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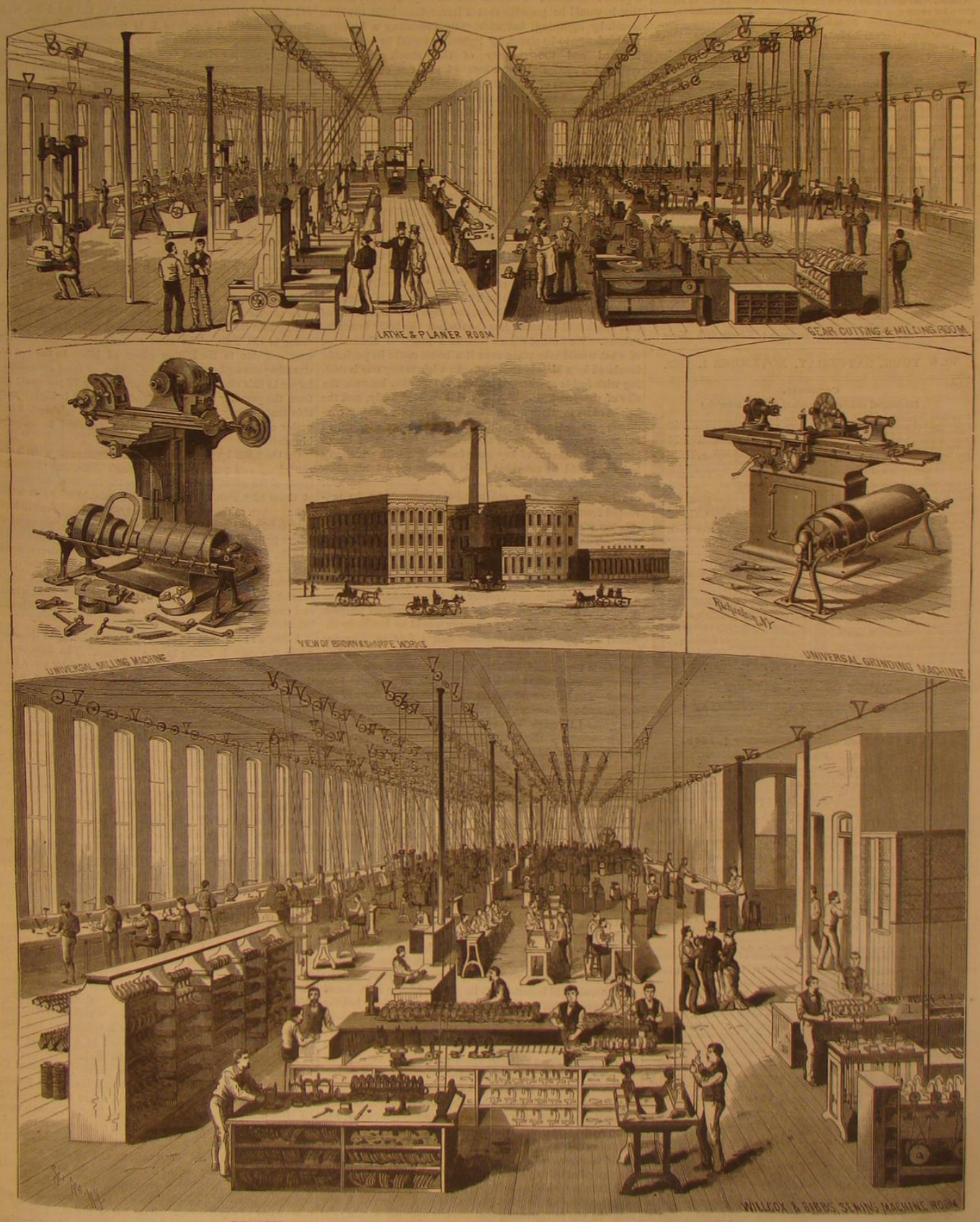

BROWN & SHARPE MANUFACTURING COMPANY'S SHOPS.—[See page 273.]

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VOL. XLI., No. 18. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, NOVEMBER 1, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 200,

For the Week ending November 1, 1879.

Price 10 cents. For sale by all newsdealers.

PROTECTION FROM LIGHTNING.

We learn that a lightning rod company in Cincinnati has patented a system of lightning protection which consists of an iron rod running along the ridge of the building, with points at each end projecting upward. It is supported upon large glass insulators, and has no electrical connection with the building and no rod running to the ground. It is said that there are many public buildings in Iowa which have been provided with this system of lightning rods. We also perceive in the September number of the College Quarterly, a journal issued by the Iowa Agricultural College, in the interest of industrial progress, an inquiry addressed to Professor Macomber of that college in regard to the possibility of protecting a building from lightning by insulating it with a glass foundation. Professor Macomber in his reply admits that it would be possible that a house thus built could be struck by lightning; but adds, "By insulating a building the tendency to be struck by lightning would be very much lessened and the severity of the shock much decreased. Practical illustrations of this can easily be obtained by means of an electrical machine. A spark can be made to pass from the machine to an insulated body, although the force of the shock will be much less than when not insulated." After further illustration, Professor Macomber concludes thus: "Practically it would be almost impossible to insulate a building because after rain commenced to fall it would wet it so that communication with the earth would be established." The belief is quite common that by providing a chair or a bed with glass blocks upon which it rests, safety from lightning is secured, and the lightning company of Cincinnati and the inquirer in the College Quarterly both have the belief in mind. Professor Macomber is evidently not a believer; but we are nevertheless tempted to criticise the tender manner with which he treats this belief, and his use of the word "practical." In his illustration he causes a spark to pass from an electrical machine to an insulated body, and says that the shock of this spark will be much less than when the body is not insulated. We cannot regard this as a practical illustration of what would take place even if a house could be perfectly insulated by a glass foundation. In a laboratory one is dealing with feeble sparks. Moreover the relation between the size of the spark, the size of the insulated body, and the height of its insulation from the earth or neighboring conducting masses is entirely different from the relation which exists between the size of thunderbolts, the size of buildings, and the height of any glass foundation with which any building could be provided. We cannot regard his illustration in any sense a practical one. A thunderbolt which can leap to a house or other building would not be prevented from working its effect upon the building by any insulation which human means could provide its foundation with. The spark would strike the house and then pass by another leap the comparatively insensible interval which separates the house, provided with a glass foundation, from the ground. It is true that the spark would be divided into a spark to the house and another to the ground, through or around the glass foundation; but for the practical purpose of demolishing the house, its energy would be but little impaired Suppose that a metallic ball a foot in diameter should be hung up by a rubber cord just an eighth of an inch from the ground, and we should cause a spark twenty feet or more in length to leap to the ball, what would take place? The ball would receive almost the entire force of the shock, and the discharge would find its way, so to speak, to the ground through the space of one eighth of an inch which separates the ball from the ground. It does not matter whether this space is filled with air or glass or any insulating medium now known.

This relative magnitude between the discharge and the object struck is apparently not considered by the "Chambers National Lightning Protection Company" of Cincinnati. It is needless to say that their system is impracticable and entirely untrustworthy, for the reasons that we have given above.

For the same reasons the glass insulators with which most lighting rods are provided are useless. If there is a path of least resistance from the lightning rod to the ground through the house the discharge will take this path without regard to the glass insulators. The ordinary lightning arrester in telegraph offices is an illustration of this. the discharge leaps across the short air interval provided between the telegraph wire and an earth connection, this air interval could be replaced by a plate of glass and the spark would still leap through it. All lightning rods should be connected with the system of gas pipes and steam heating apparatus, furnaces, or large masses of metal about a house, and then carefully grounded in moist earth. The best ground can be obtained by connecting the lightning rod with the water pipes if there are such about the house.

FREEZING IN FIRE.

A few days since, while observing the action of his new absorption refrigerating machine at Ruppert's brewery, 92d street and 3d avenue, Mr. T. L. Rankine casually placed a lighted candle against the expansion pipe leading from the liquid receiver. His intention was to melt the frost from the pipe; but to his surprise the effect was quite the opposite, frost forming within the flame much more rapidly than on other portions of the pipe. He afterward observed in the cellar he was refrigerating that directly over the burning gas jets the frost on the pipes along the ceiling was whiter and more abundant than elsewhere.

To those unfamiliar with the fact that the vapor of water is always a necessary product of combustion, the production of frost in an atmosphere of fire seems to be not merely wonderful but magical. And we confess that perfect familiarity with the chemistry of combustion did not greatly mitigate our surprise on witnessing the phenomenon. Of course the principle is the same as in the familiar experiment of freezing water by the rapid vaporizing of sulphuric ether or other volatile liquid in the presence of high heat; but in this case refrigeration is from within, and one sees only the flame surrounding an iron pipe, on which the nascent water vapor is immediately transformed into white frost. It is worthy of remark that the frost is whitest where the flame is hottest, for there the vapor is formed and the combustion is freest from smoke. Incidentally the phenomenon gives evidence of the intense cold generated by the machine, which is as compact and simple as it is powerful. It will be remembered that Mr. Rankine is the gentleman who constructed the large skating rink at Gilmore's Garden last winter, maintaining for some weeks the largest sheet of artificial ice ever known.

EFFECTS OF HEAT IN THE COMSTOCK MINES.

In an interesting paper read at the Pittsburg meeting of the American Institute of Mining Engineers, Mr. John A. Church reviewed at considerable length the accidents in the Comstock mines and their relation to deep mining. During the twenty-two months preceding May, 1879, there were 101 accidents, killing outright 53 persons and wounding 70 others. The accidents were classifiable under the eight following heads: 1. Falls of rock, timber, etc.; 2. Tramming; 3. Effects of heat; 4. Falls of men; 5. Explosions, 6. Hoisting apparatus; 7. Overwinding; 8. Miscellaneous. Most of these causes of danger and loss of life are common to all mining operations; the third class includes accidents peculiar to the Comstock mines.

In several instances miners have been fatally scalded by falling into the hot mine waters, which exhibit temperatures rising to 158° Fah. The most remarkable casualties, however, are due to the killing effect of labor in the hot and steaming atmosphere. The proportion of fatal casualties is larger in this class than in any other, being 73 per cent; and from the peculiar mental effects of the heat it is highly probable that it may be the real cause of many mishaps, which under other circumstances would be ascribed to culpable blundering.

On the 1,900 level of the Gould & Curry mine a drift was run along and quite near to the black dike, one of the hot spots of the mine. At a spot where the thermometer marked at times 128° Fah., Thomas Brown fainted while at work. When taken to the surface and revived he was found to have completely lost his memory. He could not tell his name or where he lived, and had to be dressed and taken home by his friends. The newspaper which recorded the occurrence said that such sudden loss of memory from overheating was quite common in the mines; and suggested that the fact might furnish an explanation of the walking off into fatal winzes and chutes by experienced miners, seemingly with deliberate intention.

A frequent accident in these mines is fainting in the shaft while the cage is rising to the surface. The faintness is always felt immediately upon reaching the cooler air, a hundred or a hundred and fifty feet from the surface, where there is usually a side draught through some adit. This happens so often that a man who has been working in a hot drift is never allowed to go up alone. Long habitude to the heat is no safeguard against this danger, and serious accidents have occurred in this way.

