found in the cave already named, at the foot of the western slope of the Cumberland mountain, at a point midway between the towns of Sparta and McMinnville. They were discovered in 1884 by a laborer who was digging for bat guano, covered to the depth of three feet, and lying in such a position as to show that they had never been disturbed. The head, vertebrae, and hip bones were lying as would have been necessary after the decay of the animal, and showed it to have been eight or nine feet long. The general form of the pelvis of Megalonyx strongly recalls the broad hip bones of the Megatherium; which is what we should expect, considering the affinity of the genera.

These bones are in various degrees of preservation. Some have lost one or more epiphyses. On some, portions of cartilage and tendons yet remain. The latter is a feature of great interest, agreeing with the similar condition of the bones found in the White Cave of Kentucky, and proving that the animal existed in very recent geological times, and was probably contemporaneous with the primitive men of this continent. Many of the bones have been more or less gnawed by rodents.

It is a curious fact that, in their condition and state of preservation, these bones resemble those of another lot described by Dr. Leidy, in 1853, and now in a museum at Philadelphia; being also from the same cave. In enumerating the bones of the two lots it seems probable that those described by Dr. Safford really supplement those described and figured by Dr. Leidy, and that they all belonged originally to the same individual—a question to be settled only by direct comparison.

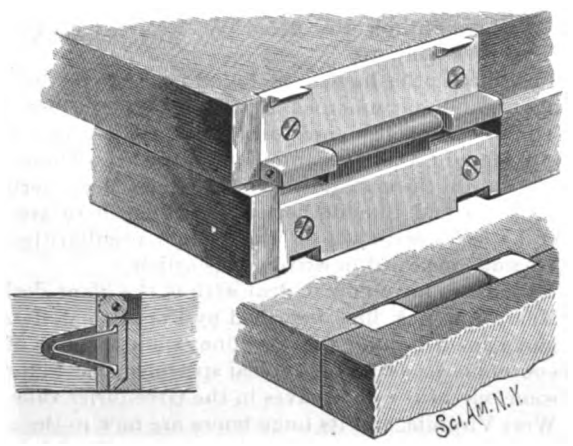
It may be added that Big Bone Cave is of large size, and once contained much saltpeter earth. In 1811–12 much of the most accessible of this material was dug out and leached to make the saltpeter. It was at the time an important industry, in pursuit of which quite a village grew around the mouth of the cave. It was during this early period that the large bones were found that suggested the name by which the cave has been known ever since.

A New Twenty-Four Knot Torpedo Boat.

Bids were opened at Washington, August 26, for the construction, exclusive of armament and of torpedoes and their appendages, of a steel twin screw sea-going torpedo boat of not less than 120 tons displacement. The vessel is, in all its parts, including shafting, to be of material of a domestic manufacture. It is also provided that the speed developed by the vessel shall be not less than an average of twenty-four knots per hour, maintained successfully for two consecutive hours. There were but two bids submitted, and they were for department plans. They were: The Cowles Engineering Company, of Brooklyn, N. Y., $117,490, and the Iowa Iron Works, of Dubuque, Iowa, $113,500.

AN IMPROVEMENT IN FLUSH HINGES.

The illustration represents a hinge which will not project in either direction beyond the sides of the parts of the cover to which it is applied, the hinge being shown in open and closed position, and one figure representing a sectional view. The invention forms the subject of a patent issued to Mr. Jonathan D. Davis, of No. 12 Elias Street, Bridgeport, Conn. The angled



DAVIS' IMPROVED HINGE.

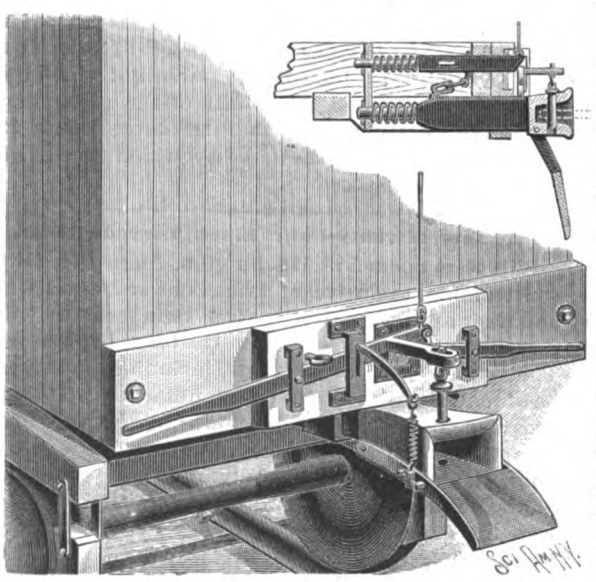
plate forming one-half of the hinge is cut away on opposite edges to form ears, opposite which are outwardly projecting beveled legs fitting notches in the other half of the hinge, while on a pintle passing through the ears is pivoted one edge of a sliding plate, the body of which is received and slides freely in a mortise in the other half of the hinge. The sliding plate and a portion of the hinge behind it are mortised, and a part of the wood is likewise cut away, sufficient to receive a V-shaped spring, which bears against one-half of the hinge and against the sliding plate to draw the latter into the mortise.

As the cover is opened the plate is drawn out against the pressure of the spring, and when the cover is being closed the spring draws it into place, the lugs fitting in the notches preventing longitudinal movement of one part of the hinge upon the other. When the hinge is used on covers that naturally lie in a horizontal position, the spring may be omitted.

AN IMPROVED CAR COUPLING.

The illustration represents a car coupling for which a patent has been allowed Mr. William Bentley, of Lethbridge, Northwest Territory, Canada, the patent being for an improvement on a former patented invention of the same inventor. The coupling is automatic in its operation, and its construction is designed to be strong and inexpensive, having no delicate parts likely to get out of order, while the pin is fast to the car and cannot get lost. The body of the drawhead is supported to slide a limited distance between the frame timbers of the car, a guide bar extension carrying a spiral spring permitting it to yield under pressure. Above the drawhead is a sliding latch bar, around the inner end of which is a spiral spring, as shown in the sectional view, the latch bar being projected forward in the path of a pin-lifting lever pivoted on the end of the car, to be conveniently manipulated from the side. An apron designed to facilitate the entrance of an approaching coupling link is pivoted to the forward portion of the drawhead, the apron being yieldingly sustained in proper position by a spiral spring, dependent from the outer end of a rocking bar pivotally supported in the car frame above the pin-lifting lever, and projecting outwardly through a slotted guide plate embracing the lever.

The latter has a forwardly projecting arm connected with the coupling pin by a clevis, the arm

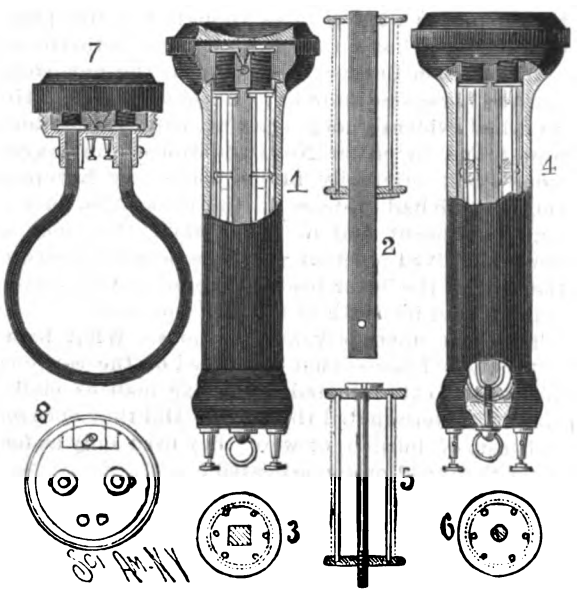


BENTLEY'S IMPROVED CAR COUPLING.

being slotted and the clevis bolted loosely on a slide block to facilitate free motion of the pin. When the pin and apron are in raised position to allow the entrance of an approaching coupling link, as shown in the illustration, the pin-lifting lever rests upon the latch bar, which is so connected with the drawhead as to be moved inward when the drawhead is similarly moved as two cars come together, thereby releasing the lever and allowing the pin to drop to effect the coupling. The latch bar may also be drawn inwardly by means of a pull bar connected with it and projecting over the pin-lifting lever, and connected by a link to this lever is a tripping lever, adapted to be operated from the opposite side of the car for uncoupling and simultaneously raising the lever and apron into position for recoupling. A rod extending to the car roof is also connected with the pin-lifting lever, for the manipulation of the device from this position. As the coupling is effected the apron drops freely out of the way, and the springs on the latch bar as well as on the drawhead form cushions to diminish the shock of the coming together of the cars.

AN IMPROVED RECEIVING TELEPHONE.

The illustration represents a simple and effective receiving telephone to be used in connection with a microphone, Fig. 1 showing a longitudinal section and Fig. 4 a slight modification, while Fig. 2 shows a sectional detail of the polar extremity of one of the magnets and the skeleton of the bobbin, Fig. 5 being another section of the skeleton of the bobbin and polar extension, and Figs. 3 and 6 being transverse views. A compound U-shaped magnet is secured in the telephone handle by screws passing through the end of the handle and into the bend of the magnet, the opposite end of the handle being formed into an externally threaded cell which receives the ear piece, in which is an iron diaphragm, near the polar extremity of the U-shaped magnet, but not in contact with it. Between the outer members of the compound magnet are slightly projecting pole pieces of soft iron which



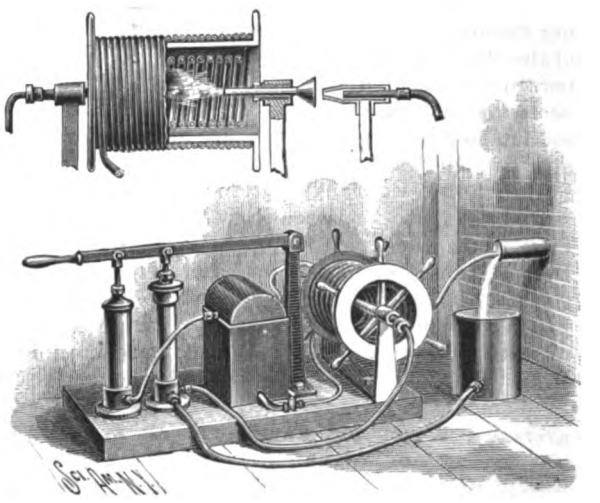
NORIEGA'S TELEPHONE.

receive the bobbins, connected with each other by one terminal in the same manner as those of an electromagnet, the other terminals being connected with the binding posts at the opposite end of the handle. The polar extensions are held in place by screws passing through them and through the arms of the magnet, but in the modification shown in Fig. 4, the extensions consist of screws having a head of large diameter, the screws being inserted in the central portion of the compound magnet. Each bobbin has soft iron heads fitted to the polar extensions, soft iron wires being fitted in a circle within the heads to form the framework of the bobbins. These wires are insulated and upon them is wound a fine wire forming the conductor of the telephone, the winding varying according to the conditions under which the instrument is to be used, and its sensitiveness being varied by adjusting the diaphragm. Figs. 7 and 8 illustrate modifications in which the telephone handle is omitted and the ear piece cell is placed directly on the poles of a permanent horseshoe magnet, the bobbins being attached to the poles by screws, while the earpiece is arranged to adjust the distance of the diaphragm with reference to the polar extensions.

This invention has been patented by Mr. Eloy Noriega, Box 516, Mexico City, Mexico.

A DEVICE FOR THAWING ICE FROM PIPES.

A portable apparatus for conveniently and rapidly thawing ice formed in water pipes is shown in the illustration, and has been patented by Mr. Isaiah H. Simpson, of Brunswick, Me. On a suitable base are mounted a hollow drum supporting inside and outside coils, an oil reservoir, a pump and an air compressor, the two latter being simultaneously operated by a hand lever. The pump is connected by a suction hose with a receptacle set under the pipe to be thawed, and the discharge hose from the pump is centrally connected by a coupling with the inner coil of pipe, the other end of this coil connecting with the one on the outside of the drum, the outer end of the latter coil



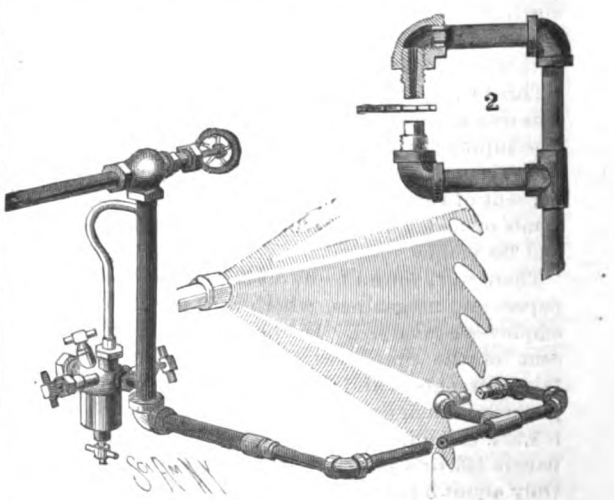
SIMPSON'S ICE-THAWING DEVICE.

being extended for insertion in the pipe to be thawed. The inner coil of pipe is preferably of wrought iron, to withstand heat, but the other portions are of zinc or lead, or material that will bend easily, while the drum is mounted to be conveniently turned without disconnecting the pipes.

Through one trunnion of the drum, as shown in the small figure, extends a pipe having a bell-shaped outer end, into which passes the flame of a hydrocarbon burner provided with an air pipe, while its feed pipe leads to the reservoir, having oil in its lower part, above which is an air chamber connected with the air compressor. The air compressor forces the air into the chamber above the oil, and from this chamber an air pipe leads to the burner, where the oil is drawn in through the feed pipe and atomized by the compressed air, the combustion heating the water at the same time passed through the coil, so that any ice in the pipe to be thawed will be quickly melted, the water flowing into the receptacle to be used over again. Any length of pipe desired can be run over the drum to pass a distance into the pipe to be thawed out, or, by a modified form of the improvement, a section of the pipe may be heated in coil form within a separate shell instead of within the drum, the device being then used in the same manner as described.

A DEVICE FOR CLEANING WOOD SAWS.