Among minor casualties, Mr. Church mentions one which happened to Mr. Sutro, in the Sutro Tunnel, before it made a connection with the Savage mine. After spending some time in an air temperature of 110° Fah., Mr. Sutro went to the air pipe to cool off. He stayed so long that the miners told him to get way from the pipe and let them have air. He did not move, and when they tried to stir him up with the handles of their shovels they found him unable to move. He had lost all volition, and had to be taken out on a car.

The graver results of overheating include insanity and death. The death of a carman on the 1,400 level of the Caledonia mine, Gold Hill, March 11, 1878, is a case in point. He had been idle for six months, and that morning he was working his first shift. At an early hour he rushed into the station of the 1,400 level and reported that the wheels of his car were smashed. The station master returned with him to his car and found it all right. There was evidently something wrong with the man, and he was taken to a cooling place. Here decided mental aberration was discovered, and the man, firmly lashed to the cage, was hoisted to the surface, where he fainted at once and died in a few minutes. In this case the heat was only about 90° Fah.

In another case a miner died from cramps, attributed to heat, but which may have been due to drinking ice water; and another death is charged to a cold taken while cooling off after being partially overcome with heat. Though contrary to the rules of outside hygiene, the miners resort to copious draughts of ice water or to exposure to strong cold air currents for recovery from overheating, and usually with impunity. The cold air cooling is considered the safer method; but to gain time Mr. Church commonly chose the ice water, and never felt any ill effects from it. With several thousand cases a day of rapid cooling off by one or the other of these methods it is surprising that fatal consequences have been so infrequent.

The next case illustrates the violent effects which excessive heat may have upon a person not accustomed to it: "On Friday, October 11th, 1878, John McCauley went to work for the first time in the Imperial Mine. He was cautioned against over-exerting himself in the extreme heat of the lower levels. He replied that he thought he was strong enough to stand anything and paid no attention to the advice. At half past two in the afternoon he was brought to the surface in an unconscious state, and died the next morning at half past ten o'clock."

Two other cases very similar to this have occurred in the Imperial within a few years. This mine is excavated in one of the hot spots of the Comstock.

The hot drift on the 1,900 level of the Gould and Curry is the scene of the most serious of these casualties due to heat. Five men were sent there in June, 1878, to load a donkey pump on a car. The work was so exhausting that when the pump caught on a plank they were not able to move it. They seem to have been in a state of mental confusion, but felt that they could not remain longer. Starting up a winze which connects with the 1,700 level one man fell on the way, and the others were afraid to stop to help him, but pressed on, reaching the 1,700 level in half an hour from the time they left it. They were very confused and nearly speechless, and hardly realized what had occurred. Three men went down to the rescue and found the fallen man still alive. Clearing the pump they got into the car and signaled to hoist, but on the way up the winze the man they had gone to rescue reeled and fell off. The car was stopped at once, but he was jammed between it and the brattice so fast that the others left him and went for help. They all gave out, two half way up, and the other just as he reached the 1,700 level, where a friendly hand pulled him up. A new rescue party went down and found two men dead, and the third died soon after. The shift boss reports that "the accident was due solely to the heat, as the air is good enough and pure enough, barring the heat." The winze was not an abandoned one, but in daily use. A heavy volume of steam is reported to rise through it from the 1,900 level, the temperature of which, at the time of this accident, is given at 128° Fah. Mr. Church gathers from the detailed account that the death of the men is possibly attributable to the fact that when the miner fell off the car the latter was stopped in a place that was hotter than the rest of the winze.

It is to be regretted that no adequate studies have been made upon the precise physiological phenomena presented by death under these circumstances. The legal requirements are satisfied when it is proved that the casualties are due to heat.

PUSHING AN IRON BRIDGE ACROSS A RIVER.

A notable feat in engineering was brought to successful issue in the latter part of September, at Dinard, in the department of Ille and Vilaine, France. In carrying a railway across the river Rance, the novel plan was adopted of building the bridge on shore and boldly pushing it bodily across the stream. The bridge weighed 2,600,000 pounds; its height above the river was 100 feet, and the length of the main span 314 feet. Twelve windlasses were used in rolling the bridge into position. It was calculated that four or five days would suffice for the work of putting the bridge in place, but owing to the breakage of chains, it took two weeks.

Our correspondent, Mr. Geo. Quincy Thorndike, who furnishes these details, also favors us with a photograph of the bridge, taken just before the end touched the west bank. For two hundred and fifty feet or so, the western end of the bridge is comparatively light in structure, so that only about fifty feet of the main span projected over the river before connection was made with the further side.

We do not recall any previous instance of the pushing of a long and heavy bridge into position in this manner. The nearest approach to it—and quite as notable as a specimen of engineering skill—is the splendid bridge of the Cincinnati Southern Railway across the Kentucky river, a full description of which, with several illustrations of the structure at different stages of construction, appeared in the SCIENTIFIC AMERICAN SUPPLEMENT for October 27, 1877. In the latter case the chasm to be crossed was 1,138 feet wide, with almost vertical walls of limestone from 280 feet high. The bridge was made of three spans of 375 feet each, resting on the bluffs and on two iron piers supported by stone piers. During erection the truss was a continuous girder, 1,125 feet long, of the Whipple type, but after erection it was converted into one continuous girder, 525 feet long, projecting at each end 75 feet over its points of support, and carrying from each of these cantilevers a 300 foot span, bridging the distance from the cantilever to the bluff.

Taking advantage of two towers and two sets of anchorage, which had been constructed at the point of crossing for a wire suspension bridge, and abandoned, the engineer in charge, Mr C. Shaler Smith, bolted to the towers the first panel of the bridge on each side, and then pushed forward the construction of the bridge by corbeling out panel by panel. The towers were calculated to be strong enough to carry 196 feet of projecting spans, and at that distance temporary towers of wood were built to furnish an intermediate support. The corbeling process was then continued until the shore spans each reached the main iron piers, which were built up simultaneously, so that the projecting bridge and piers met in mid-air. Each half of the center span was then corbeled out as before until they met in the center, where they were joined.

This is regarded as not only one of the boldest and most original pieces of bridge engineering in America, but one of the best in the world when judged by the crucial test of accomplishing a great work at the least possible cost. How the French bridge will compare in the latter respect cannot be told without more detailed information.

THE ELEVATED RAILWAY EXTENSION.—DETAILS OF CONSTRUCTION.

The constructors of the iron work of the Second Avenue Metropolitan Elevated Road and the extension of the west side line to Harlem, Messrs. Clarke, Reeves & Co., furnish the following figures, supplementing those given in our description of that work last week. It is proper to add that we are indebted to the same gentlemen for the photograph from which the large engraving of the 110th street curve was made.

The new structure on the east side has a length of seven and thirty-six hundredths miles, and required 28,000 tons of iron. The west side extension, from 83d street to Harlem river, four miles in length, required 16,200 tons of iron. In the 44,200 tons of iron used in building the two sections of the road, there are 971 miles of angles, 314 miles of flat bars, 20 miles of Phœnix columns, 2 acres of plates, 5¼ million rivets, and 21 million punched holes. The preparatory work was done at the Phœnixville rolling mills and shops, the average day's work being 3 miles of angles and 1¼ miles of flat bars, at the mills; and 66,600 holes punched and 17,430 rivets driven, at the shops.

The high viaduct shown in our engravings is 4,000 feet long, with an average height of 45 feet. At 8th avenue and 110th street the road is 59 feet above the pavement, and the foundation extends 36 feet below the pavement, making the total height of the structure 95 feet. The foundations are from 30 to 40 feet deep, and cost $200,000 a mile. Each pair of high piers contains as many bricks as a house 20 by 50 feet and three stories high.

If the grades had followed the streets a maximum grade of 170 feet to the mile would have been required. Now the maximum grade is 75 feet. The foundations and general design and arrangement of the iron work were planned by John Baird, General Manager, and W. F. Shunk, Chief Engineer of the Metropolitan Elevated Railway Company. The special design and construction of the iron work was by Clarke, Reeves & Co., of Phœnixville, Pa.

AMERICAN INDUSTRIES.—No. 21.

THE BROWN & SHARPE MANUFACTURING COMPANY.

For accuracy of workmanship, order, cleanliness, and completeness, no establishment is more justly noted than that represented in our leading illustration this week, and the work turned out at this shop is recognized everywhere as being as near perfection as it is possible to make it. Only accurate tools, skilled workmen, and good materials, supplemented, of course, by capital and experience, can produce these results, and these are found in the works of the Brown & Sharpe Manufacturing Company, of Providence, R. I.

The business of the company was begun in 1833 by David Brown and his son, Joseph R., and has been conducted under the style of David Brown & Son, Joseph R. Brown, J. R. Brown & Sharpe, and is now managed under the style of the Brown & Sharpe Manufacturing Company. From the first its aim has been to develop mechanical perfection by producing machinery of superior design and finish, and to furnish tools of such quality to the users as would enable them also to carry a just system practically into their work.

In 1866 the rule and gauge making branch of J. R. Brown & Sharpe's business combined with Samuel Darling, adding the business formerly known as Darling & Schwartz, of Bangor, Maine. The new firm adopted the style of Darling, Brown & Sharpe, and have since carried on the manufacture of U. S. standard rules, Ames' universal squares, patent hardened cast steel try squares, the American standard wire gauge, bevel protractors, hardened T squares and bevels, and a great variety of steel and boxwood rules and scales, and other small tools for machinists, draughtsmen, and wood-workmen's use. Darling, Brown & Sharpe occupy premises in the new factory of the Brown & Sharpe Manufacturing Company, and partake of the same high character in respect to the superiority of their productions.

The building occupied by this company in Providence, R. I., is architecturally handsome, and its plan admirably provides for light, ventilation, and security. It is not only adapted in its particular appointments and on account of its size, the area of floors equaling 60,000 feet, to their purpose as manufacturers, but it is fireproof and every way calculated to preserve the patterns and machines, the drawings and plans that years of study and labor have perfected.

The machines made by this company are so well known that they need no special description. We have represented two of the more important ones in our engraving, the one on the right being the universal milling machine, the producer of tools, a machine that is indispensable in any well equipped shop; that on the left is the universal grinding machine, designed for doing a large variety of work by the use of solid emery and corundum wheels. It is especially adapted for grinding soft or hardened spindles, arbors, cutters, either straight or angular, reamers, and standards, also for grinding out straight and tapered holes, standard rings, hardened boxes, jewelers' rolls, and other work.

Besides these machines this company make surface grinding machines, small milling machines, screw machinery, gear cutting attachments for milling machines, index plates for gear cutting machines. In addition to this they make a lathe which is not designed to compete with other lathes in the matter of price, but to supply a want felt by those who require a lathe that is as near absolute perfection as the most skilled workmen can make it. Besides this they are the makers of the Willcox & Gibbs sewing machines, and have filled the orders of that company for nearly 300,000, complete for market. This sewing machine among experts bears the reputation of being among the finest pieces of well executed mechanical work. They are the inventors of machinery as well as the users of it, by which the most mathematically correct instruments that are furnished to draughtsmen and others are manufactured.