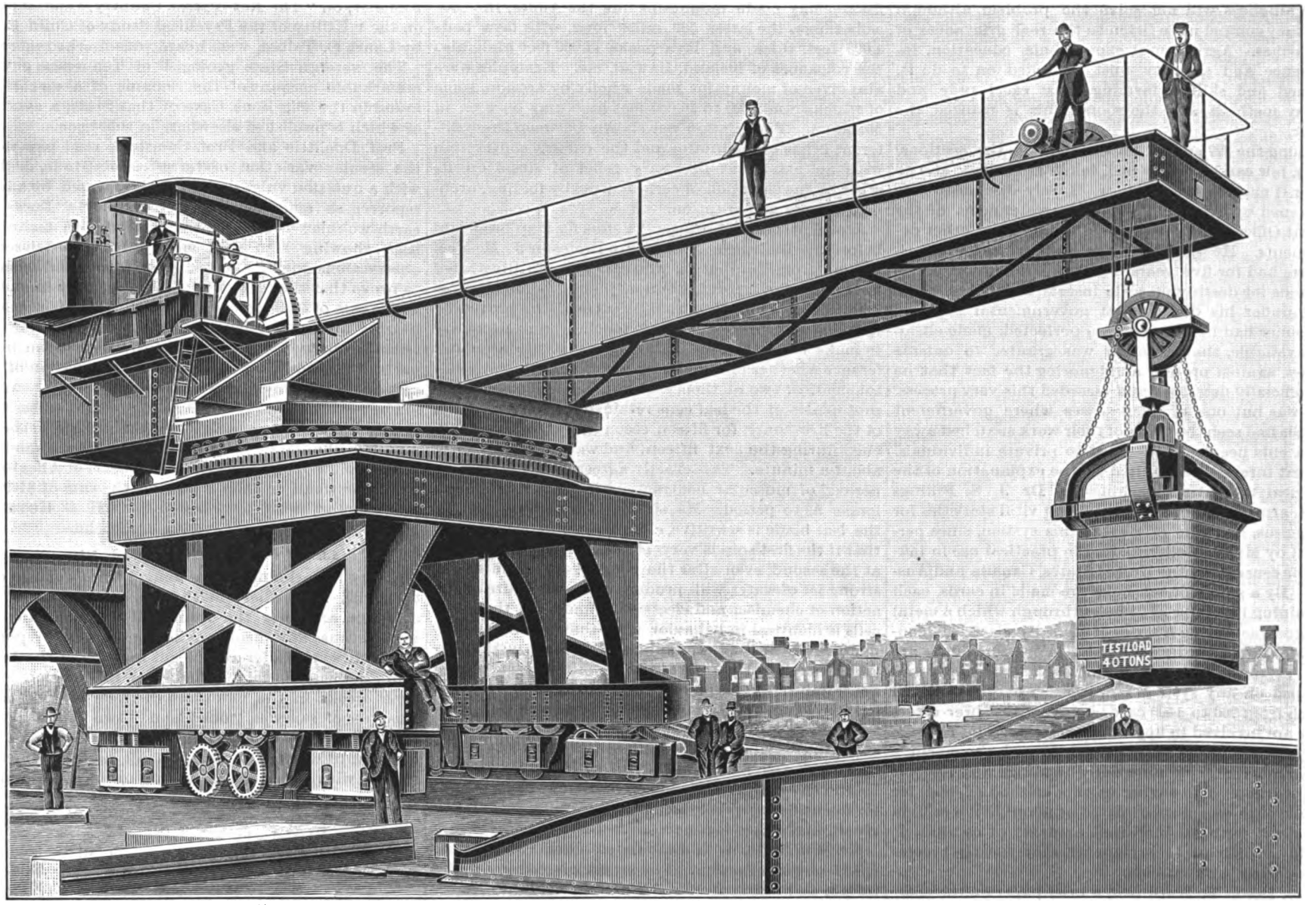
In the device shown in the illustration the gummy matter accumulating upon the saw is removed by steam emitted in contact with the teeth, while the saw is running in the lumber, Fig. 1 showing the application of the improvement, while Fig. 2 is an enlarged view of the nozzles and pipe connection. The invention has been patented by Mr. Thadious V. Elliott, Nichols, S. C. A pipe from a steam boiler, adapted to supply steam and water of condensation, or hot water, is connected by means of a valve with a vertical pipe, a lateral and horizontal extension from which connects with two nozzles whose apertures are adjacent to opposite sides of the saw, near its cutting edge. The nozzles are in the form of threaded hollow plugs, which screw into elbows of the supply pipes, being adjustably held to be readily moved toward or from the saw blade. To facilitate the cleaning of the saw, a lubricator of approved form is connected with the vertical pipe, as shown in Fig. 1, the oil passing from the lubricator to mix with the steam or water carried to the nozzles. The openings in the nozzles are preferably conical, so that the cleaning mixture is ejected with considerable force against the sides of the saw.



ELLIOTT'S SAW CLEANER.

A POWERFUL STEAM CRANE.

The illustration represents a huge steam crane, called a steam Titan, built by Messrs. Ransomes & Rapier, of Ipswich, to the designs of Mr. F. G. M. Stoney, M.I.C.E., and to the order of Sir Alexander Rendel, M.I.C.E., consulting engineeer to the Madras Harbor Works, where it will be chiefly employed for transporting blocks of concrete weighing 32 tons, used in the construction of the breakwater now in progress. The weight of the Titan, without water ballast or load, is 152 tons, and with ballast 170 tons. All the motions of the appliance are under perfect control by means of a set of levers situated on a platform and within easy reach of the single operator. A feature of importance in connection with this appliance is that it not only has to be capable of slewing round in a complete circle, but has also, owing to the shape of the breakwater on which it will be employed, to be capable of traveling on a curved road. To enable it to accomplish this the Titan is carried upon twelve wheels arranged as two four-wheeled bogies, one at each end, and with driving wheels in the center. This arrangement enables the Titan to travel with ease round a curve 90 ft. radius. The radius described by the arm is 50 ft., and to minimize the shock produced by stopping a load, owing to the momentum acquired when being slewed round, spring braking devices are introduced in connection with the gearing so as to bring the arm to a gradual stop. The crane is made of mild steel, all parts being carefully machined, and all rivet holes drilled in position. The whole of the work is so arranged that it can be conveniently taken to pieces for transport and re-erected at its destination with a minimum of trouble. This fine crane has been inspected and put through a series of severe tests by Sir Alexander Rendel, and has given general satisfaction. The test load, as shown in the illustration, was 40 tons.—*Industries.*



GENERAL VIEW OF CRANE CARRYING TEST LOAD.

SUCCESS presupposes conditions and preparations for it—the energy, self-sacrifice, and self-abnegation which brings brawn and breadth and dignity, strength and wisdom and skill. We cannot safely jump into success; we are likely to get hurt, and soon fall back disheartened to where we belong. Some try to succeed by jumping into their father's shoes; but these shoes do not fit, and cause the young man to walk so awkwardly he generally makes a fool of himself. Nearly everything of real worth has to be earned. To be appreciated and judiciously appropriated, our possessions must have cost us their value. The very toil and struggle and plodding that bring solid gain bring also the mature experience, thorough discipline, and hard knocks that make up stalwart manhood and permanent success.—*Items of Interest.*

Old Time Weather.

The last bulletin of the Essex Institute contains an account of the annual meeting held last May, and a retrospect of the year, from which we learn that Mr. Perley, in a lecture on "Old Time Winters in Essex County, Mass.," gave interesting particulars on many subjects, including weather. We give the following extract:

"The lecturer spoke of the watch, church services, dress, food, and schools of the early winter seasons; how the people spent their evenings, the winter employment of the people in cutting off the forests, sledding timber and wood, making pipe staves and barrel hoops, and, most interesting of all, the institution of the old-fashioned shoemakers' shops, of which nearly every farm had one a century ago. Women in those days engaged in spinning and weaving. The holidays were referred to—Thanksgiving, Christmas, and New Year's; and the winter pleasures, such as sleigh rides, dancing, spinning and quilting parties, and games, shuffle-board, coasting, skating, trapping, gunning, fishing, singing schools, and girls' samplers. He also spoke of the old modes of travel, snow shoes, etc. Nearly all the heavy teaming was done on sleds, and he mentioned the winter of 1768–69, when the traveling was so bad that the farmers in the western part of the State could not get their grain and provisions to the coast to market. Snow remained on the roads as it fell until about a century ago. Mr. Perley then spoke of particular winters: That of 1641–42, when the Indians said they had not seen the ocean so much frozen for forty years; of 1646–47, when there was no snow to lay; of 1696–97, said to be the coldest winter since the first settlement of New England; of 1701–2, which was 'turned into summer;' of 1717–18, when the snow was from ten to fifteen feet deep and the drifts twenty-five feet, many one story houses being buried; of 1740–41, said to be the severest winter known by the settlers, Salem Harbor being frozen over as early as October; of 1774–75, a wonderfully mild winter; of 1779–80, when for forty days, including March, there was no perceptible thaw, and the snow was so hard and deep that loaded teams passed over the fences in any direction, arches being dug under the snow so that men on horseback could ride under them, and which was long remembered as *the* hard winter; of 1784–85, when, as late as April 15, snow was two feet deep, and frozen hard enough to bear cattle; of 1785–86, when in the remarkable storm of November 25, the snow blew into balls, one of which had rolled 76 feet, measuring 17½ by 22 inches; of 1794–95, when the Betsey was launched in Salem on Christmas Day, the thermometer indicating 80° above zero at noon, and men and boys went in swimming; of 1801–2, when the Ulysses, Brutus, and Volutia, three Salem vessels, which sailed out of the harbor on a summer-like morning in February, were all cast away at night on Cape Cod, in a terrible snow storm, which continued a week. He also referred to more recent seasons, and of the cold winter of 1856–57, when in one week in January was the coldest day by the thermometer ever recorded of late years, mercury in Salem 20° below zero; travel on the railroad between Boston and Salem entirely suspended from Tuesday morning to Thursday afternoon. The recent mild winters were also alluded to."

Steam Company's Liability—Damages.

In a case recently decided by the New York Court of Appeals it appeared that a steam company fitted a store with steam for elevator and heating purposes. The apparatus was tested by letting on the steam, and it worked satisfactorily. The steam company then left the steam on and closed the store for three days. While the store was closed the bonnet of the service pipe blew off, and the steam escaped and injured the goods in the store. The court held (Reiss *vs.* New York Steam Company) that the steam company was not liable for damages, but that, having furnished the best material and employed competent and skilled mechanics, it was not bound to anticipate or guard against such an unusual accident which had never before happened in its business. The court said: This steam apparatus was put into the plaintiffs' store for their benefit. The defendant did not insure or guarantee them against danger therefrom. It was bound only to use that degree of care which ordinary prudence and foresight would under the circumstances suggest and prompt. Whether or not it failed in such care could not be left to mere speculation. The burden was upon them to establish such failure by proof, and this burden they were bound to sustain, however necessary and difficult it proved to be.

A Remedy for Poisoning by Venomous Snakes and Rabid Dogs.

The Berlin correspondent of the *Therapeutic Gazette* says that a remedy for blood poisoning caused by the bites of snakes and rabid dogs has been discovered in Africa, by a Dr. Engels, in the "wild-growing, black, noble palm." Five hundred negroes bitten by poisonous snakes were treated with the extract of the noble palm, and four hundred and eighty-seven were cured in five days. Of sixty-seven farmers and negroes bitten by rabid dogs sixty-five were saved, while two died of weakness. The remedy is injected under the skin, and causes a moderate fever, not exceeding 35 5° C. On the third day the patient is without fever, swelling and inflammation of the affected part have disappeared, and on the fifth, or, latest, on the seventh, day the patient is cured.

Meeting of the American Association.

(*Continued from page* 145.)

Prof. Thomas Gray addressed the mechanical engineers, deprecating the teaching of trades in schools instead of in workshops, the old system of apprenticeship being better. But he strongly advocated teaching of a practical character, both in mathematics and theoretical dynamics, in technical colleges and similar institutions. He named some of the directions in which technical research should be pushed, especially as to the behavior of steam, combustion, and electrical engineering.

In the Section of Economics and Statistics, Prof. James spoke of "The American Farmer, his Condition and Prospects." On awaking to the fact that he is not up with the age, the farmer is apt to explain his ills by the machinations of other classes. He blames bankers, politicians, manufacturers and railroads. Wealth flows from the country to the city. The farmer feels keenly that his interests are not taken into the account as they should be in adjusting taxation, the tariff, and other mooted matters of national financial policy. Unless a radical change is brought about, his future will be darker than his present. Along what line does his hope of improvement lie? Mere alliances will not solve the problem, although they may compel us to listen to the real grievances of the farmer. Agricultural experiments, education, intelligence and sagacity must be relied on to do it. Trained and skillful farming must excel rude and clumsy methods, and the sooner this is realized, the better.

Among the 227 special papers read in the sections, only a few can be mentioned, taken at random, and no better it may be than others. Lively discussion was awakened by Prof. C. V. Riley's arraignment of the Patent Office for trespassing on the rights of other departments. He said that the Department of Agriculture had for five years been experimenting as to methods for destroying scale insects and other parasites, under his direction, at governmental expense. No sooner had his process been perfected, made cheap and available, than a patent was granted to outside parties, against protest, and ignoring the fact that he had officially described and recorded this very process. This was but one of many cases where government officials had seen the fruits of their work snatched away by patents heedlessly awarded to private individuals.

Great interest was excited by the explanation of the electrical tabulating machines by Dr. J. S. Billings (U. S. army), who had charge of the vital statistics for the census, and who originated this system, since perfected by Mr. H. Hollerith, and in practical use in taking the censuses of the United States, Canada and Austria. By a gauge punch holes are made in cards, each containing 12 groups of 24 holes through which a metal rod goes, actuating a series of dials by electrical connection, thus recording the data. Forty such dials are used at once, each for a single class of facts, and grouped on any system required. An operator will punch from 700 to 1400 cards a day, with fewer errors than are involved in any other system. The average number of punched cards passed through the machine with an average of nine daily readings was 7000 for each worker. The saving by this method effected for the eleventh census is estimated at about half a million of dollars, with an increased accuracy of results. It would be difficult to explain this interesting process more clearly without cuts.

Prof. Lester F. Ward read a brief paper on the character and purpose of a national university, such as was advocated by Washington, Jefferson, Madison and others, and which was certain to be realized in the near future. It should be national, not political nor sectarian, its chairs held by Americans only, its scholarships allotted by congressional districts and on competitive examination, and its faculties chosen by a special commission from among our most eminent scientific men, its "strong chair" being in the science and art of government, with the aim of ultimately filling all administrative offices from its list of graduates, thus securing trained and skilled officers.

Among other papers read in the Economic Section may be mentioned one by Prof. Anderson on the World's Columbian Exposition, on which $40,000,000 were to be expended; on state railway supervision, by B. W. Snow; on our mercantile marine, by Henry Farquhar; on the muck soils of Florida, by H. W. Wiley; and on the artesian wells and underground waters of Texas, by R. T. Hill.

Prof. Springer attracted the attention of the Chemical Section by his remarks on "A Latent Characteristic of Aluminum," as adapting it for sounding boards of musical instruments. He claimed that it differed from other metals in the absence of the tones described as "metallic," and also in having an elasticity capable of sympathetic vibration uniformly through a wide range of tone pitch, being in this respect superior to any kind of wood. It is also superior to wood in being incombustible, impermeable to moisture, and in permitting the thickness of the sheet to be so reduced as to obtain the utmost amplitude of vibration without injuring the tone.

The processes of mountain building were explained by Prof. Warren Upham in a communication to the Geological Section. Six classes of mountains exist: the folded, arched, domed, tilted, erupted, and eroded. The long mountain belts consist of folded rock formation, wave-like ridges with intervening troughs, the folds being sometimes closely pressed together. Examples are found in the Appalachian, Atlantic, and Laurentian systems of America, and the grand Alp-Himalayan belt of the Old World, reaching from the Pyrenees to the China Sea. The arched mountains are typified by the Uinta range in Utah, an arch having been raised during the tertiary period 150 miles long and 40 wide, and about five and a half miles high. By erosion this arch has been since cut down to half its original height. Domed mountains, exemplified by the Henry mountains in Utah, were formed by volcanic uplifts of previously horizontal strata, the lava being injected between the strata, to which Gilbert gives the name of "alaccolite." The Wasatch mountains and the Sierra Nevada are examples of tilted ranges, being immense rocky masses tilted by the upheaval of one border with a corresponding depression of its opposite border, taking place along fault lines. Volcanic eruption on a grand scale along deep fissures has made mountains like the Andes, the Cascade range, the latter 500 miles long, with lava beds 4,000 feet thick, and lava peaks 14,000 feet high, also the volcanoes of Iceland, Hawaii, etc. Examples were also given of mountains made wholly by erosion, some of which from 5,000 to 16,000 feet high may be seen in Montana. The relation was shown between these different kinds of mountains and the earth's contraction with an attendant necessary relief of stress on its crust by the elevation of certain areas by folding, arching, doming and eruption.

A curious account of the "Venus fly trap" was laid before the Biological Section by Professor J. M. Macfarlane, from Edinburgh, who also gave an illustrated lecture on the hybridization of plants, before the Association. Concerning the "fly trap," he proved by specimens at hand that two touches were necessary to make the leaf close up, but that it made no difference whether one of the six sensitive hairs was twice touched, or two of them each touched but once. The protoplasm of the leaf cells retained sharp recollection of the first touch for fifteen seconds, which was weakened during the next fifteen, and was wholly gone in about a minute. This exactly agrees with the "latent period" of muscular contraction in animals, though longer as to period. He showed that every part of the leaf blade is sensitive, closing after two snips; and that if the first snip is very strong, closure may occur at the second, even after the lapse of two minutes. A strong jet of water will produce sudden closure. The action of chemical and electrical stimuli on these leaf cells is identical in behavior with that on the nerve-muscle-cells of the lower animals. This discussion was made particularly interesting by the presence of a beautiful array of plants from the public botanical garden, loaned for the purpose of demonstration.