Their weighing scales turn upon the accession of the thousandth part of a pound. Their sheet metal gauge determines thickness to the thousandth part of an inch. From tiny and light instruments to the universal milling machine with gear cutting attachment, their great factory produces in mathematical correctness of detail the tools that are in constant use in the different manufacturing establishments throughout the country.

Our engraving shows in the central figure the exterior of the buildings of the Brown & Sharpe Manufacturing Company, and the two upper figures show the lathe and planer room, and the gear cutting and milling room. The lower and larger view represents the department devoted to the manufacture of the Willcox & Gibbs sewing machine. These views serve to give an idea of a part of the works only; it would require a volume to illustrate and describe in detail the various departments of this establishment. There is of course a similarity between machine shops the world over; but in the matter of system and cleanliness we do not know of an establishment that excels this.

From storerooms situated upon the respective floors small tools are furnished for especial use to workmen, who deposit checks therefor, to be redeemed upon the return of the article taken. There is a library of interesting and valuable books free to all employes, and it is prized by them, as is made evident by their constant use of it. Every man employed, in an apartment for the purpose, finds accommodation for clothing and even dinner pail, if he brings one, under a registered number. Each man of all the large force has his appointed place for washing after work, even the soap that he uses not being interfered with by any one else. A little river of clear rinsing water flows through the center of the best devised washing accommodation for hundreds of men we have ever seen inside a building. One may judge what class of mechanics are at work in an establishment so ordered, and what may be expected from their hands.

The Egyptian Obelisk for New York.

Lieutenant Commander Gorringe, U.S.N., and his assistant, Lieutenant Schroeder, have sailed for Liverpool, on their way to Egypt, to superintend the removal and shipment of the Cleopatra Needle presented by the late Khedive to this city. The machinery to be used in handling the monolith has been prepared at the Roebling Works, Trenton, under the direction of Mr. Gorringe. The *World* says that this machinery will aggregate about eighty tons in weight. It consists of two towers, each 26 feet in height (which are to be shipped in sections and put together after their arrival in Alexandria), two steel castings, each weighing over six tons, and a cradle 60 feet in length. The towers correspond to the sides of a gun carriage, and the castings to the trunnions on a gun. Like the machinery for handling the monster gun of the colossal Italian ironclad Duilio, this machinery for moving the Alexandrian obelisk will command the critical attention of machinists and engineers; and it is satisfactory to know that the work of transferring to the New World this great Egyptian monument will be carried out entirely under American auspices.

The method of embarking the obelisk is described as follows: A steam collier having a water ballast compartment will be secured alongside of the pier, and the necessary preparations made for heaving her down to careening lighters placed alongside on the side opposite to the pier. The water ballast compartment will be filled. A port having been opened to admit the obelisk into the fore-hold, it will be launched in. The listing of the steamer from taking its weight will be overcome by heaving down on the careening lighters, and the sinking due to both operations will be counteracted by pumping out the water ballast compartment, thus removing a weight of water corresponding to that of the obelisk. Tidal and wind-drift differences of level will be overcome by means of a float secured at the shore end after the fashion of a ferry slip.

An Extensive Beard.

The Detroit *Post and Tribune* has been interviewing the possessor of the longest beard on record, Mr. Edwin Smith, of Fairfield, near Adrian, Mich. The beard measures 7 feet 6½ inches. Mr. Smith is a farmer, forty-seven years old, 6 feet high, and weighs only 145 pounds; hair and beard sandy and tinged with gray. His twin brother, less bearded, is stouter and enjoys much better health. No unusual growth of hair is noticeable in any other member of the family. Mr. Smith had a fuzzy face in childhood, began to shave at the age of thirteen, but stopped shaving eighteen years ago. His hair is thick and strong, and has to be cut fortnightly.

Experimental Ballooning.

We learn from our London contemporaries that ballooning will henceforth form a part of the art of war, for, by order of the War Office, a balloon equipment has been placed in the Royal Arsenal, Woolwich. Two balloons for experimental purposes, and a portable furnace for the manufacture of hydrogen gas, are in commission; and a party of men and officers of the Royal Engineers have been instructed in aerostatics, and in the preparation of network and other appliances required in actual service. The balloons and all the appurtenances have been made within the arsenal, so that ample supplies can be produced as required in working out the important aeronautical question. That balloons may be employed with great advantage in war has already been demonstrated. To look down into an enemy's camp, or to spy out his movements behind a ridge or in the rear of a wood, may tend to the defeat of his plans and the shortening of a campaign; and this may be done by means of a captive balloon. But very much more might be done if a free balloon could be made to sail in any direction; this is the problem which the Royal Engineers and the Aeronautical Society have now to work out, and it is hoped they may be successful in solving it.

THE BLAKE TRANSMITTER.

The Blake telephonic transmitter, now so largely used in connection with the Bell telephone, is in some respects quite similar to Mr. Edison's transmitter, figured in our pages a few weeks since, and both are, in principle, like a comparatively old invention of Mr. Edison's, which he calls the inertia telephone.

This transmitter is in extensive use and is very efficient, notwithstanding its apparent clumsiness. There is, in fact, nothing delicate or fine about its construction. Those at present in use are securely inclosed in boxes which shield them from the eyes of the curious, nothing being exposed save a small portion of the diaphragm, which is seen through a ½ inch hole in the mouthpiece formed in the cover.

The transmitter is generally attached in a vertical position to a board, which also supports the switches and other accessories. To the hinged cover of the box is secured the annular cast iron frame, A, in which is placed a 3 inch circular diaphragm, B, made of common Russia iron of medium thickness, bound around the edges by a soft rubber band, stretched over it so that it covers about a quarter of an inch of its edge. The diaphragm is held in place by a small clip just touching the rubber binding upon one edge, and by a steel spring upon the other edge, which is rubber tipped and touches the diaphragm about ¾ inch from the center with a pressure of several ounces. Short arms are cast on the ring, A, one at the bottom, the other at the top, and to the upper arm is attached a spring, which is riveted to the casting, C. This casting supports two delicate springs, D E (watch springs). The spring, D, has an insulated support, and is connected by a wire with the upper hinge of the box cover, the hinge being connected with the binding post, *d*, at the top of the box.

The free end of the spring, D, rests against the diaphragm, and is provided with a convex platinum button, which is pressed by a carbon button inserted in a piece of brass weighing two or three pennyweights and fastened to the free end of the spring, E.

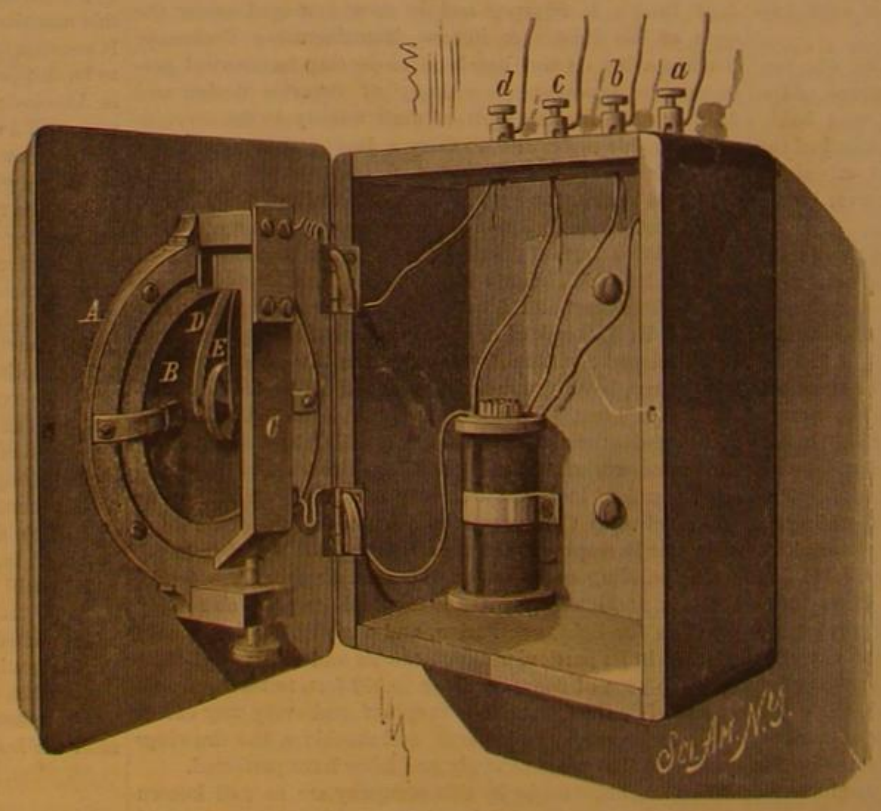
The spring, E, is in metallic contact with the casting, C, and the latter is in electrical communication with the frame, A, which is connected by a wire with the lower hinge of the box, and the hinge is connected with the bending post, *c*, by a wire that includes the primary wire of the small induction coil, seen in the corner of the box. The secondary wires of the induction coil are connected with the binding posts, *a b*.

The inclined surface of the lower end of the casting is engaged by an adjusting screw which passes through the lower arm of the frame, A. By turning this screw one way or the other the springs, D E, are made to press with more or less force upon the diaphragm, and the contact between the platinum button and the carbon is varied.

The binding posts, *c d*, are connected with a battery. The binding posts, *a b*, are connected with a telephone line, including the receiving telephones, usually of the Bell form.

The primary current passes through the springs, D E, and the primary wire of the induction coil. The vibrations of the diaphragm vary the contact between the platinum button and the carbon, and produce a variation in the current, which induces a corresponding current in the secondary wire of the induction coil and in the line including the telephones. A single cell of Leclanché or Fuller battery is sufficient to work this transmitter. It will be noticed that while the spring, D, is in contact with the diaphragm the latter is insulated from everything else by the rubber binding and the rubber tip of the spring.

The box hinges are provided with springs soldered to one half, and pressing upon the other half to insure a good electrical contact. A closed circuit bell is extensively employed in connection with this transmitter for calling attention. Magneto bells are generally used on isolated lines.

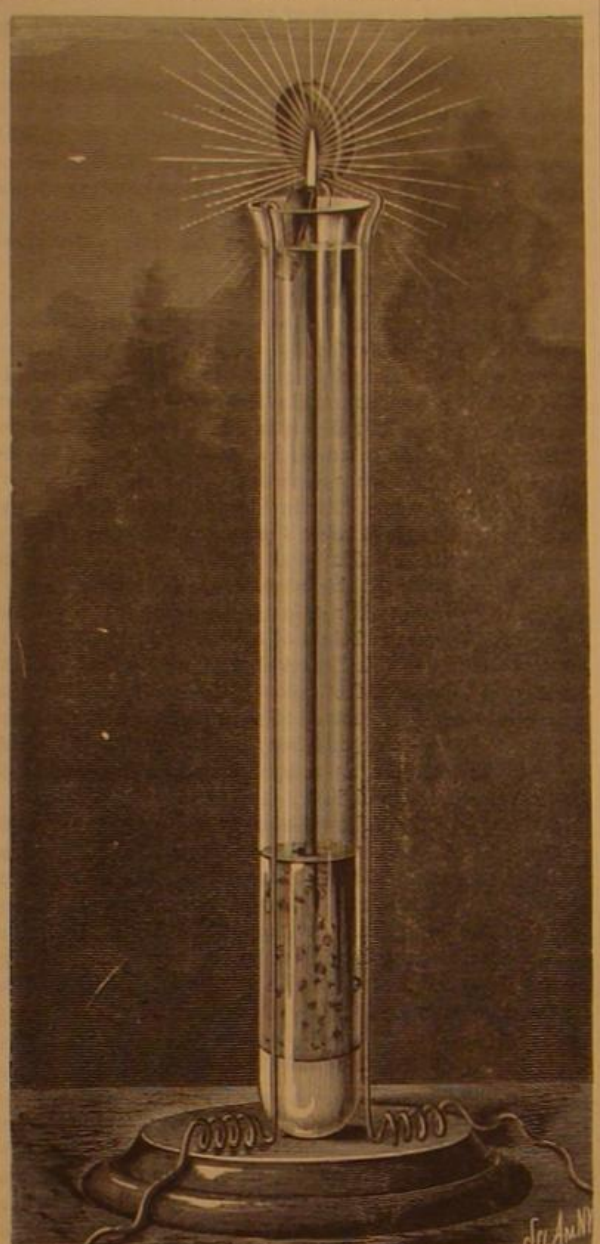


THE BLAKE TELEPHONIC TRANSMITTER.

MODIFICATION OF THE REYNIER AND WERDERMANN ELECTRIC LAMP.

BY GEO. M. HOPKINS.

In the Reynier and Werdermann systems of electric lighting the light is produced by the incandescence of a slender pencil of carbon and by a small voltaic arc between the end



SIMPLE ELECTRIC LAMP.

of the pencil and the carbon block forming one of the electrodes. In the Reynier system the carbon block is in the form of a wheel that revolves slowly by contact with the end of the carbon pencil. In the Werdermann system the carbon block is stationary. In both systems the pencil is carried forward as it is consumed, by gravity of a simple weight or of the parts of the lamp and the pencil, and Mr. Reynier, in a recent description of his lamp, proposes to employ hydrostatic pressure as a means of carrying forward the pencil. This is not a new idea, the principle having been already applied to feeding carbons in electric lamps.

The lamp shown in the accompanying engraving embodies the principle of the Werdermann and the Reynier, and the carbon pencil is carried upward by a float which creates the required pressure between the electrodes and presents a ready means of moving the carbon with a gentle, continuous pressure.

This lamp is as simple in its construction as any having means of feeding the carbons, and it is as inexpensive as it is simple. With appropriate battery power it will give a light equal to at least two five-foot gas burners.

The test tube which contains the water and the cork float, is 9 inches high and about 1⅛ inch in diameter. From the base rise two wires, which are formed into a circular loop at the top for receiving the carbon button forming one of the electrodes. This carbon button is circular and somewhat conical, and is held in place by simply crowding it into the loop. It is arranged eccentrically in relation to the top of the test tube, to admit of turning it so as to present a new surface to the end of the carbon pencil, and it is inclined so that the upward pressure of the carbon pencil will insure a contact between the button and the pencil, and between the pencil and the small carbon block below and in front of the button. This block is inserted in the coil formed on the end of the wire which extends over the side of the test tube and downward to the base, where it is connected with one of the battery wires.

The looped wire that supports the carbon button and the wire supporting the carbon block are inserted in the base, and form a support for the test tube.

The carbon pencil is $\frac{1}{16}$ inch in diameter and 9 inches long. The cork that buoys it up has in its center a small tube for receiving the lower end of the carbon pencil; for this tube a very small quill answers well.

The carbon button and the carbon block are cut from a hard piece of battery carbon or from a piece of gas retort carbon.

The test tube is nearly filled with water, which bears up the cork float and brings the upper end of the carbon pencil into contact with the carbon button; the pressure of the pencil against the inclined surface of the button throws the pencil into contact with the carbon block, completing the electrical circuit.

Six cells of Grenet battery, each consisting of a zinc plate, 3x6 inches, placed between two carbon plates of the same size, will afford a splendid light for a short time, but this form of battery soon polarizes. For a continuous light some form of constant battery is desirable, although a greater number of elements will be required.

In the published descriptions of the Reynier lamp it is stated that four Bunsen elements will afford a clear white light, and that with a battery of thirty-six elements, grouped in two series of eighteen elements each, four lamps may be placed in a single circuit. The writer's experience has been that this lamp, as well as most of the other simple lamps, requires more battery power than the inventors claim to use.

To obtain the maximum result from one of these simple lamps it is probably safe to say that at least eight Bunsen elements will be required.

The lamp shown in the engraving seems to yield results equal to those obtained from the more expensive apparatus, and by a comparison with another lamp of more complicated and costly construction the writer was forced to believe that the results were even better. Whether this is attributable to the combustion of the gases resulting from the decomposition of steam by the intense heat of the incandescent carbon remains to be determined by future experiment.

MECHANICAL INVENTIONS.

An improved elevator for use in manufactories, shops, planing mills, storehouses, warehouses, and other places where lumber and other articles are to be taken from higher to lower floors, has been patented by Mr. Latham W. Greenleaf, of Terre Haute, Ind. It is so constructed as to load and unload itself while in motion.

Messrs. Myron A. Culver, William A. Jones, and Myron C. Briggs, of Bairdstown, Ohio, have invented an improved machine for lapping patent hoops, which will form the laps rapidly, evenly, and without danger of splitting the hoops, which may be adjusted to operate upon hoops of different lengths.

An improvement in carpet sweepers has been patented by Mr. Frederick Cook, of New Haven, Conn. The object of this invention is to provide a carpet sweeper whose brush is made to revolve by means of adjustable cord and pulleys, and is also vertically adjustable in its box.

Mr. John Hyslop, Jr., of Abington, Mass., has patented an improved machine for tonguing and grooving the edges of boards, and at the same time jointing them, which may also be used for forming moulding. The invention consists in combining with a transversely slotted frame, the table having median rib, and spring-supported rolls, a rotary shaft having two heads, one arranged on each side of the rib, and provided with cutters.

Mr. John P. Cotaya, of New Orleans, La., has invented an improved device for attachment to the shutters of warehouses, storehouses, etc., to open the shutters automatically in case of fire, and thus allow the firemen to have access to the interior of the building.

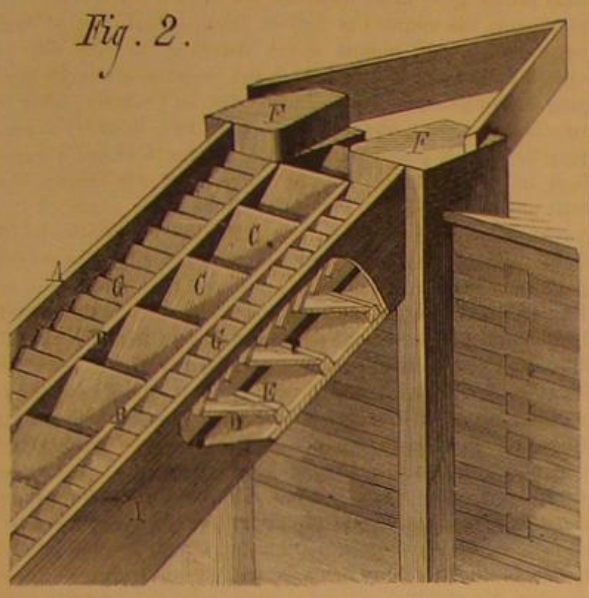
A NEW FISH WAY.

To provide a practicable passage for fish over dams or other obstructions, a current of water must be conducted from the upper level to the lower, with such velocity that fish may readily swim it, and under such conditions that they may readily find it.

Heretofore this has been accomplished in one of two ways. Either the total fall to be overcome has been broken into a succession of falls, connected by pools, as is common in the salmon ladders of Europe, or, second, the water is compelled to traverse a tortuous path down a flat incline—the tendency to increased velocity being controlled by the friction produced by the incessant changes of direction.

The greatest slope allowable for dams of any height is about one foot in twelve, and the length of the water way

Fig. 2.



McDONALD'S FISH WAY.

being about three times the length of the incline, it follows that fish, to overcome a fall of one foot, must swim a distance of thirty or forty feet, with continual changes of direction, and at every turn encountering baffling swirls or eddies.

In the fish way here illustrated and described the water is delivered down a straight sluice way having an inclination of one in three; on either side the water is banked with a slight upward and inward impulse, while down the center a current flows with uniform motion, being no faster at the foot of the way than it is at the top. The velocity of the central current may be regulated to four, three, or two miles an hour, as may be desired. The simple device by which these marvelous results are obtained will be readily understood by a careful study of the accompanying engravings.

Fig. 1 is a perspective view of the way as it appears when in operation. It is represented as built of timber, attached to a crib dam, and anchored to a rock bottom by means of iron rods. The intervening supports may be piles, as in the engravings, stone cribs, or trestles. The builder will determine the best modes of securing according to the circumstances of the particular case. At the head of the way is shown a V-shaped guard of timber, the lower edge of which is a few inches below the level of the crest of the dam. This will deflect the light floating material (sticks, leaves, etc.) and prevent any interference with the working of the way.

Fig. 2 is a perspective view of the upper portion of the way, with the side broken away to show the internal construction. Fig. 3 is a sectional view of the same.

The course of the water in the way is shown by the arrows. This fish way, when made in its simplest form, is a rectangular timber trough, two feet wide and two feet deep, inside dimensions. One end of the trough rests against the crest of the dam, the other in the pool below. The trough is firmly secured to the dam and to the bottom, and supported at intermediate points if necessary. Transverse cleats, E, three inches high, at intervals of twelve inches, are nailed to the bottom of the trough. The stringers, B, rest upon the cleats, dividing the trough into three longitudinal compartments, the middle one being twelve inches wide, the lateral compartments being five and a half inches each. The stringers are one inch boards, ten or twelve inches, set on edge. The middle section of the way is divided by the inclined portions or buckets, C, into a series of compartments, as shown in Figs. 2 and 3. The lateral sections are similarly divided by partitions or buckets, D, inclined in a reverse direction, into a series of compartments, communicating below by the openings between the cleats, E, with the corresponding middle compartments. The division of the lateral longitudinal compartments is completed by the series of directing plates, G. The water is brought into the way through a notch or sluice in the dam, two feet wide and six inches deep, and the interior hollow floor of the way is beveled off level with the bottom of the sluice way through the dam. The shoulder blocks, F, prevent the water from the dam overriding the lateral banked eddy water.