The deep well at Wheeling, W. Va., is 4,500 ft. deep, and will be drilled to the depth of 6,000 ft. It was drilled by T. S. Kinsey, and when done will be the deepest well in the world. It has been presented by its owners for scientific purposes, being dry, and useless so far as its original object is concerned.

Mr. Wm. Hallock laid tabulated observations before the Geological Section. The strata pierced are undistorted, and nearly *in situ*. The well is cased for 1,500 ft., and the uncased portion is mainly in shale. Thermometers were lowered to various successive depths, and the temperature was recorded as registered. In the upper half of the uncased portion the mercury rose 1° Fahr. for every 80 or 90 ft., but increased to 1° for every 60 ft. in the lower half, reaching over 110° at the bottom, which is 3,700 ft. below the sea level. In wells near Berlin and Leipsic, one 4,170 ft. deep, and the other 5,740 ft., the temperature at the bottom is about 118° and 135°. Further observations as to barometrical and other phenomena will be awaited with interest.

Prof. C. B. Thwing explained the Lippmann process of color photography, described in France last February, and which differs from that of M. Becquerel, discovered in 1848. The latter by a photo-chemical method produced a colored image that could not be exposed to the light. Lippmann by a physical method gets an image that retains its colors after treatment with hyposulphite of soda, and is as permanent as any plain negative. A transparent plate is exposed with its film side resting against a reflecting surface of mercury. This divides the film into layers as far apart as the wave length of the incident light, and thus reproduces by reflection the color that produced the layer. Overexposure may completely reverse the colors of nature, giving the complementary colors instead. A number of colored negatives were exhibited illustrating the paper.

Free coinage was discussed by the eminent statistician Edward Atkinson, the secretary reading the paper in the absence of the author; which was followed by another on coinage ratio and our silver policy, by E. T. Peters; these papers presenting the two sides of the exciting question of bi-metalism, and fairly recognizing the difficulties on either side.

In the Anthropological Section several papers were read by ladies, one of which especially, by Mrs. Anita Newcomb McGee, attracted attention both by its ability and the singularity of its subject, namely, "An Experiment in Human Stirpiculture." In other words, she explained the methods and results of the Oneida Community, where between 1868 and 1879 there were sixty children born on what were alleged to be scientific principles, according to a peculiar system devised by Mr. Noyes, that separated the amative and propogative functions. It was claimed that most of these children were remarkably bright and healthy. But the spirit of monogamy prevailed, so that when, in 1879, the question was put to a vote, only three favored the continuance of the experiment. In the discussion following this paper curious facts were brought out as to the Mormons as well as the communists; but some doubted if rural surroundings and unusual care in training did not have more to do with the superiority of the Oneida offspring than any system of stirpiculture.

An elaborate and valuable paper by Miss Alice C. Fletcher, on "The Nez Perces Country," and another on the "Utility of the Psychical Study of Child Life," by Laura O. Talbot, were heard with marked interest.

The veteran State geologist of Tennessee gave a remarkable account of the remains of a megalonyx found in the Big Bone Cave of that State, a synopsis of which is published elsewhere in this issue.

Prof. Doolittle and Prof. Comstock read papers on the secular variation of terrestrial latitude, dealing with a question vulgarly but aptly phrased by a local reporter as amounting to the inquiry, "Does the earth wobble?" The papers bristled with technicalities, showing results of many thousand telescopic observations during a long term of years, and seeming to prove that the terrestrial pole is actually in motion at the rate of 4½ seconds a century. This fact has its bearing on many other questions, and calls for systematic observation simultaneously carried on in all parts of the world for the better determination of the rate and significance of polar motion.

The research fund of the A.A.A.S. ought to be sufficiently increased to enable it to take a share in special inquiries like the foregoing. Accordingly a committee was appointed, of which Prof. Brashear, of Allegheny, is the chairman, to raise if possible the sum of $100,000 for that purpose.

H. C. HOVEY.

Effect of Water on Lead Pipe.

A very remarkable case of danger from water in contact with lead, where neither the conditions of the drainage area nor the results of chemical analysis would arouse any suspicions as to safety, was reported by Dr. Elwyn Waller at a recent meeting of the American Chemical Society. The water in question came from creeks in the mountain districts of Kentucky. Analyses of samples "one" and "two" were as follows, the acid radicles being distributed among varying quantities of the usual alkali and alkali earth metals, with also some silica, iron oxide and alumina:

	Parts in 100,000.	
	I.	II.
Odor when heated to 100° F.	None.	None.
Chlorine, in chlorides	0·0311	0·0560
Phosphates	None.	None.
Nitrogen, in nitrates	0·0165	0·0247
Free ammonia	0·0004	Trace.
Albuminoid ammonia	0·0046	0·0016
Temporary hardness	0·9500	0·7500
Permanent "	1·4000	1·3000
Organic and volatile	1·3000	1·4000
	3·7026	3·5323

As a further test, sections of 1 in. lead pipe, each 1 in. long, freshly scraped, were put into about a pint of each sample, and for comparison a piece of the pipe was put into an equal quantity of Croton water. A slight cloudiness occurred in No. II. in twenty-four hours, a still further discoloration in No. I., and none in the Croton. Fresh samples were put into bottles with the lead, and left, with glass stopples tied down, for several months. At the end of that time the piece of lead in the Croton water was blackened, and had developed one or two spots of adherent white incrustations. Sample of water No. I. was whitish in color, with some detached white sediment, while No. II. was decidedly milky, and contained a half inch of detached sediment, the action upon the lead apparently going on indefinitely, the scales becoming detached as fast as formed. A similar case was reported some years ago by Prof. Frederick Penny, in his experiments upon the water of Loch Katrine, which showed an almost identical composition by analysis.

PHOSPHATED SALT.—Potassium, sodium, and calcium phosphates in nearly equal proportions are well mixed and finely ground. Common salt is then well ground and incorporated with 3 per cent of the phosphate mixture to form a prepared table salt.—*G. D. Bowie.*

The Dairy of the Exhibition.

Chief of Construction Burnham has designated sites for the Forestry, Sawmill, Dairy and Agricultural annex buildings. They will be grouped on the space formerly planned for a lagoon, south of the Agricultural building and near the lake shore. The lagoon, which is a natural one, will disappear, the buildings being constructed on a piling foundation over it. The approximate dimensions of the Dairy building are given as 95×200 feet; those of the Forestry building 300×500 feet. Chief Buchanan, of the Department of Agriculture, has secured the construction of all these structures. The Forestry building will be unique in that it will be surrounded by natural tree trunks as columns, one or more of which will be contributed by each of the several States. The sawmill people have been making a vigorous plea for their building, in which to show the actual operation of producing lumber.

No feature of the Exposition, probably, will possess greater interest or value to the agriculturist than will the dairy school, the holding of which substantially in accordance with the plan submitted some time ago by Chief Buchanan is now assured. The school will include a contest between both herds and individuals of the chief breeds of dairy cattle, with a view of ascertaining the respective merits of each in milk giving and butter and cheese producing. Each herd will be charged each day with the food consumed, accurately weighed, and will be credited with the milk, butter, and cheese produced. Manufacturers of dairy utensils and appliances will gladly furnish all that will be required in their line. Accommodations will be provided, so that spectators may view the processes of butter and cheese making.

The tests and all details of management will be under rules to be prepared by a committee composed of one member from each of the dairy cattle associations in the United States, three from the Columbian Dairy Association, three from the Agricultural Colleges and United States Experimental Stations, and one from the manufacturers of dairy utensils.

The manufacture of the product will take place in the dairy building, in an operating space 25 by 100 feet, above which on either side will be a gallery which will accommodate fully 500 spectators. The school, in all probability, will continue through four months, and each participating herd will be represented by a given number of cows. The results of this test and of the exhibition which will be made of the latest and most advanced scientific methods known in connection with the feeding and care of cattle, the treatment of milk and the production of butter and cheese, cannot fail to be of very great value to the dairy interests of this country. These interests, it is scarcely necessary to state, are of enormous importance and extent, and, indeed, are scarcely surpassed by any other branch of industry in respect of the amount of money invested. It cannot be doubted that the Exposition Dairy School will cause a more economic and scientific management of the dairy interests of the entire country, and consequently a greater return from the capital and labor invested.

The India Rubber Tree.

The India rubber tree cannot stand shade, and unless the seedlings are fully exposed to light and well drained, they cannot grow. Owing to this it is found that in the depths of the forest, where light and air are shut out by the dense crowd of trees of many species, natural reproduction takes place by the germination of seeds carried by birds high up in the crowns of other trees, aerial roots descending in process of time to the ground, and developing into a huge hollow cylinder round the foster stem, which is soon killed. The descent of the roots may take years, but once they have taken hold of the ground, the further growth is exceedingly rapid. In cultivating, the seeds are found to grow much better than cuttings, and these are tended in large nurseries until they are 10 feet high, when they are transplanted into clearings made in the forest, in strips of 40 feet wide, alternating with 60 feet of natural forest, this being found necessary to furnish the necessary moisture, while narrower clearings do not give air and light enough. Trees grown in grass land were found on tapping to yield scarcely any rubber, the difference being attributed to absence of the moisture afforded by the forest. Plants of 1874–75 were found, in April, 1889, to have attained an average height of 61 feet 11 inches and a girth of 11 feet 5 inches, thus having grown at the very rapid rate of 6 feet 1 inch in height and 9 inches in girth per year.—*Demerara Argosy.*

Improved Cementing Material.

V. L. Daguzan says: This material is called by the inventor pyro-cement, and is "a blackish product, which adheres strongly to iron, wood, stone," etc. The following constituents and proportions yield a useful result: "18 to 25 per cent of gas petroleum or other resinous matters, 75 to 80 per cent of clay or argillaceous earth and silica, 2 to 8 per cent of natural sulphates."

Correspondence.

The Grooved Cartridge.

To the Editor of the Scientific American:

I came across a copy of the SCIENTIFIC AMERICAN, dated April 26, 1890, in which you give a description of the new rifle adopted by the German government. You say for it: The cartridge forms an innovation upon all others that now exist, inasmuch as it has no projecting rim at the base; but, on the contrary, has a small groove, in order to allow it to be grasped by the extractor hook. Now I can prove that I am the original inventor of that construction of cartridge, as will be seen by the plans and specifications, No. 7,779, published at the British Patent Office, entitled "Jennings' Combined Single Loading and Repeating Rifle," and dated 26th June, 1885, that is, three years prior to the German model, 1888. R. JENNINGS.

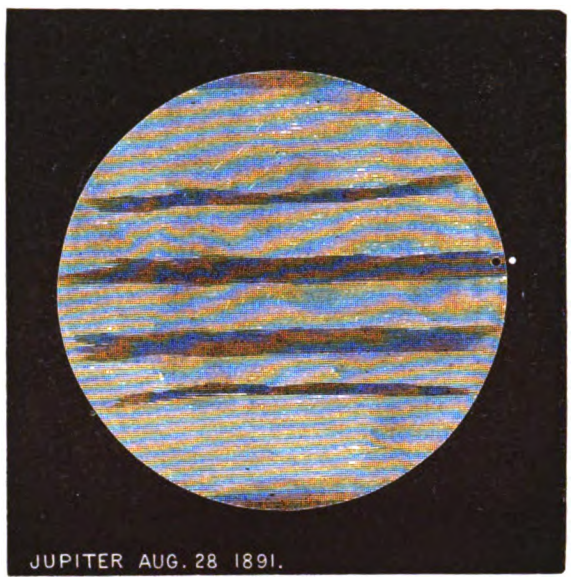
54 Fruit St., Youngstown, O., Aug. 5, 1891.

JUPITER.

To the Editor of the Scientific American:

The planet Jupiter is now in good position to observe even with small telescopes. The ever-changing relations of the four moons to each other and the planet will interest and instruct.

The belts are also of constant interest. I send herewith sketch of the planet as observed last night. Four



belts were very prominent and finely marked. The little white spot near the right hand edge of Jupiter is the first satellite about to transit, which occurred at 9 hours 52 minutes. The small black spot just entered upon the disk of the planet is the shadow of the satellite. It came on 18 minutes before the satellite itself, and, of course, preceded it entirely across the planet. The satellite could be easily seen in transit upon the gray background formed by the belt.

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., Aug. 29, 1891.

How to Get Rid of Snails.

To the Editor of the Scientific American:

In one of your numbers, a correspondent inquires as to the getting rid of snails and slugs. I remember a few years ago traveling in Brittany and meeting boys carrying sea sand in baskets. Having asked them for what purpose, they answered it was to prevent snails and slugs getting on to the flower beds, and that it answered perfectly. Your correspondent might try this remedy. A. B.

Sainte Adresse, France, August 15, 1891.

Jet Propulsion.

To the Editor of the Scientific American:

I note the remarks of Mr. W. H. Wetherill in your issue of August 29. The principle of hydraulic propulsion is already secured, in that past experiments have shown its superiority to that of the screw propeller; but its adoption has been retarded because experimenters have used impractical pumps; consequently a medium size jet has not been obtained—a condition vitally germane to the success of the method. For example, the two 9 inch nozzles on the English torpedo boat of 66 feet and the one ¾ inch jet of Dr. Jackson's yacht of 106 feet, both size nozzles being extremes.

The experiments made by the English Admiralty employed centrifugal pumps of great capacity and comparatively little power, while the steam pumps used in the United States experiments had great power and little capacity. A pump which combines capacity and power will effect the speedy adoption of the principle.

I contend the screw is not intermittent. It has a continuous thrust—every blade constantly doing duty by turning a complete circle. Suppose one blade were left on the shaft, does Mr. Wetherill think its action is intermittent? If not, could a screw propeller with more blades be regarded as intermittent? So with three or four constant jets impinging the water of flotation at the same time, while each jet is independent of the others in its work; thus each blade is independent yet continuous in its action.

In conclusion, the possibilities of obtaining greater speed through the screw propeller are nearly limited. The application of its highest power is nearly reached; but with a practical pump three or four times the power can be realized. In this direction lies the probability of four days Atlantic liners.

JOHN W. HAHN.

Newton, Mass., August 29, 1891.

Collapse of a Kitchen Boiler under Apparently Normal Working Conditions.

To the Editor of the Scientific American:

A 30 gallon upright copper boiler had been in use twenty years and was in perfect order. It was supplied from a tank under a maximum head of 8 ft. 6 in. Minimum head (tank almost empty) about 3 ft. 6 in. A few days ago (Monday, Aug. 31), the tank having been drawn down for washing so that the head was about 4½ ft., the upper part of the boiler suddenly collapsed, hot water being drawn at the same moment in the washtubs.

The cause was at first not evident, nor had the plumber any explanation to offer.

The facts are that within a year the range formerly in use has been taken out and a larger one put in, with water back having a much greater heating power. It now appears that for some time a snapping has been noticed in the hot water pipes, which indicates that steam had been formed in the boiler and was condensed with the noise observed; proving that the water back was too powerful for the demands made upon it.

On the morning in question the fire was hot, the water in the boiler was undoubtedly at the boiling point, and had forced back water into the tank until there was a steam space of fifteen or eighteen inches in the boiler.

On opening the faucet in the tub the pressure was relieved—cold water passed into the boiler from the tank, and the condensation was instantaneous, allowing no time for equalization of pressure through the feed, or open faucet, which was at the end of not less than 13 ft. of ¾ in. pipe, and was probably only partly open.