The water passing through the sluice from the dam tends to continually sink in the middle line of buckets and emerge at the sides at a lower; level the difference of head and the directing plates, G, causes it to bank up on the sides and feed back to the middle of the way. The sinking in the middle is compensated in this way, and a constant depth and constant velocity is maintained from the top to the bottom of the way.

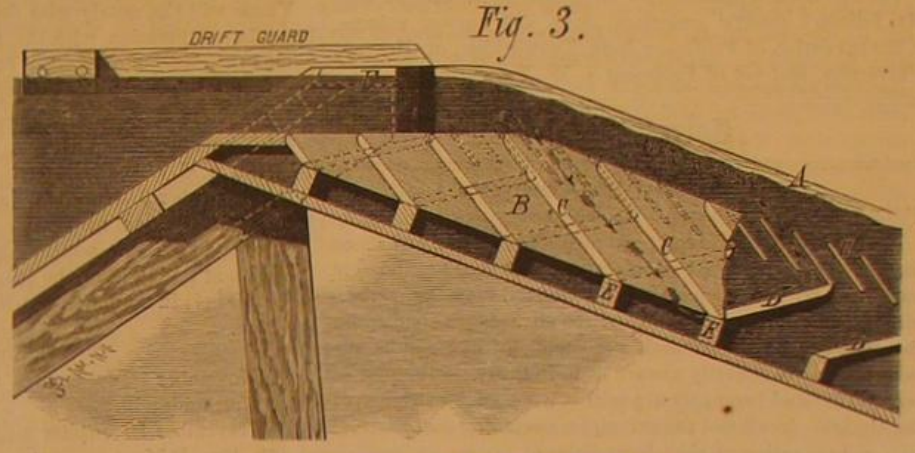
Mr. McDonald, the patentee of this way, claims that it delivers the water down a straight sluice, and under such conditions as closely to simulate the natural flow, and that the moderate velocity of descent offers no impediment to the ascent of the most sluggish fish. It may be built on a slope of one in three, or even greater, and it need not be wider than the water way, and does not require a great amount of material in its construction. It may be adapted to any water supply, and for a given capacity secures the greatest economy in the use of water. For our small streams, to pass alewives, etc., it may be roughly built of boards, with saw and hammer, at a low cost, or it may be expanded so as to throw the entire volume of a river through it.

From its compactness and lying so close under the dam, it possesses greater immunity from freshets, and can be protected with less cost than other ways.

This fish way has been adopted by the Board of Public Works of Virginia, and its erection made obligatory on all dams in the State. Mr. Marshall McDonald, of Lexington, Va., the patentee of the way, is the Fish Commissioner for the State of Virginia.

A PARIS review of the sugar trade says: "Beets are worse than was expected from the appearance of the growing crops, but the amount of the deficit cannot yet be estimated.

Fig. 3.



LONGITUDINAL SECTION OF FISH WAY.

FIG. 1.—McDONALD'S FISH WAY.

MISCELLANEOUS INVENTIONS.

An improved bale tie, patented by Mr. Robert G. Stewart, of Augusta, Ga., consists of a cast buckle having three openings or band slots, of which the central opening is longer than the side openings, and communicates through a tapering throat with one of the side openings, and in which also the side openings are formed in a portion of the buckle which dips downwardly at a sharp angle into a different plane from the main central portion of the buckle, the buckle being designed to be used with a band whose bent ends occupy a position around the bars of the middle section, while the free ends of the band pass above the outer sections of the buckle, so that they are held by a positive bearing surface without depending upon the expansion of the bale for holding it.

Mr. William Mather, of Salford, county of Lancaster, England, has patented an improvement in apparatus for damping woven fabrics by means of a spray or sprinkling of water upon the fabric after starching or stiffening. It consists of a damping roller made of metal, with an engraved surface. The damping roller revolves in a trough containing the water, and a doctor, of India rubber or other suitable material, is applied to the damping roller to remove the excess of moisture. The fabric or other material is pressed against the damping roller by a roller supported in a swing frame.

Mr. William P. Gilmer, of Mount Airy, N. C., has patented improvements in clamps for holding the boxes under the plunger of presses for compressing plug tobacco in the boxes. The object of the invention is to enable boxes of different sizes to be clamped and held securely under the plunger and in the proper position relative thereto.

Mr. William J. Taber, of Lookout Station, Wyoming Ter., has patented an improved trap for catching bears, wolves, and other animals. The invention consists in the combination of four curved spring bars provided with hooks and a trigger, and catches. The trap is hung upon a tree, stake, or bush, so that the bait will be within reach of the animal to be caught. Dogs, wolves, bears, and many other animals will seize a piece of flesh with their jaws and bolt it down. This operates the trigger and releases the spring hooks.

An improved combined filter and supply pipe has been patented by Mr. James Gainey, of Augusta, Ga. The invention relates to improvements in the arrangement of a filter in connection with the supply pipe of a house. It consists in combining a filter with a three-way cock by means of connecting pipes, so that filtered or unfiltered water may be drawn from the same locality and at any part of the house.

Mr. Sylvanus B. Crane, of Davenport, Iowa, has patented an improved electrical passenger recorder, designed to register all of the passengers of a railway car, whether sitting upon the seats, standing between seats, sitting on the arm rests, standing in the aisle, or standing upon the steps outside of the car, and it operates upon the general principle of closing an electric circuit by the depression of the support upon which the passenger may be sitting or standing.

Mr. James Gardiner, of Mantua, N. J., has patented an improvement in the class of portable apparatus used in scalding swine. It consists of a tub or boiler having appliances for raising and lowering the carcasses of swine, and a furnace or fire box on which the tub rests.

A paper bag machine, patented by Mr. Otis E. Davidson, of Clarksville, Tenn., is an improvement in the class of machines adapted to form satchel-bottomed bags having a single lengthwise seam or lap. The invention consists in novel mechanism for feeding and pasting, and also creasing, the continuous web of paper,

and for cutting off blanks therefrom, and folding, pasting, pressing the latter, and discharging them from the machine as completed bags

Mr Samuel M. Eddy, of Dalton, Ga., has patented a simple, easily operated, and efficient apparatus for washing gold from the dirt, stones, etc., with which it is mingled. It consists of a rectangular trough provided with gates, bars, or bridges, intervening pockets, and zigzag ribs or bars, for obstructing the material and supplying places for receiving and retaining the precious metal as it gravitates from the gold bearing dirt or sand.

An improved automatic car brake, patented by Mr. Cooley M. Wilkins, of Ashtabula, O., is an improvement upon that general form of car brake in which a longitudinal bar runs the full length of the car beneath the same, and terminates in heads, so that when the cars are slowed up these heads on the adjacent cars strike together, and by a longitudinal movement of the bars apply the brakes.

The Trowbridge Electrical Dynamometer.

The electrical dynamometer described in connection with Mr. Edison's electric generator, on p. 239, current volume, is the invention of Professor John Trowbridge, of Harvard University, and not of Professor J W. Trowbridge.

Correspondence.

Edison's Electrical Generator.

To the Editor of the Scientific American:

I can scarcely conceive it as possible that the article on the above subject in last week's SCIENTIFIC AMERICAN could have been written from statements derived from Mr. Edison himself, inasmuch as so many of the advantages claimed for the machine described and statements of the results obtained are so manifestly absurd as to indicate on the part of both writer and prompter a positive want of knowledge of the electric circuit and the principles governing the construction and operation of electric machines.

It is not my intention to criticise the design or construction of the machine (not because they are not open to criticism), as I am now, and have been for many years, engaged in the manufacture of electric machines, but rather to call attention to the impossibility of obtaining the described results without destroying the doctrine of the conservation and correlation of forces.

What the "important fact" "developed in the course of Mr Edison's experiments with this generator" is (if it means anything more than what Hjorth, Wilde, Siemens, and Wheatstone set forth many years ago) I am unable to comprehend from the description given.

It is stated that "the internal resistance of the armature" of this machine "is only ½ ohm." On this fact, and the disproportion between this resistance and that of the external circuit, the theory of the alleged efficiency of the machine is stated to be based, for we are informed that "while this generator in general principle is the same as in the best well known forms, still there is an all-important difference, which is that it will convert and deliver for useful work nearly double the number of foot pounds that any other machine will under like conditions." The explanation of this remarkable efficiency I quote: "Now the energy converted is distributed over the whole resistance, hence if the resistance of the machine be represented by 1, and the exterior circuit by 9, then of the total energy converted nine-tenths will be useful, as it is outside of the machine, and one-tenth is lost in the resistance of the machine."

How any one acquainted with the laws of the electric cir cuit can make such statements is what I cannot understand. The statement last quoted is mathematically absurd. It implies either that the machine is *capable of increasing its own electromotive force nine times without an increased expenditure of power*, or that external resistance is *not* resistance to the current induced in the Edison machine.

Does Mr. Edison, or any one for him, mean to say that $\frac{r}{n}$ enables him to obtain nE, and that C is *not* $= \frac{E}{\frac{r}{n}+R}$? If so, Mr Edison has discovered something *more* than perpetual motion, and Mr. Keely had better retire from the field.

Further on the writer gives us another example of this mode of reasoning, when, emboldened and satisfied with the absurd theory above exposed, he endeavors to prove the cause of the inefficiency of the Siemens and other machines. Couldn't the writer of the article see that since $C = \frac{E}{r+R}$, that by $\frac{R}{n}$ or by making $R = r$, the machine would, according to his theory, have returned more useful current to the circuit than could be due to the power employed (and in the ratio indicated), so that there would actually be a creation of force!

If such statements as these have been made by Mr. Edison to the representatives of the daily papers I think he has no cause to complain of the treatment received, but rather to consider himself fortunate that he has escaped rougher handling.

In conclusion, allow me to say that if Mr. Edison thinks he has accomplished so much by the *reduction of the internal resistance* of his machine, that he has much more to do in this direction before his machine will equal in *this respect* others already in the market.

EDWARD WESTON.

Newark, N. J., October 13, 1879.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although they are merely approximate, they will enable the observer to recognize the planets.

M. M

POSITIONS OF PLANETS FOR NOVEMBER, 1879.

Mercury.

On November 1 Mercury rises at 8h. 4m. A.M., and sets at 5h. 27m. P.M.

On November 30 Mercury rises at 8h. 43m. A.M., and sets at 5h. 29m. P.M.

Mercury will be in conjunction with the moon on the morning of November 15, and will be between the crescent moon and the horizon on the evening of that day.

Venus.

On November 1 Venus rises at 3h. 9m. A.M., and sets at 3h. 7m. P.M.

On November 30 Venus rises at 3h. 8m. A.M., and sets at 2h. 33m. P.M.

Venus will rise nearly with the waning moon on the 10th, being in conjunction with the moon at 8 A.M. Although passed the position of greatest brilliancy, Venus will be very conspicuous in the early morning during November.

Mars.

On November 1 Mars rises at 5h. 33m. P.M., and sets at 7h. 51m. A.M. of the next day.

On November 30 Mars rises at 3h. 5m. P.M., and sets at 5h. 12m. of the next morning.