It appears from this that water backs are put in without any calculation as to their capacity, and that under some conditions steam may be formed and a collapsed boiler result, with all the details of inlet and outlet in ordinary working order.

The primary cause in this instance was the unnecessarily powerful water back, to which the low head of water was contributory. The conditions have been the same for twenty years as regards pressure; but a pipe water back running around the top of the fire had been used in the old range.

This accident serves to call attention to the need for especial care in proportioning the water back to the work it has to perform where a low pressure water supply is in use. DURAND WOODMAN.

80 Beaver St., N. Y., Sept. 2, 1891.

White Metal Alloys.

The following alloys are used as lining metals by the Eastern Railroad of France:

Number.	Lead.	Antimony.	Tin.	Copper.
1	65	25	0	10
2	0	11·12	83·33	5·55
3	70	20	10	0
4	80	8	12	0

No. 1 is used for lining crosshead slides, rod brasses and axle bearings. No. 2 is used for lining axle bearings and connecting rod brasses of heavy engines. No. 3 is used for lining eccentric straps and for bronze slide valves. No. 4 is a special alloy for metallic rod packing.

A Light Concrete.

F. Sang states, tufa sand, which is found as small pellets or granules in the Rhenish provinces, is mixed dry or wet with Portland or other cement, and the concrete formed moulded into any desired shape. A mixture of equal parts is said to be as strong as granite and less than half its weight, but for many purposes a mixture of 1 part of cement to 3 to 5 of tufa sand suffices.

Besides being applicable for ordinary building purposes, the patented material is said to be a good nonconductor of heat, and therefore to be fit for forming the roofs of bakers' ovens and similar uses.

THE race of the two-year-olds for the Futurity stake of $75,000 took place at Coney Island, N. Y., on August 29, and was won by His Highness, a bay colt 15·2½ hands high, of such splendid proportions that he would be readily taken for a well furnished three-year-old. He was bred at the Kentucky stud of the late Hon. August Belmont, and was sired by imported The Ill Used, out of imported Princess, the dam of Prince Royal and Her Highness. He cost his owner, Mr. David Gideon, $3,400 at the closing-out sale of Mr. Belmont's race horses at Babylon, N. Y., last February. It is said His Highness has already netted over $100,000 for his owner.

Improvements in Aluminum Alloys.

J. W. Langley finds that if pure aluminum be alloyed with between one half per cent and 10 per cent of titanium, the product is harder than aluminum, nearly as incorrodible, and capable of acquiring by hammering or rolling a degree of elasticity and hardness much superior to pure aluminum. These alloys are fusible below the melting point of steel, the temperature required depending upon the percentage of titanium. When the proportion of titanium is less than 5 per cent, the alloy is nearly as malleable as pure aluminum. The presence of iron and silicon in this alloy are injurious, tending to render it brittle and non-malleable, but a small proportion of chromium is of substantial benefit in increasing the elasticity of the product. The alloy is prepared by the action of metallic aluminum on titanic oxide. The method used is also claimed for the preparation of alloys of aluminum with any more electro-negative metal, and is as follows:

A bath of preferably pure fluoride of aluminum and sodium is prepared in a carbon crucible, the oxide or other salt of titanium added, well mixed and allowed to dissolve; when the mass is thoroughly incorporated and quite fluid, metallic aluminum is charged in, the relative proportions of aluminum and oxide or salt being such that the percentage of oxide shall be about twice the percentage of metal required in the alloy. The temperature of the bath rapidly rises on the introduction of the aluminum, and as soon as this ceases, the reaction is completed and the mass is teemed into a suitable vessel, allowed to cool somewhat, and the fluid slag run off from the metal. The latter is remelted before use.

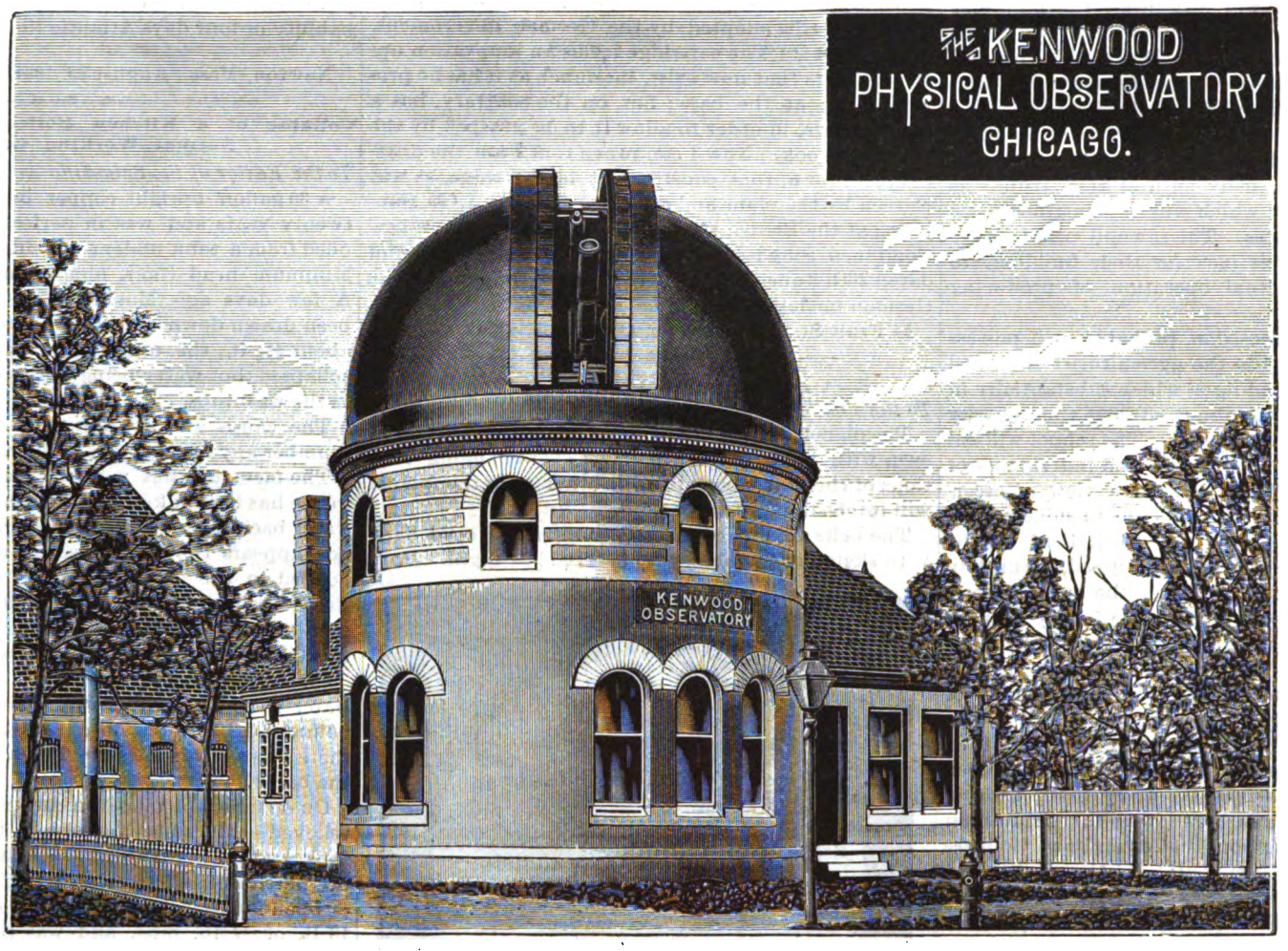
The proportion of fluoride used is from one to four times the weight of the aluminum. Fluoride of sodium, fluoride of aluminum, sodium and calcium, or generally a fluoride of any metal or metals more electro-positive than aluminum, may be used for the bath, but cryolite is disadvantageous, on account of the iron it contains.

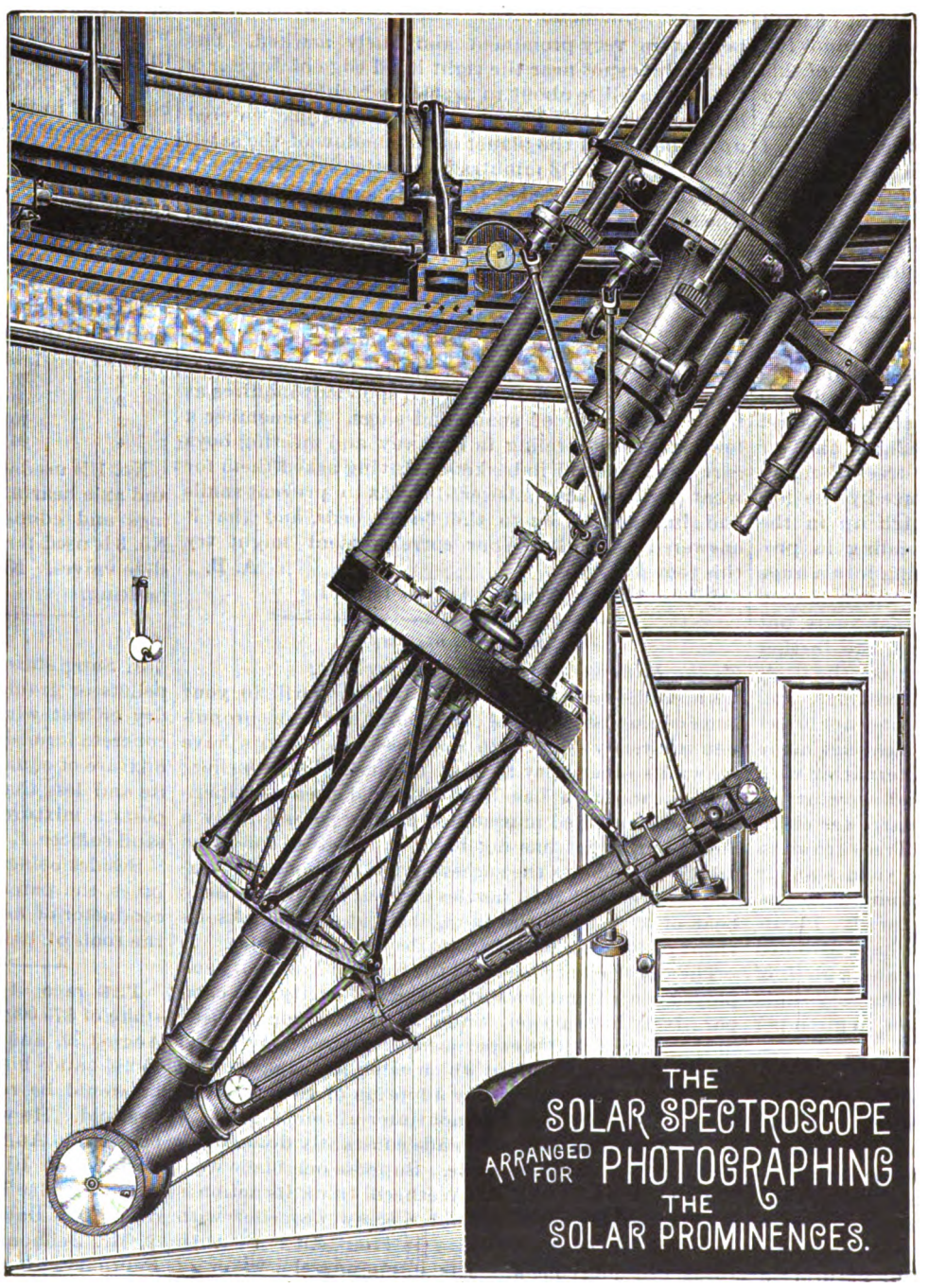
The process must not be conducted in a siliceous crucible, a portion of the silicon being reduced and entering the alloy. Chromium may be introduced as oxide into the fluoride bath, or an alloy of chromium and aluminum may be mixed with the manufactured titanium alloy.

Price of Rare Metals.

Iridium, a very heavy metal of the platinum group, so named from the iridescence of some of its solutions, and well known in connection with its use for the points of gold pens, may be bought to-day at approximately $720 per pound. The present price of platinum, the better known tin white, ductile, but very infusible metal, is on a par with that of gold, namely, about $350 per pound. But generally its value fluctuates between its more popular brothers, gold and silver. The rarest metal—and it is so rare that recent discoveries have thrown doubt on its elemental character—is didymium, and its present market price, if one may thus term the quotation of an article that never appears on the market, is $4,500 per pound. The next costliest metal is barium, an element belonging to the alkaline earth group; its value is $3,750. Berylium, or glucinium, a metallic substance found in the beautiful beryl, is quoted at $3,375.

To prevent the feet from sweating, try the following: One part of salicylic acid, one of subnitrate of bismuth, and two of starch. Wash, and apply powder freely.





APPARATUS AT THE KENWOOD OBSERVATORY.

THE KENWOOD PHYSICAL OBSERVATORY.

GEORGE E. HALE, DIRECTOR.

The Kenwood Physical Observatory had its inception in a spectroscopic laboratory erected in Chicago in the summer of 1888. The addition of a tower and wing during the winter of 1890–91 brought the building to its present form, and it now includes a reception room, library, equatorial room, "slit room," "grating room," photographic dark room, general laboratory, and workshop. The grating room contains a four-inch concave grating of ten feet radius of curvature, mounted in the manner employed by Professor Rowland. A shorter girder allows the use of a grating of only five feet radius, in cases when the light source is too faint to admit of the highest dispersion. Sunlight is furnished by a heliostat on a pier some distance to the north of the building, while a Weston dynamo, driven by a gas engine of six horse power, supplies the direct current used in spectroscopic studies of the electric arc. An alternating current of fifty-two volts is also supplied by the Hyde Park Thomson-Houston Company, and this is especially useful in producing heavy electric sparks with a large induction coil, and in lighting the whole observatory with incandescent lamps. A set of thirty-five Julien storage cells can be charged by the Weston machine, and used when desired.

The mounting of the equatorial was finished in March, 1891, by Messrs. Warner & Swasey, and the excellent 12·2 inch object glass, figured from Dr. Hastings' calculations by Mr. J. A. Brashear, was in place and ready for use early in April, 1891. The spectroscope is of very large size, and was also made by Mr. Brashear. A frame of strongly braced steel tubing carries the collimator and observing telescope, which make with each other a constant angle of 25 degrees. The objectives are exactly alike, of 3¼ inches clear aperture and 42½ inches focus, corrected for work in the visual region. The grating is a 4 inch flat, and in many respects is the finest ruling I have ever seen. In addition to the grating there is a 30 degrees white flint prism, silvered on the back, which is used in photographing the spectra of the fainter stars. The large size of the spectroscope, and the necessity of a perfectly rigid attachment to the equatorial, have caused us to mount the spectroscope and tube as if in one piece, the declination axis coming at the center of their combined lengths. As the object glass of the equatorial has a focal length of 18 feet, the total length of the combination is 22 feet 9 inches. The mounting is built very large and heavy, and carries also a four-inch Clark telescope and a small finder. The weight of the driving clock can be controlled by electric connection with an excellent Howard clock.

As my recent photographic investigations of solar prominences and their spectra have shown the necessity of employing specially corrected objectives in a continuance of

the research, it has been decided to supply the telescope with a photographic object glass of exactly the same aperture and focal length as the present visual glass. A double tube will replace the single tube now used, and the object glass will be so supported that either one may be used on either tube. The spectroscope will thus form a part of the instrument, as before, and the eye end of the second tube will be left free for the attachment of any desired apparatus, such as an amplifying lens and camera for photographing sun spots on the Janssen method. Various improvements of the spectroscope will be made by Mr. Brashear, one of the most important being the construction of a new device of the writer's for prominence photography. A new observing telescope with an objective of about six feet focus corrected for the K region is to be constructed for the spectroscope, and used for further study of the prominence and chromosphere lines recently discovered. Mr. Brashear also has the order for the twelve-inch photographic object glass, for which the whitest possible flint will be secured from the Jena factories, while the crown will be furnished by Mantois. The writer will spend some time visiting the European observatories in search of new ideas in apparatus and methods of work, which will be embodied in the improved instruments.

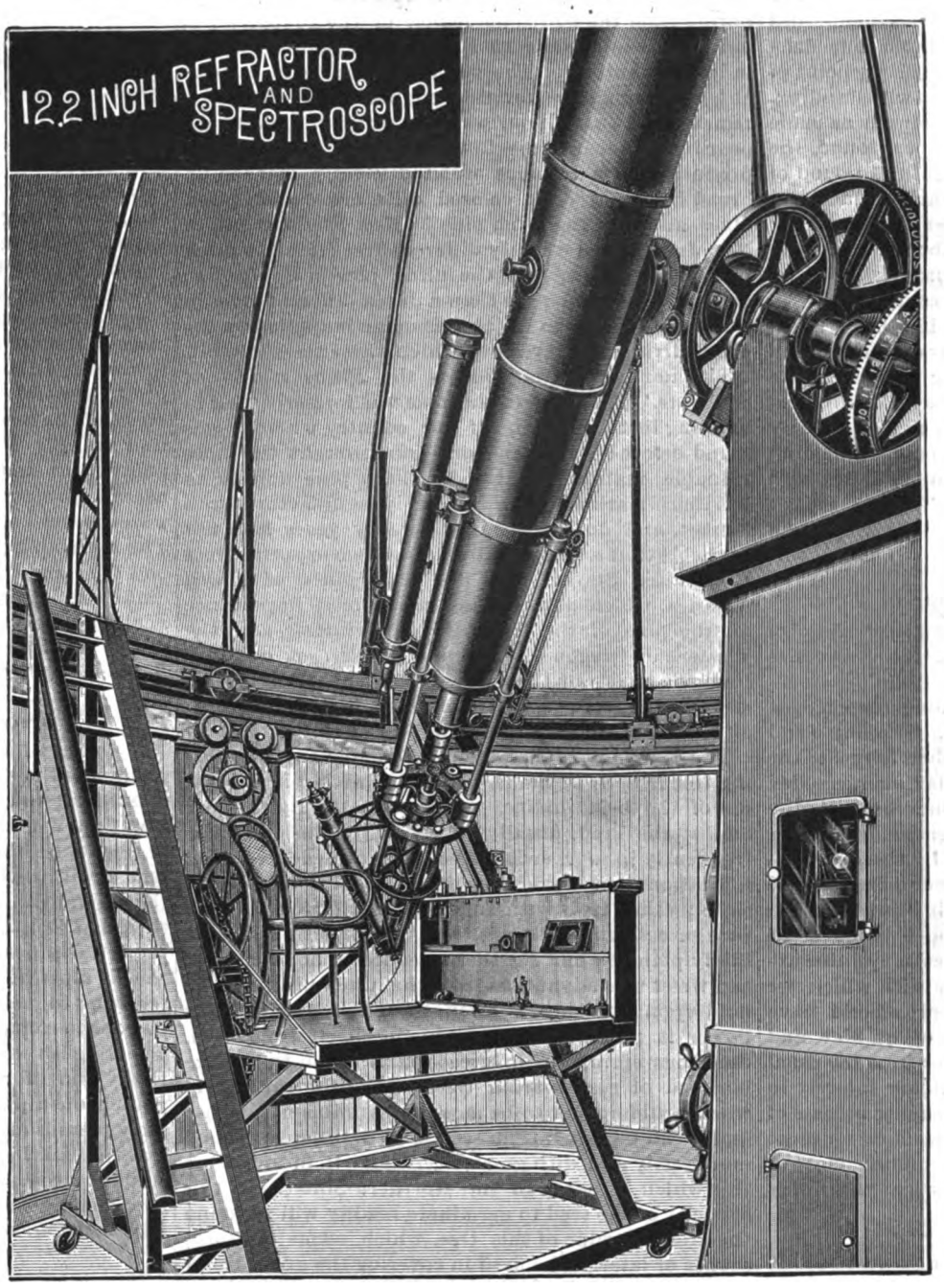
The Kenwood Physical Observatory was dedicated to scientific research on June 15, 1891. Addresses were made by Professor C. A. Young, Professor G. W. Hough, of the Dearborn Observatory, Mr. J. A. Brashear, President E. D. Eaton, of Beloit College, and several others. The observatory has been incorporated under the laws of the State of Illinois, and its control is vested in a board of trustees. The plan of work laid out for the future includes a thorough study of solar phenomena, and particular attention will be given to spectroscopic investigations of the spots, chromosphere, and prominences.—*Sidereal Messenger*.

Artificial Ivory.

Attempts have been made to produce a good artificial substitute for ivory. Hitherto none have been successful. A patent has recently been taken out for a process based upon the employment of those materials, of which natural ivory is composed, consisting, as it does, of tribasic phosphate of lime, calcium carbonate, magnesia, alumina, gelatine, and albumen. By this process, quicklime is first treated with sufficient water to convert it into the hydrate, but before it has become completely hydrated, or "slaked," an aqueous solution of phosphoric acid is poured on to it; and while stirring the mixture the calcium carbonate, magnesia, and alumina are incorporated in small quantities at a time; and lastly the gelatine and albumen dissolved in water are added. The point to aim at is to obtain a compost sufficiently plastic and as intimately mixed as possible. It is then set aside to allow the phosphoric acid to complete its action upon the chalk. The following day the mixture, while still plastic, is pressed into the desired form in moulds, and dried in a current of air at a temperature of about 150 deg. C. To complete the preparation of the artificial product by this process, it is kept for three or four weeks, during which time it becomes perfectly hard. The following are the proportions for the mixture, which can be colored by the addition of suitable substance: Quicklime, 100 parts; water, 300 parts; phosphoric acid solution—1·05 sp. gr., 75 parts; calcium carbonate, 16 parts; magnesia, 1 to 2 parts; alumina, precipitated, 5 parts; gelatine, 15 parts.

New French Railway.

There has just been inaugurated with great *éclat* the opening of a new railway from Brive to Gourdon, the construction of which has called into force the utmost skill and ingenuity of the engineers engaged on the project, and has entailed an enormous expense. It has no fewer than seven viaducts, one of which, near Le Boulet, measures 476 meters, and twelve tunnels, several of which are over 1,000 meters long. The new line will shorten the journey between Paris and Toulouse by two hours, and when quite ready for traffic will considerably expedite the transport of goods between France and Spain.



APPARATUS AT THE KENWOOD OBSERVATORY.

Manufacture of Rubber Water Bottles and Fountains.

So much has been said about white compounds and the methods of making up the goods into which they enter, that it may seem like a rehash of an old story to talk on this subject; but there are some few points that have not as yet been touched upon, which is my excuse for this article. Of course any fairly furnished rubber manufacturer knows how to make white rubber, or at least ought to, for, even while I say this, I recall the fact of a man well posted in black mixtures who had so been brought up in the belief that litharge must enter into every compound that he put it into a white compound, and could not understand why after vulcanization it was not white. Without dwelling upon this, or giving any specific compounds for white goods, I am going briefly to give an idea of exactly how the goods are made up.

The part of making up, perhaps, begins with the spreading of the stock. In this, however, if the calender and the calender man are all right, there should be no trouble in turning out exactly the thickness wanted and in having the texture all right for the best results. After the stock has been stripped from the apron upon which it is spread, the next thing is to give it the peculiarly ribbed appearance that many of the goods have. This, to be sure, is not a necessity, as many water bottles are made up plain. One method of producing this ribbing was to press the rubber after it had been cut up into small sheets between metal plates that acted as dies and gave a fine appearance. Another way is to have a grooving roll so arranged that it may be run against one of the calender rolls, and thus give this result.

The stock after being thus ribbed is sent to the cutting room, and here the parts for the water bag are shaped. These parts consist of the bag shape proper, the neck, the binding, the rubber handle and the tail piece. The bag proper is cut out by a die, two sheets of the stock being laid together with the ribbed sides out, and the cutting of the die through the two sheets of rubber in a measure catches them together, so that this is really a part of the making up. These large pieces are put in cloth books, and then sent to the tables where the making up takes place. This work is all done by girls. The bag maker's table is, as a rule, covered with zinc, has a hanging shelf above it and a shelf below it, also zinc covered, for receiving finished work. Each worker at a table is provided with a tin cement cup, with brush and cover, a stitcher made after the fashion of the well known tracing wheel, and a smooth iron hand roller for setting the seams after cementing.

The first process in the manufacture after the different parts reach the bag maker is that of cementing. In order that the cement may not touch the portions of the bag that are not to be covered with binding, a metal form is laid lightly over the bag, leaving the edge free, which is brushed lightly over with the best white rubber compound dissolved in naphtha that can be produced, as upon the integrity of the cement depends a great deal of the strength and durability of the water bottle. After the various parts have been cemented, that is, the various parts of the bag proper, the binding and the neck, the double bag piece is opened out at the mouth and slipped over a curved rod of half round iron, somewhat similar to a section of a wheel tire. The binding is then put over the edges of the bag pieces, holding them together, is rolled down by the roller, and then run over by the tracing wheel, which latter gives it a finish, and also helps to set the two portions of unvulcanized rubber more closely together. The neck piece is then formed separately, and after being cemented at its lower edge is placed around the metal bottle top, the thread of which has received a generous coating of cement. This is sometimes wound in with wire to keep it solid and to keep it from leaking, and sometimes it is not. A piece of binding is run around the neck of the bottle, the flexible rubber handle, which is made of friction cloth covered with rubber, is next cemented to the shoulders of the bag, the tail piece is cemented on, and, if it is a solid piece, is eyeleted. If the bag is a combination syringe and water bottle, an outlet pipe is put at the lower end of it, and the whole dusted over with French talc and laid upon the zinc-covered shelf, out of the way of the workers.

In finishing up the work of the bag, the next process is to carry it to the vulcanizing room, where it is laid in an immense sheet iron pan that is practically filled with a layer of French talc pressed down very smooth. A little of the talc is put inside of the body of the bag to keep it from sticking together, and then the whole is covered about three inches deep with another layer of talc. This forms in reality a mould for the water bottle, the whole design being to hold it in place after it is exposed to the heat, and until vulcanization is complete. A two or three hour heat is commonly given goods of this sort, after which they are taken out, the French talc is carefully blown out from the interior of the bottle, and the goods go to the packing room, where they are gotten ready for shipment.—*Rubber World*.

To Restore Faded or Obliterated Ink.

The following suggestions are from Haldane's "Workshop Receipts:"

1. Wash in warm water to remove salt if the paper has been immersed in sea water, and then soak in a solution of gallic acid, 3 grains to the ounce of water.

2. Wash in clean water and soak in solution of ferrous sulphate, 10 grains to the ounce.

3. Apply a solution of potassium ferrocyanide with a brush, when the writing will appear in blue, if any iron is left of the original ink.

4. *Falsified Writing.*—Gobert has found that if writing is ever so carefully scratched out, there are still left sufficient traces of the oxide of iron in the ink to become visible in a photographic copy. Light reflected from paper that has not been written on acts in a different way on the photographic materials from that reflected from places which have been once covered with ink.

Rubber Cement.

To fasten glass letters, figures, etc., on glass (show windows) so that, even when submerged in water for several days, they will not become detached, use an India rubber cement. The best for this purpose consists of one part India rubber, three parts of mastic and fifty parts chloroform. Let stand for several days at a low temperature to dissolve the cement. It must be applied very rapidly, as it becomes thick very soon.

Aluminum.

A. E. Hunt stated in a lecture before the Boston Society of Arts that the extravagant claims made concerning the production and properties of aluminum had constituted the chief difficulty in its introduction and extended use. The pure metal is soft and weaker than the commercial variety containing 3—4 per cent of impurity. The tendency of aluminum to become coated with a thin film of oxide in exposure to air gives it a dull appearance and makes it unsuited for table ware. It loses its tensile strength and much of its rigidity at 400°—500° Fah., becomes pasty at 1,000 Fah., and melts at 1,300° Fah. It does not roll or cast well, and its conductivity for heat and electricity is only about half that of copper, its tensile strength is not greater than that of common cast iron and only about one-thifd that of structural steel, while its strength in compression is only about one-sixth that of cast iron.

A bar of aluminum 1 inch square and 4 feet 6 inches between its supports deflects 2 inches with a load of 250 pounds, while a similar bar of cast iron requires double the load to give an equal deflection. The modulus of elasticity of cast aluminum is about 11,000,000, being only about one-half that of cast iron and one-third that of steel. Its presence in iron is stated to be deleterious, and it is said not to lower the melting point of steel, statements to the contrary notwithstanding. The theoretical cost of 1 pound of aluminum as made by the Pittsburg Company is 20 cents per pound, the items being, 2 pounds of alumina, 6 cents; 1 pound of carbon electrode, 2 cents; chemicals, carbon dust, and pots, 1 cent; 22 electrical horse power for one hour (water power being used), 5 cents; labor and superintendence, 3 cents; general expense, interest, and repairs, 2 cents (this amounts to only 19 cents).

Although the value of aluminum has been much overrated, both it and its alloys have many useful qualities. The difficulty of soldering it is alleged to have been overcome by the use of a special flux (nature not stated). Hard or soft solder, zinc or an alloy of zinc and aluminum are the solders used. The difficulty caused by the softness of aluminum is also said to have been overcome by alloying it "with a few per cent of hardening metal," or hammering or drop forging.

The New Artificial Quinine.

Artificial quinine, writes the Paris correspondent of the *Lancet*, may be considered one of the discoveries of the year. The synthesis of that useful, nay, indispensable substance, quinine, has long been a desideratum, and now, thanks to MM. Grimaux and Arnaud (the former professor of chemistry at the Ecole Polytechnique, and the latter having succeeded the late illustrious centenarian, Chevreul, at the Museum d'Histoire Naturelle), the chemical dream has been realized. The method adopted by these gentlemen is as follows: The base cuprein contained in the shrub *Remijia pedunculata* growing in Brazil is treated with sodium, then the combination thus obtained with chloride of methyl. The product is quinine absolutely identical with the substance with which we are familiar. This important discovery should have the effect of bringing down the price of quinine, and of rendering us independent of supplies from the usual sources. The discovery presents a further interest in that, by the substitution in the foregoing process of compounds of ethyl and other higher alcohols for those of methyl, new bodies analogous to quinine may be manufactured—bodies whose therapeutical value may be great.

Black Tea and Green.

Mrs. Scidmore, in her "Jinrikisha Days in Japan," says:

The tea plant, as every one knows, is a hardy evergreen of the camellia family. In the spring the young leaves crop out at the ends of the shoots and branches, and when the whole top of the bush is covered with pale, golden green tips, generally in May, the first picking takes place. The choicer qualities of tea are never exported, but consumed at home. The average tea brought by the exporters for shipment to the United States and Canada is of the commonest quality, and, according to Japanese trade statistics, the average value is eleven cents a pound.

For green tea, the leaves are dried over hot fires almost immediately after picking, leaving the *theine* or active principle of the leaf in full strength. For black tea, the leaves are allowed to wilt and ferment in heaps for from five to fourteen days, or until the leaf turns red and the harmful properties of the *theine* have been partly destroyed.

Tea which is to be exported is treated to an extra firing, to dry it thoroughly before the voyage, and, at the same time, it is "polished," or coated with indigo, Prussian blue, gypsum and other things, which give it the gray luster that no dried tea leaf ever naturally wore, but that American tea drinkers insist on having. Before the tea leaves are put in the pans for the second firing, men, whose arms are dyed with indigo to the elbows, go down the lines and dust a little of the powder into each pan. Then the tossing and stirring of the leaves follows, and the dye is worked thoroughly into them. . . . This skilled labor is paid for at rates to make the Knights of Labor groan, the wage-list showing how impossible tea culture is for the United States until protectionist tea drinkers are ready to pay ten dollars a pound for the commonest grades. During the four busy months of the tea season the firers are paid the equivalent of eleven and four-tenths cents, United States gold, for a day's work of thirteen hours. Less expert hands, who give the second firing, or polishing, receive nine and six-tenths cents a day. Those who sort and finally pack the tea and who work as rapidly and automatically as machines, get the immense sum of fifteen cents. . . . Each year the United States pays over $7,000,000 for the nerve-racking green tea of Japan.