Mars is in its best position in November, coming to the meridian at midnight of the 9th, at an altitude of more than 66°. Mars is in conjunction with the moon at midnight of the 26th.

Jupiter.

On November 1 Jupiter rises at 2h. 20m. P.M., and sets 55m. after midnight.

On November 30 Jupiter rises 29m. after noon, and sets at 11h. 10m. P.M.

If we examine the group of Jupiter satellites between the hours 8 and 10 of the November evenings we shall find the first satellite is hidden by occultation on the 5th, 12th, 21st, and 28th, for some portion of this time; the same satellite is unseen, because in transit, on the 13th and 20th; it is unseen at the same hour on the 21st, because it is in the shadow of the planet.

The second satellite is passing across the face of the planet in transit during these hours on November 8 and 15; it is in the shadow of Jupiter on the 17th and 24th.

The third satellite may be seen to enter upon the face of Jupiter between 9 and 10 P.M of November 3; it will come out of the shadow of Jupiter between 8 and 9 P.M. of November 7, and it will disappear by going into the shadow of Jupiter on the 14th.

The fourth satellite, which is the farthest from Jupiter, will reappear from behind Jupiter on the 27th, between 8 and 9 P.M.

All these changes are very easily seen with a small telescope.

Saturn.

On November 1 Saturn rises at 3h. 52m. P.M., and sets at 4h. 4m. of the next morning.

On November 30 Saturn rises at 1h. 55m. P.M., and sets at 2h. 4m. of the next morning.

The ring of Saturn is now opening to our view, and with a small glass the spaces between ring and ball can be seen on both sides. The satellite Titan can be seen, and on November 7 will be found (with an inverting glass) on the right of the planet. It is possible that Rhea may be seen with an object glass of 4 inches diameter.

With the glass at the Observatory of Vassar College, on October 6, the five small satellites interior to Titan were seen; Mimas, which is a very difficult object even with a large glass, was seen to move rapidly along the edge of the ring.

Uranus.

On November 1 Uranus rises at 1h. 25m. A.M., and on November 30 at 11h. 31m. P.M

Uranus is still among the stars of Leo, and not yet well situated for evening observers.

Neptune.

Neptune is in good position, but can be known as a planet only by aid of a good glass. It is among the stars of Cetus. It rises on November 1 at 5h. 3m. P.M., and on November 30 at 3h. 6m. P.M.

Probable Death of Prof. Wise, the Aeronaut.

On Sunday, September 28, Prof. John Wise, the aeronaut, ascended in a balloon from Lindell Park, St. Louis, Mo., with one companion, and has not since been heard from. The balloon was last seen at about half past eleven the same night by an engineer of the Lake Shore and Michigan Railroad at Miller's Station, 35 miles from Chicago. It was plainly visible in the bright moonlight, not very high, and was drifting northeastward over the lake.

Prof. Wise was born in Lancaster, Pa., in 1808, and had made a practical study of aeronautics for over forty years. His last ascension was his three hundred and sixty-third. The fatal balloon was the "Pathfinder," and is described by the aeronaut's son, Charles E. Wise, as new and strong. It had never been used before. The bag was of material made expressly for it, and of the best quality for the purpose; the basket was one of the strongest, and was commodious.

Wages and Prices in Germany.

According to the official review, by Secretary Evarts, of the Consular reports from Germany, the condition of the laboring classes there is wretched and deplorable.

In the coal and iron mining districts, according to the report of the Consul at Barmen, it is almost impossible for a working man to earn more than enough for his individual support, and every member of the family is required to contribute to the general support. The Consul at Bremen writes that in order to make life possible women in the country raise garden produce, and work on the farms, while in the towns they keep shops, peddle, wash, sew, etc. As illustrating the general depression which prevails throughout Germany, and the wretchedness which exists among her laboring classes, the following extract is introduced from the report of the Consul at Chemnitz: "At the present time [June, 1878] large numbers are unable to obtain employment; the country is full of tramps, both honest and vagabondish, and almost every dwelling in this city is visited daily by at least a half dozen beggars, although begging is prohibited by law. In this district [Saxony] labor is subdivided, giving one man's work to two, in order to employ the largest possible number. As the husband's earnings are not sufficient for the support of his family, the wife and older children must contribute their share of the weekly earnings. This is a general rule, and applies to all families whose support is dependent on labor." The wages paid to mechanics in Germany are lower than those paid in France, and those paid in France are lower than those paid in Belgium. The average weekly wages of the agricultural laborer of Germany are as follows: Men without board or lodging, $3.50; with board and lodging, $1.80; women, without board or lodging, $1.55; with board and lodging, 60 cents. With such nominal wages it can be readily understood how, as the Consul at Sonneberg writes, "the workingman rarely eats meat at all in any other form than sausage, and his wife and children scarcely know its taste, so little do they get of it. There is poverty in superabundance in the workingman's home, often verging upon squalor; his children are generally barefooted, and his wife looks haggard and weary of her lot." The following extract from the report of the Consul at Chemnitz will illustrate at once the condition of the working classes of Germany and their disposition to be happy under the most pinching circumstances: "The poorer classes in Southern Saxony fare very meanly indeed. For houses they have generally a single room, which answers for workshop also. For household furniture, they have a few chairs or wooden stools, a table, stove, and sometimes a loom. For beds, they have the bare floors or straw pallets. For fuel, they have the dead branches fallen from the trees in the King's forest, carried home in their arms. For food, they have black bread, made of rye; coffee, made principally of chiccory; a few boiled potatoes; sometimes a little cheese, butter, or goose grease, and on Sundays a pound of meat for a family of five or six persons. But if 'poor and content' is rich, no others within my knowledge can compare in wealth with the poor of this district. They live in villages and love company. When Sundays or holidays come, they meet at restaurants, smoke poor tobacco, drink poor beer, talk, sing, and dance, and seem as happy as if they had a thousand a year."

Steam Towing on the Canals.

The extension of the Belgian cable towing system, lately illustrated and described in this paper, goes on rapidly in the Erie Canal. It is now complete to Rochester. The cost of towing by this system is reduced by one half, and the time consumed, two thirds. One great advantage of this method of towing is that boats will take full loads West, instead of part loads as at present, while the saving of freights will give New York virtually a free canal. This at least is the opinion of the President of the Buffalo Board of Trade, Mr. Alonzo Richmond.

Official Ink.

A commission lately appointed by the Prussian Government to investigate the best class of inks to be employed for official purposes, have just presented their report. They state that aniline inks are not suited for this purpose, because they can be easily washed away, especially by preparations of chlorine. Inks in the composition of which alizari (Adrianople red) is employed can be obliterated less easily. But they are of opinion that the best of all is that made from gall nuts, and recommend that it shall be used for official purposes, and for all documents the preservation of which is of importance.—*London Times.*

Good Pas e.

Herr O. Heim, of Grimmen, gives a receipt for making a durable paste. He takes 20 grammes of wheat starch, and makes it into a stiff paste with a little cold water; then he pours 100 c. c. of boiling water all at once—not gradually—into this paste, and stirs it rapidly. A little carbolic or salicylic acid is then stirred in, and a paste is obtained which will keep indefinitely (or at any rate until it dries up) in a cool place. Care must be taken to have the best starch, as good paste cannot be made with the inferior kinds.

SPENCER WELLS recently performed his nine hundred and fifty-fifth ovariotomy, in which he employed bichloride of methyline as the anæsthetic. The bichloride has been employed in over 100,000 cases in England, without as yet a single evil result following its use.—*Mich Med. News.*

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the U. S. Circuit Court.—Southern District of New York.

By Judge Wheeler.

LOOMS.—WEBSTER LOOM COMPANY *vs.* HIGGINS *et al.*

1. Patents are to be construed in the light of what was before known to persons skilled in the art to which they relate in order to give effect to the true meaning of what is there described.

2. The description in a patent must be so full and plain that a fairly competent workman in the art could take it, and, exercising the then existing knowledge of the trade, follow it out, and by it, without invention or addition, construct an operative machine containing the parts mentioned in combination.

3. If it requires experiment and invention to make and use the matter described the patent is invalid.

4. The several parts of a machine or device may combine in producing a result and yet not constitute a patentable combination, but only a mere aggregation.

5. In the absence of other evidence the date of the patent is to be taken as the date of invention, and the burden of proof is upon the defendant to show, beyond any fair doubt, prior knowledge and use. When such evidence has been produced the burden is shifted upon the plaintiff to show still earlier invention.

Bill dismissed with costs.

By the Commissioner of Patents.

TRADE MARK.—EX PARTE PEPER.

1. The statutory requirement of a *facsimile* of a proposed trade mark is mandatory. The *facsimile* of a trade mark consisting of an actual kernel of corn and the word "Corn" must include both the representation of the kernel of corn and the word "Corn."

2. An alternative form of trade mark seems to be warranted by the authorities.

TRADE MARK.—EX PARTE COHN.

The words "Druggists' Sundries" are not registrable as a trade mark for cigars.

The Examiner declines to register the words "Druggists' Sundries" as a trade mark for cigars. These words are descriptive of a class of goods in which druggists deal, which class includes cigars. They are not registrable.

The decision of the Examiner is affirmed.

TRADE MARK.—EX PARTE COHN.

The word and letter "Standard A" are not registrable as a trade mark for cigars.

The applicant demands registration of the word and letter "Standard A" as a trade mark for cigars. The Examiner refuses registration on the ground that "Standard A" is not an arbitrary symbol, but is descriptive. This term will obviously indicate that the cigars to which it shall be applied are in quality of the highest standard. It will, therefore, be descriptive.

The decision of the Examiner is affirmed.

TRADE MARK.—EX PARTE SMITH.

The letters and words "'A. S. California Family Soap,' with the symbol of a star placed between 'Family' and 'Soap,' and a monogram formed of the letters 'A. S.' placed at the center of the star symbol," are excluded from registration as a trade mark for soap by the prior registration of the symbol of a star, No. 9, 1870, as a trade mark for soap, in favor of John K. Hogg, and the prior registration, No. 3,461, 1876, of the word "California" as a trade mark for soap, in favor of J. Biechele.

TRADE MARK.—EX PARTE SMITH.

The words "Smith's Medicated Prunes," associated with a pictorial representation of a part of a twig, three leaves, and a plum, are not registrable as a trade mark for medicated prunes.

The Primary Examiner declines to register as a trade mark for medicated prunes the pictorial representation of a twig, three leaves, and a plum, with the words "Smith's Medicated Prunes," on two grounds: First, that the picture is descriptive; and, second, that the words are descriptive. His decision is affirmed.

TRADE MARK.—EX PARTE WEISERT BROS.

The words "Belle of North Carolina," placed above a circular picture representing a female figure in a sitting posture in front of a rock, with packages of merchandise on either hand, the sea, a point of land, and a lighthouse being shown in the distance, so resemble the trade mark registered in favor of Marburg Bros., Nov. 3, 1874, and June 11, 1878, as to be calculated to deceive or mislead the public, and they are therefore not registrable as a trade mark.

TRADE MARK.—EX PARTE CONSOLIDATED FRUIT JAR COMPANY.

1. The word "Mason," in the collocation "Mason's Fruit Jar," was a valid trade mark at common law in 1870.

2. The name of a patented article which was a valid common law trade mark in 1870 cannot be registered for a period to extend beyond the expiration of the patent in favor of an applicant who is not the owner of the trade mark or the patent.

3. The validity of a common law trade mark is not affected by the fact that the owner of the trade mark is also the owner of a patent covering the article to which the trade mark is applied. The expiration of the patent does not terminate the existence of the trade mark.

4. An assignee of a common law trade mark which was in use before 1870, and of a patent covering the article to which the trade mark was applied, is protected by the statutory provision, which preserves the right to register common law trade marks which were in use before 1870.

5. While the fact that a term has become generic is fatal to its subsequent adoption as a trade mark, it is not fatal to its continued use, nor to its registration by the lawful assignee of those whose use rendered it generic, any more than to its continued use or registration by the assignors themselves.

Progress of Chicago.

In a long letter to the London *Times* an English resident of Chicago predicts that in a few years the population of that city will number 2,000,000. He bases the prediction upon the rate of growth already established and the rapidly increasing business of the city due to the enormous and enormously rapid industrial development of the West. He says:

To give some idea of the products of the State of Illinois alone, a glance at the yearly production of leading articles will be all that is necessary. Now, the area of Illinois and England are very nearly equal, each containing somewhat more than 55,000 square miles. The whole surface of the country in this State is almost one unbroken plain or prairie, and 90 out of 100 acres is capable of profitable cultivation. I have before me a statement of the crop of Indian corn or maize in the State of Illinois for the year 1877, and I find it aggregates 269,889,742 bushels. This is nearly three times the annual wheat production of Great Britain, and gives just about six bushels per head to every one of the 45,000,000 now inhabiting the United States. The great bulk of this product goes to feed hogs and cattle and to furnish breadstuffs for consumption at home and export abroad. A fair crop of wheat for the State may be put at about 30 million bushels, which would give ten bushels per head for the residents within its territory, say 3,000,000.

Allusion is made to these two products of the State to signify the aggregate of surplus products handled in Chicago pouring in from all the Northwestern States in a similar proportion, except in the one article of Indian corn, in which this State is pre-eminent among all the States of the Union.

The reception, storage, and transhipment of this surplus gives employment, directly and indirectly, to a very large amount of labor, but it is all conducted so quietly that a careless observer could form no conception of the magnitude of the business. In 1876 the total receipts of grain at this point were 97,000,000 bushels—an amount equal to the entire production of wheat in Great Britain, passing through one city alone! Subsequent years show an increase on this amount. There seems practically no limit to the production of cereals in this region, as there must be at least 1,000,000 square miles of land suitable for culture and as yet untouched by the plow. The production of food is not the result only of the larger area of land than most countries, but is largely influenced by the immense amount of labor in the country as compared with most other civilized nations.

There is probably not a country in Europe in which the females do not largely exceed the males, and in the Continental countries standing armies composed of the best physical material of the country number from 200,000 to 700,000 men, which are virtually taken out of the labor market. Now, how stands the case in America? Instead of a surplus of women, we have an excess of some 600,000 men, most of them in the prime of life, and a consequence of the immigration from abroad. This, together with the fact that we have no standing army of any magnitude (the present army numbering only 25,000 men), gives a surplus of 1,000,000 laborers over any other country of an equal population. Nor does this cover the whole difference, for in those countries where large armies are maintained, many are employed in furnishing the food, clothing, arms, and material necessary for their maintenance, taking out so much labor which, in other circumstances, would have an influence on the commercial or trade production of the world, representing a local or international value; whereas the labor expended on standing armies is virtually lost to the nation, and is a continuous drain on its resources.

Now, as the great employment of this country is farming and some one of its varied forms, a very large proportion of the labor takes that direction, and we cease to be surprised at the bountiful result. The aggregate is simply enormous. In maize alone the production of the country was 1,300,000,000 bushels last year, or very nearly 30 bushels to every man, woman, and child in the whole country. Were this used for human food alone, we should have 600,000,000 bushels to spare for export. The produce of the most productive and extensive area of the country gravitates toward Chicago as a primary market, and in this fact we find one of the prominent causes of the rapid increase of this city and an exemplification of what has been before assumed—that an aggregation of population centers at the center of food production.

How to Discourage Inventors.

The world owes its progress in material things mainly to inventors—men of original thought and restless brains, who are all the time seeking to devise some improvement on existing things and methods. Inventors are sometimes wildly impracticable men who annoy others with the persistency with which they advocate their particular hobbies, but there is too great a disposition, we fear, on the part of railway managers, as well as business men generally, to class all inventors in the same category, to assume the defensive at their approach, and to throw cold water on their enthusiastic projects for improvement.

In the railway service this tendency is often very strongly exhibited. Master mechanics and master car builders are mainly of two classes—the cautious, conservative men, who are governed largely by precedent, believe that their ways of doing things are about right, because they have done things so for many years, and are loth to try any new-fangled device; and the progressive men, with restless brains, who are never satisfied with things as they are, believe that in almost every railway device and appliance there is room for and need of improvement, and are all the time inspired with the desire to work out in practical form some of the many ideas with which their heads are teeming. There is perhaps a middle ground between these two, occupied by men who, while aware that there is room for improvement in their ways of doing things, are yet able to keep on the safe side, and, while progressive, never become impracticable; but heads thus perfectly balanced are rare if indeed they exist. Now between the old fogy who never wants to, and the active brained thinker, who sometimes attempts improvements that do not succeed, we believe that the latter is far more useful, indeed he is absolutely indispensable in this day when improvements are imperatively demanded.

But the inventive genius is generally made very uncomfortable in the exercise of his talents. Railway managers and directors are apt to look with disfavor upon men in charge of their rolling stock who are inclined to experiment much with new devices of their own or others, and it is often as much as a man's official head is worth to be known as an experimenter. Thus invention is discouraged from lack of opportunity of putting apparently valuable ideas to the test of practice, and many gifted men in the service are to-day hiding in their breasts discoveries which they firmly believe might be of great value to the company which they serve and to the world, through fear that if they attempt to put them to test in the shops they will be declared visionary and will lose their positions.

We are inclined to think, too, that the organizations of railway companies known as the Eastern and Western Railroad associations, while designed to protect the companies from imposition and extortion on the part of patentees, and doing a very important work in this respect, are sometimes the means not only of unduly repressing worthy inventors, but of preventing the railway interest from receiving the benefit of really important improvements. Inventors as a rule are men of small means, and few of them are able to pay hundreds of dollars for the privilege of bringing their devices before the notice of the companies, in addition to the heavy legal and other expenses attending the obtaining of patents.

Now the question which we wish to raise is this: Would it not only be just but profitable for the railroad associations to encourage improvements themselves, assuming the expense of testing all that are offered, instead of raising a prohibitory barrier of fees and costs in the face of every inventor? If a device applicable to the operation of railways is really valuable, the railways will be benefited more than the patentee. Thus the two most successful of modern railway appliances, the air brake and the Miller platform and coupler, now in almost general use, are of vastly more benefit to the entire railway system than they are to the fortunate originators.

Suppose the railroad associations should take this course of encouraging inventors by furnishing the means of proving the value of all devices that they considered to have real merit, protecting themselves as carefully as they pleased against any unfair advantage, and contracting that if an invention is adopted the cost of the experiments shall eventually come out of the patentee. Would not this course secure a much more rapid improvement in railway appliances, many of which are manifestly defective and unsatisfactory, than the present practice of warning off the possessors of ideas from the machine shop and the manager's office?—*Railway Age.*

French Railway Traveling.

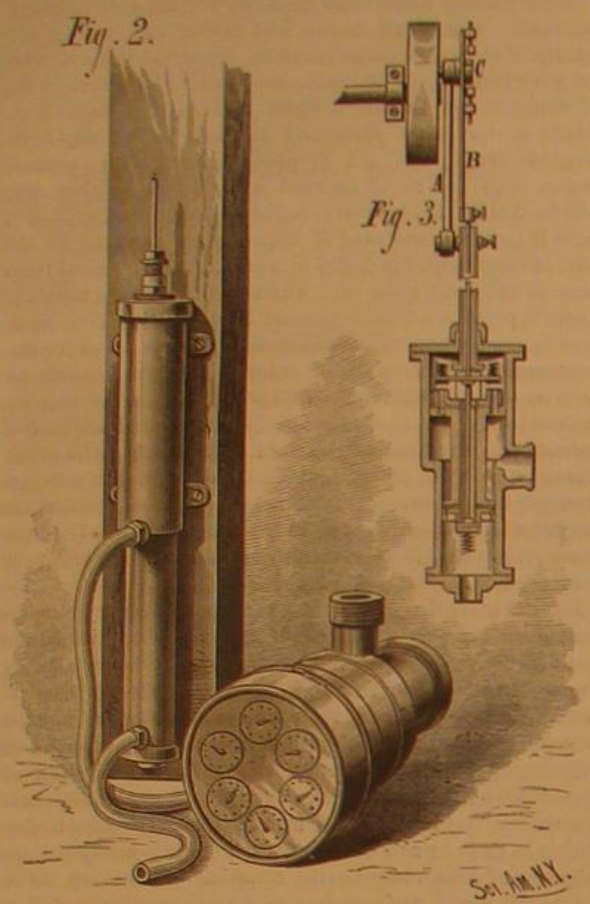
The distance from Paris to Marseilles is 600 miles, and by a recent arrangement a train of the Paris, Lyons, and Mediterranean Railway makes this long journey in fifteen hours, leaving the capital at 8 A.M., and reaching the shores of the Mediterranean at 11 P.M., an average continuous speed of 40 miles per hour.

THE Bank of England was incorporated in 1649. It covers five acres of ground and employs 900 clerks. There are no windows on the street; light is admitted through open courts. No mob could take the bank, therefore, without cannon to batter the immense walls. The clock in the center of the bank has fifty dials attached to it. Large cisterns are sunk in the courts, and engines in perfect order are always in readiness in case of fire.

NEW MOTOR AND METER.

We give on this page engravings of a new reciprocating apparatus recently patented in the United States and Canada by Mr. Adam Knecht, of Quebec, Canada. The principle is applicable to air, steam, and hydraulic engines, reciprocating motors for blowing organs, pumping, etc., also to meters for measuring liquids and gas.