The Northern Pitch Pine.

Inquiries about this tree often reach us from Europe, especially from France and Germany, where the impression prevails that it is the species which produces the pitch pine of commerce, generally known in this country as Southern pine or Georgia pine, and now exported from the maritime region of the southern Atlantic and Gulf States to Europe and South America in large quantities. The vernacular name is, in part at least, responsible for this confusion. It should be remembered that all our pines on which the leaves appear in twos or in threes in the same cluster, and which produce coarse resinous wood distinctly marked by broad bands of dark colored cells, are called pitch pines, and that the pitch pine in New England and in New Jersey is an entirely different tree from the pitch pine of Georgia or from the pitch pine in California; and that there are more than a dozen different trees in the United States to which this name is applied by the people living in the regions which these trees inhabit.

The northern pitch pine is the *Pinus rigida* of botanists. The wood of this tree was formerly used in building in those parts of the country where it was found before cheap transportation brought the more valuable material of the Southern pine forests to Northern markets. Now it is rarely manufactured into lumber, and during the last twenty years it is not probable that a single foot of it has been exported from the United States. The two pitch pines of North America, which now possess commercial importance are the pine of the South, *Pinus palustris*, and the Western or Oregon pine, *Pinus ponderosa;* and it is from the forests of the former that the pitch pine so largely used in the North is derived, and that furnish all the American hard pine sold in Europe.

The Northern pitch pine is a valuable and interesting tree in spite of the fact that the lumber it yields is not of the best quality. It grows naturally on poor and sterile land, usually on sandy barrens, and less frequently in sour, swampy soil. Its presence is a good indication that the soil which bears it is too poor to supply other trees with sufficient plant food to compete successfully with this tree. Once in possession of a sandy plain on our Northern seaboard, no other tree can wrest this advantage from the pitch pine, and its hold upon existence is strengthened by the peculiar power it possesses of reproducing itself from seed. Seedlings spring up in great quantities in the neighborhood of seed-bearing trees, and grow rapidly in what would appear to be most unfavorable situations; and it can be raised from seed sown in the open ground more easily and with greater certainty than any other tree which is hardy in the Northern States. In this capacity of the seed to germinate readily will be found the greatest value of this tree, which seems destined, sooner or later, to be used in covering the great tracts of unproductive land which occur in the neighborhood of our Northern seaboard. Its value and adaptability for this purpose has already been proved. Thousands of acres of the New England coast have been covered with forests of this tree, raised from seed at a mere nominal cost, and nothing but the dread of fire prevents the extension of these forests over still larger areas. What appears to be barren soil, such as occurs on some parts of Cape Cod, in Massachusetts, and in southern New Jersey, will, in forty or fifty years, produce a forest of pitch pine of considerable money value for the fuel which it contains. No other method has yet been found by which such waste lands can be made to yield any return whatever, and any comprehensive system of agriculture must look to covering, sooner or later, these lands with trees.

The pitch pine planted on barren soil will not grow to a large size or produce anything more valuable than firewood. It will, however, in a comparatively short time yield on the poorest land several cords of fuel to the acre; and the fuel value of this wood is unsurpassed by that of any other inhabitant of our Northern forests, and for many purposes, such as brickmaking and for charcoal, it is extremely valuable. When individual specimens have happened to grow in good soil they have sent up tall, stout stems two or three feet in diameter. These trunks were eagerly sought for in the early settlement of the country, and were manufactured into timber and flooring of excellent quality and remarkable durability. In some parts of New Jersey houses timbered and floored with this wood a hundred years ago are still standing, and are in a perfect state of preservation. Such trees have now almost entirely disappeared, however, and there will probably never be a question of planting the pitch pine for timber, for where the soil is good enough to produce large individuals, with straight, clean trunks, it will support a forest of more valuable species.

As an ornamental tree, *Pinus rigida*, although it is not suited to decorate a trim lawn, can be used sometimes to advantage when it is desired to produce bold, picturesque effects, or to clothe a barren knoll with verdure. It grows rapidly; the trunk, covered with dark, deeply furrowed bark, broken into large, square plates, is always a handsome object, and the color of the coarse, pale green foliage makes a good contrast with the other trees of our woods and plantations.—*Garden and Forest.*

Spontaneous Ignition of Coal.

In the chemical section, British Association, was a paper read by Professor Vivian B. Lewes on the "Spontaneous Ignition of Coal," the true explanation of which he held to be partly physical and partly chemical, but not dependent upon the percentage of pyrites. Freshly won coal had, he said, the power of absorbing from a fraction over one to three times its volume of oxygen from the air, and the oxygen being rendered chemically highly active, partly by compression and partly by the elimination of nitrogen, it attacked some of the bituminous hydrocarbons in the coal, converting them into carbon dioxide and water vapor. With regard to the bunker fires which are now becoming perilously frequent on some of he fast liners, Professor Lewes attributed them entirely to rise of temperature, from the bunker bulkheads being too close to the hot air upcast shafts from the boilers and furnaces. In the course of a discussion which followed, pretty general agreement was expressed with the views of the reader of the paper. In reply to a question by Sir Frederick Bramwell, Professor Lewes pointed out that in case of coal bunkers in ships the necessary safety could be obtained by having a thin water jacket between the smoke shaft and the bunkers. The remaining papers were of interest only to experts, and the same may be said of all the numerous communications submitted to the mathematical and physical science group. Such subjects as the surface tension of ether and the measurement of Hertzian oscillations could allure only the initiated.

Arsenic Poisoning from Coal.

A source of contamination with arsenic recently pointed out is from coal. When coal is burnt it is roasted out and it is the only product of the coal which is at first volatile and afterward non-volatile. A part of the smoke that goes into the air is arsenious acid mixed with carbon, and a large part of it lodges in the chimneys. Now take a city like London, or any of the great English cities where coal is burnt very freely, there the quantity of arsenious acid that is given into the air must be very considerable, and it would be interesting to make comparative tests of the urine of persons in a city like Boston and in a city like London. The English coal is very bad coal in this respect. Every ton of coal burns off about twenty to forty pounds of sulphur. That sulphur is transformed into sixty pounds of sulphuric acid, which has left its stain on every marble building in London. I speak of the sulphur because the sulphur is largely accompanied by arsenic.—*Professor Crafts in Boston Medical and Surgical Journal.*

The Green Ray.

Mr. C. Mostyn, in a letter to *Nature* on the well known appearance of the green ray at sunrise or sunset, caused by the refraction of air, states: "This 'green ray' is seen to best advantage at sunrise, owing I imagine to the eye not being wearied with watching the previous glare, as is apt to be the case at sunset. At the same time, I had many very satisfactory observations at sunset, one in particular, when we were running before a very heavy sea in the Southern ocean, and the 'green ray' was seen no less than three times in as many seconds, as the ship rose and fell on the huge waves, causing as it were two sunsets, with a sunrise between them. The best displays took place when the refraction near the horizon was of such a character that the sun assumed a balloon, or vase, shape as he came close to the sea line. When, on the contrary, the sun appeared flattened out in its horizontal diameter, the 'green ray' was either entirely absent, or was seen only in an indistinct and uncertain manner."

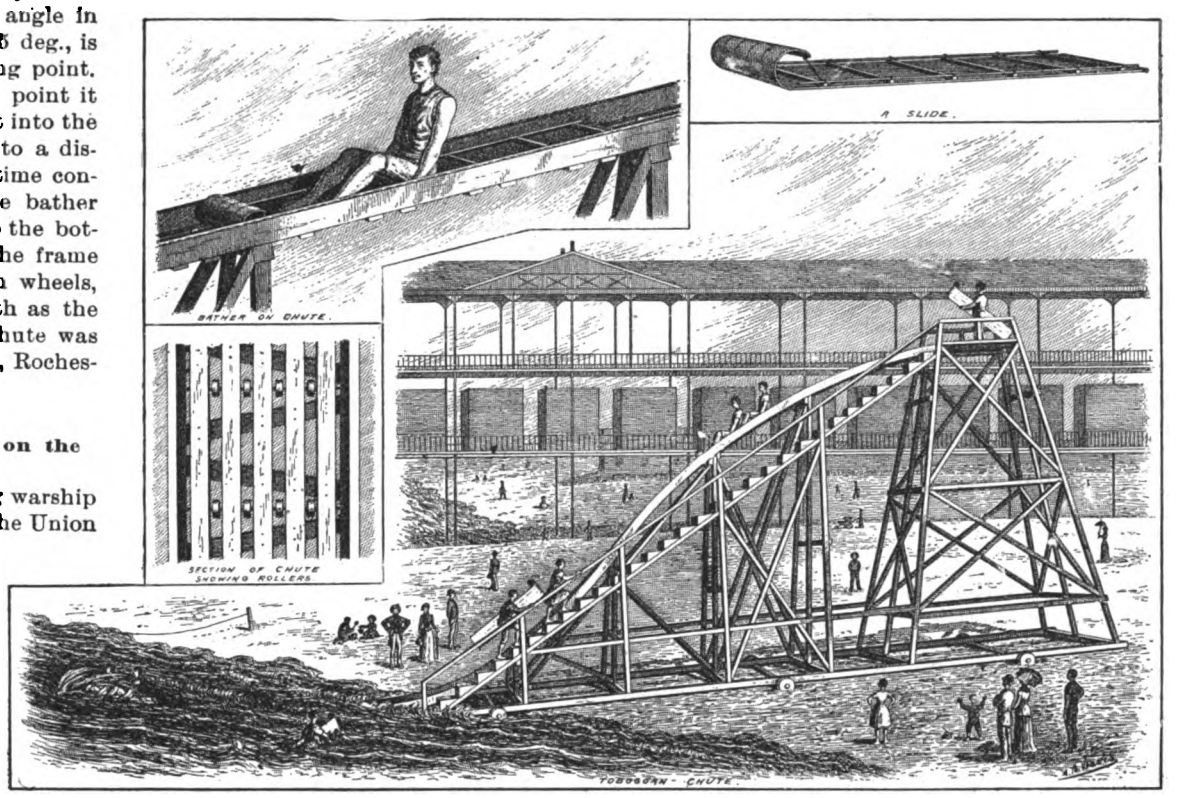
Copying Ink without Press, Black.

Nigrosine, C. P., fine	10	ounces.
Glucose "A"	1½	"
Hot water	1½	"
Glycerine	1½	"

Dissolve the nigrosine by trituration in the hot water and then add the other ingredients and strain through a piece of silk. If too thick when cold, dilute to the proper consistence with water.

NEW TOBOGGAN SLIDE FOR BATHERS.

This new toboggan shute for bathers is 22 ft. in height from the bottom to top of platform and 12 ft. 6 in. in width at the bottom, tapering up to the top of the platform to 6 ft. The framework is made of hemlock timber. On one side are steps built for bathers to ascend to the platform. They are 32 in number. On the other side is the shute. The shute is connected to the platform at the top, and runs down and out into the water for about 10 ft. The toboggan slide is carried up by the bather and placed in the shute, the bather sitting on the bottom of slide, on which are handles running full length of slide on each side, for the bather to grasp hold of. The slides are about 7 ft. in length, 2 ft. in width, of ¼ in. stuff, and are made of Kentucky hickory. They weigh about 18 to 20 pounds. The shute is 28 inches in width; the sides and strips at its bottom are made of linden wood. The sides are 8 in. in height and 1½ in. thickness. The five strips at bottom of shute are 3 in. width and 1 in. thickness and are placed about 2 in apart, so that a loose roller can revolve between them easily. Iron rods about ½ in. in diameter are run through the center of each strip and each roller and side pieces. The rollers are made of rock maple boiled in oil. They are 2 inches in diameter and 1 in. in thickness. The strips and side pieces are braced underneath by heavy ash strips running across in a zigzag manner. The shute is made in seven 6 ft. sections. Each section has eight rolls placed a short distance apart. On each are 4 rollers, making 32 rollers to a section, the slide passing over the rollers on its way down to the water. The greatest angle in the shute, which is about 45 deg., is about 25 ft. from the starting point. When the slide strikes this point it goes down like a shot and out into the water, if it is not too rough, to a distance of about 200 ft. The time consumed in the passage of the bather from the top of the shute to the bottom is about 1½ seconds. The frame work rests on 16 in. wooden wheels, and is jacked back and forth as the tide rises and falls. This shute was built by H. A. Shearer & Co., Rochester, N. Y., at a cost of $600.



NEW TOBOGGAN SLIDE FOR BATHERS.

The Two New Warships on the Pacific Coast.

Work has begun on the big warship known as Cruiser No. 6, at the Union Iron Works, San Francisco. She will be the largest vessel ever built on the Pacific coast, having a length of 340 feet, 53 feet beam, and will draw about 21½ feet when ready for sea, on a displacement of 5,500 tons. The contract calls for a speed of 20 knots or about 24 miles an hour for four consecutive hours, with engines 13,500 horse power. Her coal-carrying capacity will be 1,300 tons, and at a speed of 10 knots she will be able to steam 13,000 miles.

The new cruiser will be fitted with a steel protective deck, twin screws, and will be schooner rigged. In her main battery she will mount four 8-inch breech-loading rifles in two barbettes, one forward and one aft, and ten 5-inch rapid-fire guns. The secondary battery will consist of fourteen 7-pound and six 1-pound rapid-fire guns and four Gatling guns. She will also be fitted with six torpedo tubes.

It is hoped by the builders that the cruiser will be ready to launch within eight months at the outside.

The engines and boilers for the cruiser are in the shops, and are well advanced toward completion. They will be all set up and ready to be put in place before the vessel is launched.

Men are now at work laying the blocks on the new slip for the battleship Oregon, the keel of which soon will be laid.

Young People should have Plenty of Sleep.

A German specialist, Dr. Cold, has recently pleaded for giving young people more sleep. A healthy infant sleeps most of the time during the first weeks; and, in the early years, people are disposed to let children sleep as much as they will. But from six or seven, when school begins, there is a complete change. At the age of ten or eleven, the child sleeps only eight or nine hours, when he needs at least ten or eleven, and as he grows older the time of rest is shortened. Dr. Cold believes that, up to twenty, a youth needs nine hours' sleep and an adult should have eight or nine. With insufficient sleep, the nervous system, and brain especially, not resting enough, and ceasing to work normally, we find exhaustion, excitability, and intellectual disorders gradually taking the place of love of work, general well-being, and the spirit of initiative.

Trade School of the Pratt Institute, Brooklyn, N. Y.

Applicants must be between sixteen and twenty-five years of age. All tools and materials are furnished without extra charge. Day and evening classes.

Carpentry.—Practice is first given in the use of saws, planes, chisels, and laying-out tools, and is followed by a thorough course in joint work. After this practice, and when some mastery of the tools has been gained, a model of a frame house is made, and the different methods of framing illustrated. Afterward, partitions are set and bridged and floors laid. Door and window frames are made and placed in the partitions, which are sheathed, clapboarded, shingled, and corniced. Lastly, inside trimming is taken up; doors, sashes, and shutters are made and hung; wainscoting, baseboards, and stairs built, etc. Constant practice is given in the use of working drawings, and in laying out work from plans.

Blacksmithing.—The instruction includes care and management of fire, operations in drawing, upsetting, forming, and welding iron, and making and tempering steel tools. The exercises mainly represent useful pieces of work, and several complete designs in ornamental work finish the course.

Machine Shop (two years' course).—Bevel, surface, and keyway chipping are first practiced; after which the class is put upon straight surface filing until ability to file straight and true is obtained. This is followed by straight, tongue, round, and dovetail fitting, free-hand filing, filing to templet, making calipers, square, bevel, and gauges in sheet steel, use of taps and dies, and practice in scraping.

The tool work gives practice on the engine lathe in plain and taper turning, outside and inside screw cutting and fitting. After this, exercises are introduced in hand turning, and varied practice on the planing machine, shaper, drills, milling machine, and grinding machine is obtained. The theory of cutting tools is analyzed, and the construction of the different machines explained.

Bricklaying.—The men are first taught to handle the trowel and to spread mortar. Practice is then given in building eight, twelve, and sixteen inch walls, with square and blocked ends, and with returned corner; afterward, arches in walls of the same size are constructed, and later, flues, fireplaces, setting sills, and corbeling. At first each man works on a separate section of the wall, and no attempt is made to do rapid work; but toward the end of the course a number of men are placed side by side on a long wall and greater speed is attempted. Instruction is given, by means of lectures, upon the strength of walls, theory of arches, properties and proportions of mortar, cement, etc.

Plastering.—Instruction is given in scratch-coating, laying-off, browning, and hard finishing, and in running and mitering small mouldings and cornices. The booths for plastering are formed of stud partitions, lathed in the usual manner, and arranged to present the conditions of an ordinary room.

The use of hawk and trowel is first taught, and the scratch-coat is then applied. This is afterward taken off, and the walls are next covered by laying-off, and practice obtained in the use of darby and rod. After this, practice in browning is given on the hard and dry scratch-coat, and this is followed by considerable practice in finishing with sand mortar to prepare for hard finishing. Running and mitering simple cornices are taught last.

Plumbing.—The plumbing shop is equipped for about fifty pupils, each member having a gas furnace for melting solder, and a drawer holding a set of tools. Instruction is both practical and theoretical, lectures being given from 8:30 to 9:30 o'clock every Wednesday evening.

The manual work includes the use of tools; preparing wiping cloths; making soil; tinning soldering iron, brass, iron, lead, and tin; making solder; soldering seams; making cup-joint; over-cast joint, straight wiped-joint, flange joint, and branch joint; working sheet lead into bends, traps, service boxes, and safes; lining tanks, calking iron pipe joints, and bending with sand and kinking irons.

The lectures deal with the proper arrangement of drain, soil, and waste pipes, trapping and ventilating the same, supply pipes, boilers, tanks, fixtures, pumps, and also explain mistakes in plumbing.

House and Fresco Painting.—The Master Painters' Association, of Brooklyn, co-operates in the direction of the painting classes, and at the end of the term examinations are held and certificates granted, with their approval.

The equipment for the house painting class consists of screens containing doors, windows, and wainscoting; and, for the fresco workers, of booths, plastered on sides and ceiling, with varied forms of cove and cornice.

House Painting.—The house painting course includes both elementary and advanced classes; the former having practice in the preparation of surfaces, mixing paints, and plain painting on wood, brick, and plaster surfaces; and the latter in varnishing and hard wood polishing, polish white, gilding, lining, graining, and paper hanging.

Lectures are given on the harmony of colors, mixing of colors, proportion of oils and driers, and the various materials used in painting.

Sign Painting.—A special class in sign painting will be organized next year. The instruction will include preparation of surfaces, spacing, and plain lettering, followed by ornamental lettering in gold and colors, and painting on glass and metal.

Fresco Painting.—Instruction is given preparing walls and ceilings for calcimine, in lining, laying out work, making and applying pounce and stencil, and in putting on flat and shaded ornaments.

Advanced Fresco Painting.—Applicants are admitted only on approval of some member of the Master Painters' Association, or after giving satisfactory proof of proficiency in plain fresco painting.

Instruction is given by alternate practice in drawing and coloring designs in the Art Department, and in applying the same in fresco to the plastered wall.

Further information may be obtained upon application to F. B. Pratt, secretary, at the office of the institute, Ryerson Street, between De Kalb and Willoughby Avenues, Brooklyn, N. Y.

Free Libraries in Paris.

In a report addressed to the Prefect of the Seine with regard to the municipal and other free libraries in Paris and the suburbs, it is stated that they now number 64, and that they are attached to the different town halls and communal schools. The number of books given out to read last year was 1,886,642, and of these 690,105 were novels. The artisans, who use these libraries the most, and who prefer reading at their own homes, appear to be very scrupulous about returning the books given out, as the annual loss does not amount to one-half per cent, and when the books are not returned this is due to carelessness rather than fraud. The great preference shown for works of fiction induced the administration to instruct the librarians to bring their influence to bear on the frequenters of their libraries and get them to read more serious and instructive books, but the only result of this was to effect an immediate decrease in the number of readers. The attempt was, therefore, given up, the administration preferring that the public should read novels rather than not read at all.

To ascertain the amount of lime in Paris white or whiting, dissolve in dilute hydrochloric acid and precipitate the lime from ammoniacal solution (filtering first if necessary) with solution of ammonium oxalate.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM CYLINDER.—Charles F. Hinrichs and Joel C. Barker, Poplar Bluff, Mo. The cylinder, according to this invention, consists of a split tube or casing, with longitudinal and end flanges, with a groove or recess, and a lining or shell fitting in the casing, where it may be tightly clamped and held from turning, but which can be readily removed when worn out and another substituted in its place, without necessitating the reboring of the cylinder. It is designed in practice to furnish one new lining and an extra set of piston rings with each cylinder, so that a worn or damaged cylinder may be quickly repaired.

PACKING EXTRACTOR.—Addison Goodrich, Astoria, Oregon. This is a device for quickly and easily taking out the worn-out packings from stuffing boxes without removing or injuring the rod or stem. It consists of a screw-threaded bushing made in sections and adapted to be placed in the stuffing box, one section having tongues and the other having grooves, while there is an annular packing groove in its head and an annular inwardly projecting flange at its bottom for supporting the packing.

Railway Appliances.

SWITCH DEVICE FOR CARS.—James M. Pickell, Lake City, Fla. This is an attachment capable of ready application to the dash board of a street car, where it may be operated by either the hand or foot of the driver, or the operator of a cable or electric car, to move the frog of a switch without having to stop the car. A spring-actuated rod having a horizontal curved shoe at its lower end is held to slide in a casing, the rod terminating at its upper end in a crank, with means for guiding the rod vertically and laterally, whereby the shoe may be turned as desired, while it will when released return to its normal position, the oscillations of the car not interfering with its efficiency.

Mechanical Appliances.

GIN SAW GUARD.—Wiley S. Killingsworth, Laurens, S. C. Separate grooved guard fingers are mounted rigidly upon the cross bar of the frame-work below the saws, and extend up around their lower portion, covering the periphery of the saws between the gin ribs and the brush at the lower side of the saws to protect the hand and arm of the operator from being accidentally cut by the saws. The fingers are cheaply made of cast iron, and are applicable to all gins, one being applied to each individual saw.

HORSESHOE BLANKS.—John F. Robinson, Rockaway, N. J. This invention provides a machine for the forming of these blanks in series from a hot bar of iron or steel. It is a machine having two revoluble rolls on a housing frame, each roll having a series of horseshoe mould half sections on it, and adapted to mate in pairs, the bottom half section of each mould having sockets to form toe and heel calks on the blanks, with knife dies to sever the blanks. As the rolls are rotated toward each other the metal is forced into the moulds and crowded into the cavities, producing the calks, creases, and nail hole marks on each blank, which is cut off as it is formed.

SPOKE TENONS.—Jefferson M. Sherman, Brushton, N. Y. This invention covers an improvement in machines for turning tenons on wheel spokes, especially the spokes of carriage wheels. It consists of two aligning pairs of jaws connected by spring bars, one pair of jaws being adapted to hold a spoke and the opposite pair being hinged together and provided with a locking device, while also carrying a revoluble cutter head and suitable feed mechanism. The machine is of simple construction and easily operated and is designed to turn the tenons rapidly and accurately.

SPLIT SPINDLES.—Charles E. Soderberg, Worcester, Mass. Heretofore these spindles for weaving shuttles have been made by welding two strips of steel, the body and point previous to welding being rolled half round on each piece, the spindle being liable to overheating, causing waste, and the weld when not exact causing splitting of the spindle throughout. The invention provides an improved method of making the spindle from a single piece of stock, by first punching or otherwise forming a slot in the spindle blank, and then rolling or hammering the blank by suitable machinery to form the spindle body.

Miscellaneous.

SCALPING AND BOLTING FLOUR.—John Metherell, Murfreesborough, Tenn. This invention provides an improved apparatus for scalping, re-scalping, and bolting the flour from wheat or other grain after granulating, to render pure flour and perfect separation of the various stocks simultaneously. The machine has a plurality of bolting reels arranged one within the other and supported to revolve independently, whereby the reels may be moved at different speeds and in opposite directions, the mechanism for revolving adjacent reels in opposite directions being so arranged that the stock may be bolted from one reel upon a clear portion of the next outer reel, with other novel features. The machine is designed to effectively accomplish a classification of grades in succession, and keep its grades pure from beginning to finish.

GUN CARRIAGE BRAKE.—Adolf T. Resow, Essen, Germany. This is a self-acting brake for traveling gun carriages, the invention covering a mechanism whereby the brake blocks are brought automatically into and out of contact with the wheel tires of field and other guns, the movements of the carriage wheels being thereby controlled. A three-armed lever is mounted in a slidable bearing, one arm being connected with the brake block and another arm adapted to engage the hub of the wheel, while a lever mechanism tilts the third arm for adjusting a sliding block. The brakes are automatically applied as the carriage runs back after a discharge, and released when the gun is again to be brought into position.

AMALGAMATOR.—Thomas Shannon, Whitewood, South Dakota. This is an improved mercury amalgamator, in which the amalgamating vessel has a false bottom, with cross slats forming spaces for the quicksilver and amalgam. The bottom is removable, when it is desired to withdraw the amalgamated mercury and precious mineral, being held in place by retaining bars which extend above it and are secured by screws turned through the amalgamating vessel from the outside. The agitator or stirrer is supported to turn in the amalgamating vessel, and has arms above the mercury line to disintegrate the pulp rising through the mercury to separate its particles and insure the deposit of practically all the gold and silver.

TWO WHEELED VEHICLE.—John F. Barrows, Saginaw, Mich. This is a vehicle specially designed for carrying organs, upright pianos, sewing machines, furniture, etc., to permit of easily loading and unloading the articles, which are made to ride very easily. At the rear of the axle, between the wheels, is a frame with upright bars connected with the vehicle body, horizontal arms extending from the lower ends of the bars and connected by a board on which is held an adjustable cushioned arm to lock the article in place. By connecting the axle rigidly with the springs and the latter with the shafts, the jogging motion usual to ordinary road carts is overcome and the vehicle runs smoothly.

LAMP.—Charles H. Van Hise, New York City. This invention relates to oil-burning lamps for lighting streets, the lamp containing means for self-extinguishment at a predetermined time, these devices being also readily applied to portable lamps for use in the house. A sleeve and thimble envelop the wick tube, while a deflector plate and tube-inclosing device may be simultaneously moved toward or from each other by a mechanism provided, there being a hollow float in the oil chamber carrying a standard with a thumb piece and series of pins spaced to represent intervals of time. A rocking tripping bar, to one end of which a gravity block is loosely secured, is raised by the falling of the float throwing the extinguishing mechanism into closed adjustment.

ICE PICK, SHAVER AND SCOOP.—Frederick K. Kaiser, Wilmington, Del. In this combination implement the hand bar or blade is made with a pick point, behind which is held a scoop body formed with a cutting edge, there being a gauge plate at the pick blade next its point to control the depth of cut of the forward end of the scoop, which has a detachable cover with catch or latch devices. The implement may also be used for loosening and handling any caked or granulated substance.

STOVE DRUM AND DAMPER.—Thomas Power, Portland, North Dakota. This drum is in the shape of an inverted cone, and is preferably about the length of one joint of stove pipe, being placed in position on the stove by taking off the lower joint of pipe that bears against the stove collar and replacing it with the drum. In connection with the drum a tubular damper is provided, of the stove pipe section, by means of which the heat may be more or less confined for utilization in the drum for warming and cooking various articles of food, thereby adding to the cooking capacity of the stove, while the draught will be all the time under complete control.

SCRATCH OR MATTING BRUSH.—Stephen D. Engle, Hazleton, Pa. This is a revolving brush wheel for jewelers and engravers, with tufts of glass fiber or spun glass arranged at suitable distances apart around and secured within its hub. The ends of the tufts repeatedly strike the metal they are used on, and such a brush wheel is designed to always preserve sharp cutting ends on the glass fibers instead of blunting, while they will not corrode or become bent out of shape, to cause them to drag on the work and make scratches instead of pits. These brushes are designed to wear longer and act on harder surfaces than either the hinged or unhinged metallic bristles.

SKID FOR PILING BARRELS, ETC.—James C. Boyle, Omaha, Neb. This invention provides a sectionally constructed plank or series of skids, being fractional portions of a plank of novel construction, to facilitate the piling up of tierces, barrels, and other like packages in any number of tiers. The skids are each made of an upper board and a leg piece shaped to fit down in between each two adjacent barrels in the same tier, the leg piece tapering on its sides to hug closely the barrels and keep the top board at its proper height and level. In use a number of these skids are first arranged on the lower tier, and as the barrels are rolled to place, the skids are successively removed to be replaced on the barrels above for another tier.

CIGAR FILLER MACHINE.—Thomas Hancock and Lee B. Hancock, Richmond, Va. By this machine the tobacco is pressed into suitably shaped bunches, which are cut at proper lengths for the filler of the cigar and ready for the binder. On a suitable frame or table is journaled a revolving feed table with an annular pocket, and tobacco of proper lengths is laid on the supporting table, radially to the axis of the feed table; over a portion of the pocket projects a former or bunching housing of glass, or of metal with sight openings, there being at the discharge end a cutter operated by a gravity dog or pawl engaged by radial projections on the revolving table. The table is fed around in short intermittent movements, and the machine may also be used for making cigarettes, cheroots, etc.

CIGAR OR PIPE HOLDER.—James Skuce, Truesdell, Wis. This device has two tube sections connected at right angles with a lower parallel tube, forming a central drop tube between its mouth end and the outer end, the drop tube being so constructed as to arrest and condense the nicotine and other volatile matters, while the holder has a sufficiently long smoke passage to insure the cooling of the smoke before it reaches the mouth of the smoker. The parts may be readily taken apart for cleaning and easily put together. The outer end of the device is adapted to receive a cigar holder or the stem of a pipe.

BUNKER COVER FASTENER.—John S. Farlow, Philadelphia, Pa. Combined with a cover plate, in a nut mounted centrally in which a post is held to move perpendicularly, is a screw mechanism for moving the post, on opposite sides of which are pivoted levers having their outer ends arranged to extend beyond the edge of the cover plate while their inner ends are loosely secured to the post. The fastening may be used to secure any cover or hatch in place, but is more especially designed for the bunker covers and scupper hatches of sea-going vessels, so that they shall be water-tight, notwithstanding the wave concussions and shifting of coal in the bunker.

COVER.—Hasbrouck Alliger, Rondout, N. Y. This is a removable cover for condensed milk cans, cups, tumblers, etc., and is adapted to be moved laterally to open or close the receptacle. The device consists of a semicircular clip or band of spring metal adapted to be conveniently clasped about the glass or other vessel near its top, and having an upwardly extending eye on which the lid is pivotally connected to the band by a pin, there being a washer interposed between the eye of the clip and the lid, while the lid has a knob extension opposite its pivotal point for convenience in moving it to either side.

INCUBATOR.—George W. Murphy & Co., Quincy, Ill., are the patentees of an incubator which was described as follows in a previous issue: The invention provides a novel construction designed to facilitate the automatic regulation of the temperature of the incubator by means of a balance thermometer and other peculiar features, and whereby a constant and perfect circulation of water in the heating chamber is obtained. The body of the incubator is made impervious to moisture and cold, and the trays are so made that the heat will reach almost the whole surface of the eggs, the position of the latter being changed expeditiously and conveniently, without liability to breakage. The pans for the interior of the hatching chamber are designed to absorb any surplus of moisture, while also serving to direct the heat in currents to the trays.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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 the following week's 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.

(3341) W. S. asks (1) for an Aristo toning bath that the paper will not curl in. A. Try soaking in a mixture of alcohol and glycerine before developing. 2. A recipe for a good cheap chewing gum. A. Mix paraffin with a very little olive oil and glycerine by melting. Vary proportions to suit climate. 3. A recipe for making extract of lemon. A. Partially dry 4 ounces outside rind of lemons, pound in a mortar, agitate with 2 quarts deodorized alcohol until color is extracted, add 6 ounces recent oil of lemon, agitating and filtering after standing some days. 4. A receipt for extract of ginger? A. Pack 4 ounces ginger in a percolator, moisten with alcohol, percolate until 1½ pints have passed, add 8 ounces sirup. 5. A recipe for dissolving gold for photo purposes? A. Dissolve in hydrochloric acid to which nitric acid is added from time to time. After solution evaporate nearly to dryness and dissolve in water. 6. A recipe for making chocolate sirup that will keep for a long time. A. Mix 8 ounces chocolate with 2 pints water, stir, and warm over a slow fire. Strain, and add 4 pounds white sugar.

(3342) W. H. K. writes: There is a number of tables in different works which claim to give the degrees of heat at which different metals fuse; they differ very much in statement. Can you inform me by what means this is ascertained? Is there a special instrument made for the purpose? If so what is its name and where procured? A. Pyrometers of various construction have been applied to determining melting points of metals. The high degree determinations are not to be considered perfectly accurate. The instruments can be obtained from dealers in scientific apparatus. The determinations require a high degree of skill.

(3343) F. L. asks: 1. How can I produce a viscous or mucous fermentation of sugar? A. Procure the proper culture germ from a sample already in the mucous fermentation. Inoculate the sugar solution therewith. 2. Would the same process work with starch? A. This must be tried. It possibly may work, although a sugar is the proper basis for this ferment to work upon.

(3344) D. H. asks: Is there any known process by which eggs can be preserved and packed so they will keep fresh and good for weeks or months, at any season of the year? A. Eggs are now indefinitely preserved in a fresh state in cold storage room, where they can be kept at a low temperature, about 40° Fah. Egg packing liquid is made as follows: Lime 1 bushel (slaked with water), common salt 2 or 3 pounds, cream of tartar ½ pound, water q. s. to form a mixture

strong enough to float an egg. Used to preserve eggs, which it is said it will do for two years, by simply keeping them in it. But we have not tested the process.

(3345) A. W. writes: I want to make a frame with a strong cloth fastened around it, about 3 feet by 4 feet, so I can use it to sketch on with chalk, colored or black, and afterward wash it off clean with a sponge. Glass ground is liable to break, and a board that wide cannot be had here, and would be heavy. I have been using common cheap muslin, and getting it washed after, and using it over again. Cannot cloth (muslin) be prepared in some way as to be used for the above purpose like a blackboard, but white? A. You can prepare cloth like a blackboard by several coats of paint, rubbing down between times with ground pumice. As a final coat use white lead mixed with enough ground pumice to give a "tooth" to the cloth. Or you may use shellac varnish mixed with Chinese white and ground pumice as the final coat.

(3346) J. E. E.—Gutta percha is made to adhere and act as cement by means of heat. One of the most convenient ways of using it is to place a thin sheet of the percha between the surfaces to be joined, and then apply heat by means of a hot pressing iron, applied on the back of the leather until the heat strikes through and melts the percha. This is the mode used by tailors in cementing leather and cloth to cloth. Thin sheet percha is on the market for this purpose. Another method is to dissolve the gutta percha in bisulphide of carbon. Apply the solution to the surfaces to be joined. Let dry. Then place the coated surfaces together and apply heat as before described until the gutta percha is melted and the parts thereby cemented together.

(3347) L. H. W. asks: What can I get to wash over stone that is perishing, crumbling away, rubs off like sand? It is Ohio sandstone. Also what kind of cement can I get that will fasten on corners and slivers knocked off, so that they will stay and not attract attention? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 526, for illustrated account of the preserving process for the obelisk and discussion on preservation of stone, brick, etc.

Cement for sandstone:

Dry clean fine sand	20 parts.
Litharge	2 "
Pulverized lime	1 "

Mix with boiled linseed oil to a thick paste.

Plaster of Paris colored with any dry paints to a suitable color then quickly wet to a paste and applied makes a good cement where not exposed to the weather.

(3348) I. A. L. says: I see in the SCIENTIFIC AMERICAN, No. 8, August 22, that "oak timber loses about one-fifth of its weight in seasoning and about one-third its weight in becoming dry." Are drying and seasoning different things? Please explain. A. Lumber, when only seasoned or air-dried, is not free from moisture. There is a further loss of moisture and weight by thoroughly drying by heat.

(3349) J. S. L. says: I am running a light locomotive. Can I divide the lead of the valve while it is being run very slowly in this manner: Have the lead openings marked on the valve stem, then take a divider and mark the center of the distance between the two marks? Would the valve be made to cut off true if the eccentric rod was lengthened or shortened as the case may require, so that the valve will travel as far beyond the center mark one way as the other? A. Your method of finding an error in length of connecting rod is correct.

(3350) J. O. says: Will you let me know whether you can drive a pipe two inches in diameter for a well twenty feet deep with a sledge, and if you strike a stone, will you please let me know what to do? A. Yes, you can drive 20 feet with a sledge with a hickory block on the drive cap. Well pipes should be driven with a wooden maul or drop; hickory or locust is best. If stopped by a stone, pull up and start a little way off. A steel cap is good to strike on. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 107, on methods of driving well pipes.

(3351) G. J. L. asks: 1. How can I remove the size from one corner of a piece of paper without discoloration of the same? A. Wet the size with a soft sponge, and after it becomes thoroughly dissolved apply a piece of blotting paper to absorb it. Repeat the operation if necessary. 2. I have built an electric motor according to SUPPLEMENT, Nos. 161 and 599, but it does not work, and I am going to build a new armature. What size wire should I wind the armature with to make a motor to run a sewing machine? A. The motor, as described, should run a sewing machine with a current from four cells of a large plunging battery.

(3352) J. G. asks: 1. What should the dimensions of a boiler for a small engine (nearly 1 horse power) be for running the 8 light dynamo with incandescent lamps? Will No. 16 or 18 galvanized iron answer for this boiler? Should the dynamo be connected up in shunt or series? A. Your boiler should have 20 square feet of heating surface. For small boiler construction for amateurs see SCIENTIFIC AMERICAN SUPPLEMENT, No. 702, with illustrations and dimensions. Galvanized iron is not suitable for steam boilers. Not less than three-sixteenths iron should be used for a 1½ horse power boiler shell. Connect the dynamos in series, as shown in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600.

(3353) E. K. H. asks how to mend meerschaum, or how it can be glued. A. Caseine cement is recommended for this purpose. Boil fresh cheese in water until it is ropy. Dissolve it in water glass or solution of silicate of sodium, stir into it calcined magnesia and use at once. Use equal weights of cheese and water glass solution, and as much magnesia as will mix with it.

(3354) W. S. writes: I have been copper plating the ends of carbon plates for bichromate battery and have washed them well with clean water, but after a short time sulphate of copper has formed on them and broken the soldered connections. What is the cause and prevention of this? A. To prevent the battery solution from acting upon the copper film deposited on the carbon, you will need to paraffine the end of the carbon, that is to say, you should heat the carbon and rub on paraffine until the extreme end of the carbon is saturated. You can electroplate on this and solder your connections to the electroplated surface.

(3355) F. E. C. asks with what to coat stoneware jars where glazing is defective, to render them airtight for preserving purposes. A. Heat the jars to a temperature of boiling water, or a little hotter if possible, and rub paraffin all over the unglazed spots until they have absorbed as much as possible. It is tasteless and harmless, and may be put on inside and outside of the jars to make sure of the jars being airtight.

(3356) R. C. B. asks how to make the best kind of a battery for an electric bell. A. There is nothing better for an open circuit electric bell than the Leclanche battery. You will find this described in SUPPLEMENT, No. 159, also in "Experimental Science."

(3357) W. E. F. asks how to clean and brighten small brass work to be lacquered. Have tried different mixtures of acids, but do not get good results. The acid will either not clean or the work will tarnish (turn black) immediately on taking from the running water. A. The brass must be thoroughly cleaned from grease or dirt before dipping, by boiling in strong caustic soda water; wash in hot water, then dip. We do not know of a better mixture than equal parts of nitric and sulphuric acids, with half a part of muriatic. Dip but a few seconds and immediately plunge the brass in boiling hot water and dry quickly. Cold water will not clear the acid from the porous metal. We recommend to you Butt's "Tinman's Manual," $1.25 mailed, which has a variety of receipts for dipping metals.

(3358) T. J. asks for recipes for some cheap wash that will protect a wall plastered with common mortar against the effect of rain and consequently from frost. How will skim milk with lime or cement do? How about the solutions of oxide of zinc and chloride of zinc? Would a wash with Portland cement be sufficient? A. Whitewash used on United States public works: ½ bushel best lime slaked with boiling water, 1 peck salt dissolved in warm water, 3 pounds ground rice boiled to a thin paste, ½ pound ground whiting, and 1 pound clear glue dissolved in warm water. Mix all together, add hot water for proper use, and let stand for several days. Then heat and apply with large brushes. Chloride and oxide of zinc are good but expensive. Portland cement makes a fair brown wash. Skim milk may be used with cement and zinc oxides.

(3359) W. J. U. says: I contemplate building, for a shallow crooked river, a steamboat 65 feet long by 16 feet beam, maximum draught when loaded 2 feet (current 2½ miles per hour); have been advised to put in a single engine to operate four 2 feet propeller wheels by bevel friction, each wheel to be reversed or stopped with engine always going one way. Do you think this will be as good a plan as the ordinary double engine and stern wheel of the river boats? If so, what power should be used to make a speed of 12 miles per hour? A. We do not advise the four small screws for your boat. They are difficult to connect properly, and bevel friction is not suitable or reliable for operating propeller screws, and gearing is too noisy. You will need at least 35 horse power. We recommend a stern wheel with two engines. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 396, 217, for illustrations of stern wheel steamers.

(3360) J. H. L. asks: Is it the best to shut up all doors and windows or let as much air get in as possible during electric storms? A. We think the better plan is to close all doors and windows, as a column of warm air issuing from the house would facilitate the passage of the electric discharge.

(3361) W. A. A.—The insect is the common mole cricket, *Gryllotalpa borealis*.

(3362) E. W.—Nigrosine is a coal tar color prepared from the hydrochloride of violaniline. This product is variously modified in the process of manufacture several shades, varying from blue through bluish gray to gray, violet to black, this last being called nigrosine, are produced. Other names for the various other shades are violaniline, elberfeld blue, bengaline, aniline gray, Conner's blue, etc.

(3363) J. C. M.—See SCIENTIFIC AMERICAN SUPPLEMENT, No. 51, on the manufacture of zinc white; carbonate of baryta is used to adulterate both zinc white and white lead. Chemical analysis is the only sure test.

(3364) G. H., Jr., asks: 1. Why is the rising moon red? A. Because of the absorption of the more refrangible rays of light by the great distance that the moon's rays pass through the atmosphere at rising or setting, aided by the hygrometric condition of the air, the water in the atmosphere probably being the most active agent of absorption. The midday sun looks red as seen from a considerable depth in water. Divers notice this peculiarity. 2. Where is the largest marble cutting establishment in the world? The largest marble works are near Rutland, Vermont. 3. I have a copper bath tub which is coated with tin or zinc. This bright coating has worn off in places and the copper turned black. Is there any way in which I can recoat these injured places? A. You can do nothing better than to keep the bath tub clean by polishing with sapolio, or with oxalic acid. You cannot retin the bare spots.

(3365) J. F. M. asks: What is the inclosed powder? It is used in the porous cup of a battery. A. The powder is principally or entirely potassium nitrate, common saltpeter. In the porous cup mixed with dilute sulphuric acid it supplies free nitric acid as a depolarizer.

(3366) W. W. B. asks: 1. What chemicals and in what proportion, added to water, will extinguish fire? A. Most alkaline salts dissolved in sufficient quantity in water act as extinguishers. Sulphate of sodium is excellent. Bicarbonate of ammonium is good, as yielding a certain amount of carbonic acid gas. 2. How can a photographic plate be developed a positive? A. This has not been done except experimentally. No practically successful process is known. Several investigators are now working on the problem. 3. Explain E.M.F., which so often appears in these columns. A. Electromotive force, or the difference of potential which is the cause of a current of electricity. It is produced by batteries and dynamos in general practice.

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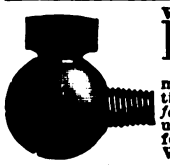

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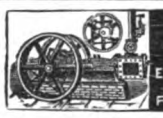

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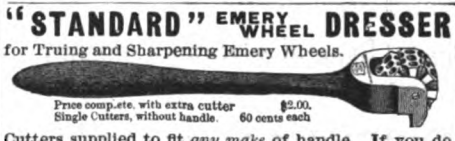

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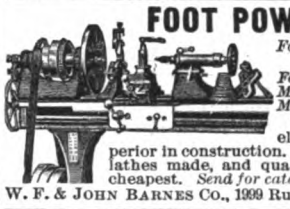

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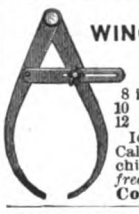

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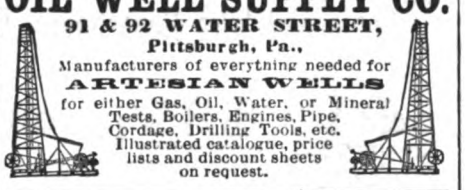

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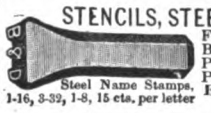

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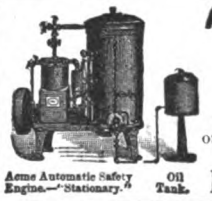

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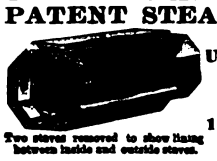

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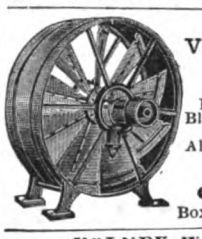

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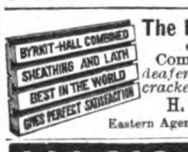

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FIG. 3.

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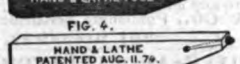

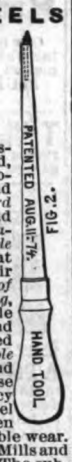

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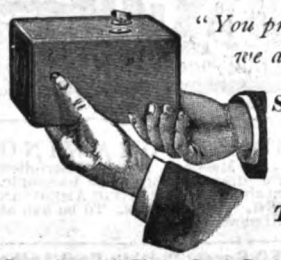

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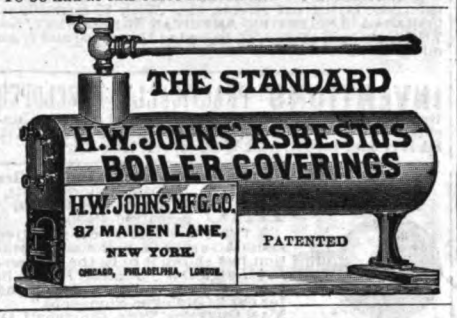

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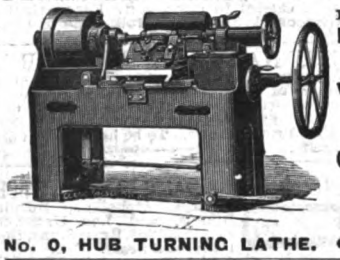

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