Fig. 1 represents a hydraulic motor built on this principle. Fig. 2 represents a reciprocating motor and a meter, and Fig. 3 is a longitudinal section of the motor showing the arrangement of internal working parts, and it is by an



MOTOR AND METER.

examination of this figure that the principle of the apparatus may be understood. When used as a reciprocating motor, the cylinder, which is made in two diameters, has an inlet at the lower end, and an outlet at the middle, and contains two pistons of different diameters connected by a tube, which affords communication between opposite ends of the cylinder. A rod extends through the connecting tube of the two pistons, and carries at its lower end a single valve which covers the tube, and at the upper end a crossbar carrying two valves adapted to openings in the larger piston. Surrounding a pin that projects from the back of each valve there is a spiral spring that is capable of touching the end of the cylinder at the end of the stroke of the pistons. The rod connecting the valve at the lower end of the piston tube with the crossbar of the upper valves, is of such length that when the valve at the lower end of the cylinders is seated the upper valves will be open, and *vice versa*. The lower valve being closed, the water entering at the lower end of the cylinder, pressing upon the smaller piston, raises both pistons until the springs above the upper valves touch the upper cylinder head with sufficient force to close the upper valves and open the lower one, the water passing through the tubular connection of the two pistons exerts a pressure on the upper surface of the upper piston, and forces it downward until the spring of the lower valve strikes the lower end of the cylinder and reverses the position of the valves, and the water again forces the pistons upward. As the pistons rise, the water between the upper piston and the upper cylinder head is discharged through the openings in the larger piston into the space between the two pistons, thence through the central opening of the cylinder to a pipe which conducts it away.

When used as a rotating motor, a tubular piston rod is connected with the larger piston by a yoke, and extends through a stuffing box in the cylinder head and is connected with a crank pin, which is movable in a governing device on the motor shaft by means of pitman, A, of ordinary construction. The valve rod is prolonged beyond the end of the tubular piston rod, and is jointed to a rod, B, which is slotted at its free end so that it may slide upon the crank pin. The connecting rod, B, carries two spring tappets, which are alternately engaged by a cam, C, on the end of the crank pin, so as to open and close the valves at the proper instant.

The meter shown in Fig. 2 is substantially the same as the reciprocating motor, the only difference being that registering mechanism is added to the meter. By substituting rubber or leather diaphragms for the pistons, the device may be used as a gas meter. The vertical reciprocating motor shown in Fig. 2 is adapted to pumps, organ blowing, etc.; when used for the latter purpose a controlling valve is provided, which may be operated by a cord or wire from the keyboard of the instrument.

The inventor informs us that this device may be applied as an auxiliary to force pumps, enabling them to draw water from a depth of 200 feet, and by using the middle opening of the cylinder as a suction and the end opening as a discharge it forms a most efficient double-acting force pump.

Further particulars may be obtained from Mr. Adam Knecht, Lock Box 395, Quebec, Canada.

ENGINEERING INVENTIONS.

An improved spark arrester for locomotives, farm, and other engines, has been patented by Mr. Eliphalet N. Berry, of Money Creek, Minn. It consists in the combination of a horizontal partition having a hole through its center, and two pivoted disks connected and held parallel by links, and a rod for moving the disks, with the lower tubular part and the upper double cone part of a smoke stack.

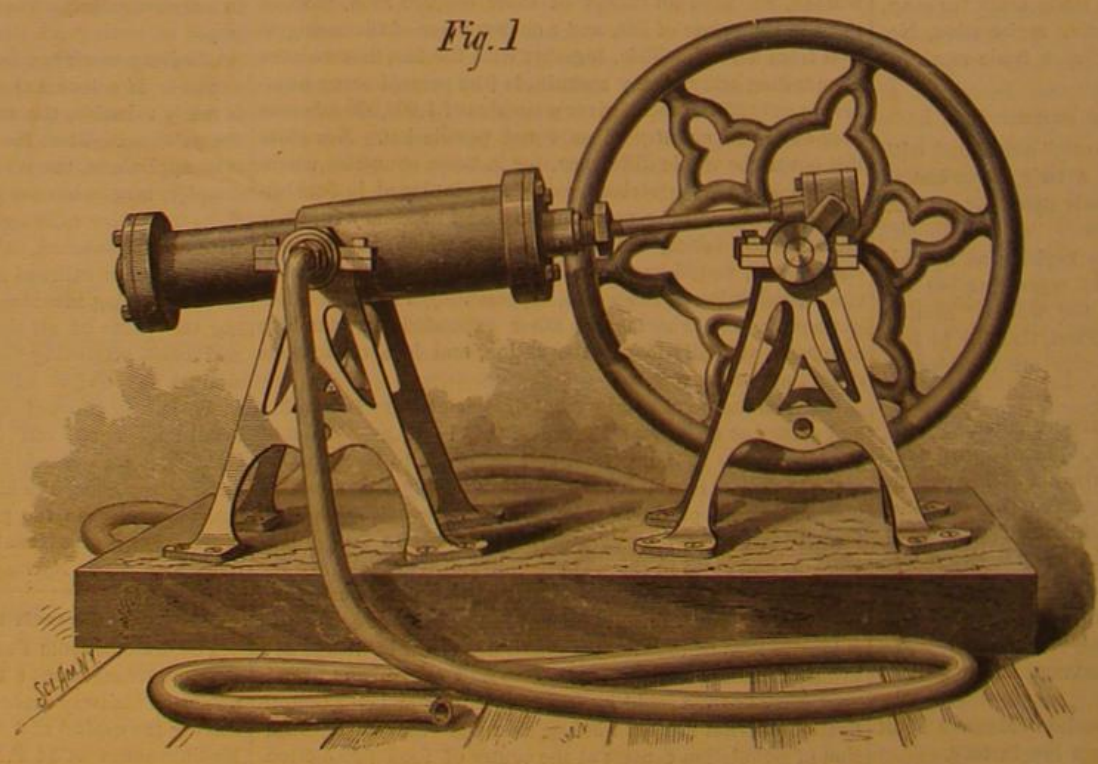
Mr. Ambrose N. Smith, of Portage, Wis., has patented a double derrick and crane to be placed on a dredge boat, for the purpose of receiving earth from a dredge, and conveying and depositing it away from the boat. The derrick and crane are so arranged that the weight which is being lifted by the one shall be counterbalanced on the opposite side by the other, so as to prevent the boat from listing or rolling.

Mr. Winfield S. Nearing, of Morris Run, Pa., has invented an improved car and cable coupling, to be attached to railroad cars or other moving devices for connecting them to wire or other cables that are in motion, so that whenever such car or device is connected by the clamp to the cable it will be propelled by it, while it will remain at rest as soon as disconnected.

Messrs. Eli T. Bangs and Moses L. Dolbey, of Fayetteville, N. Y., have invented an improvement in jetties. This relates to improvements in the construction of the foundation and heartings of jetties; and the object is to furnish a strong and durable foundation, thoroughly bound together, adapted to resist the undermining of the jetty, and of sufficient flexibility to yield to the variations in the bottom without becoming disintegrated.

Mr. Nathan M. Dibble, of Birmingham, Conn., has invented a new water wheel governor. The invention consists in combining with a speed governor for water wheels a pivoted arm connected with the gate stem and fitted to act upon the sliding shaft of governor; also in combining, with wheel stem, shaft, and balls, a lever, nut, and bearing block, which together form a safety check.

An improvement in smoke stacks, patented by Messrs. Walter A. Scott and George W. Williams, of Winona, Minn., relates to the manner of connecting the two parts of the stack between which the edge or the wire netting spark arrester is held. The object of this invention is to enable the joint between the two parts to be separated and remade quickly and easily; and it consists in fastening the two flanges together by means of a grooved or channeled tubular ring cut on one side placed over and around the two flanges, so as to hold them together, and fastening the ring by a bolt passed through two outward projections on its ends.

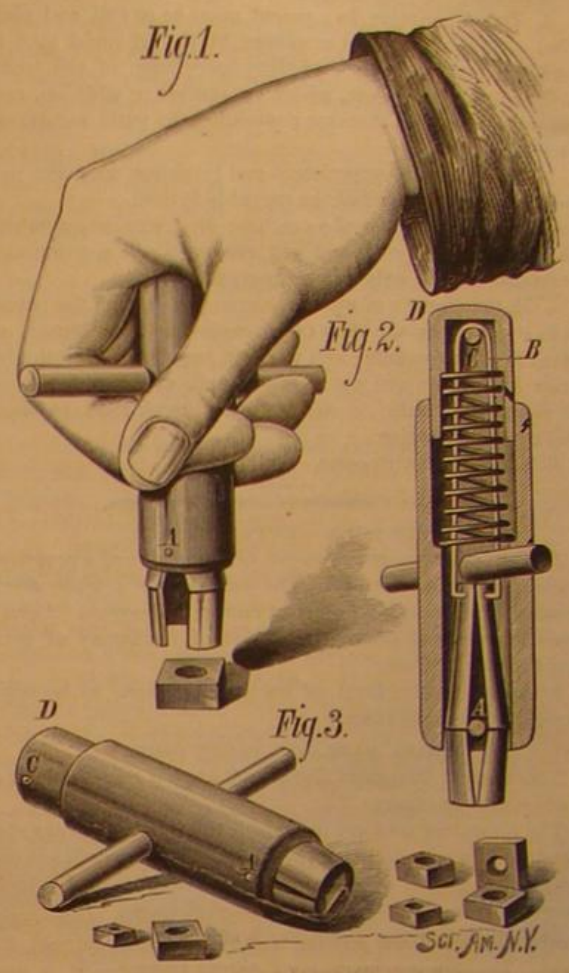


KNECHT'S MOTOR.

A NEW WRENCH.

The novel and useful tool shown in the accompanying engraving is precisely the same in principle as Birch's well known watch key, and is manufactured in different sizes under patents by Messrs. J. S. Birch & Co., of New York city.

Fig. 1 shows the wrench as it is held in the hand ready to



BIRCH'S AUTOMATIC WRENCH.

be applied to a nut; Fig. 2 is a longitudinal section showing the internal construction; and Fig. 3 is a perspective view of the wrench.

The jaws that grasp the corners of the nut or screw are tapered and placed on opposite sides of the pin, A. Transverse slots at the upper end of the jaws receive the L-shaped ends of the loop spring, B, which extends around the pin, C, in the follower, D. The latter slides easily in the upper end of the barrel, and is counterbored to receive the upper end of the spiral spring, the lower end of which rests on a shoulder near the middle of the barrel.

A small rod passes through the middle of the barrel to afford leverage for the hand of the operator. The jaws are operated by pressing down the follower, D, by grasping the wrench in the manner shown in the engraving, and when the jaws are placed upon the nut or set screw, the follower is released and the spiral spring draws the jaws into the barrel, contracting them by the engagement of their tapering sides with the sides of the barrel, until the wrench fits the nut or screw to which it is applied.

This wrench adapts itself to nuts and screw heads of various forms, as well as different sizes. It is very convenient for picking up and applying nuts and set screws in inaccessible places, and is useful for holding and turning tools of various kinds, such as bits, drills, and reamers.

The smaller sized wrenches fit all sizes of nuts between $\frac{1}{8}$ and $\frac{1}{2}$ inch, the medium size fits all sizes between $\frac{1}{2}$ inch and $1\frac{1}{4}$ inch, and the larger size will fit all sizes from 1 to 2 inches.

Its capability of universal application makes it a desirable tool for the bench, and it is valuable as an accessory to printing, sewing, and other machines. Months of constant and severe usage have shown that this wrench has ample strength, and that it is practically incapable of wearing out. We are informed that one used in the factory of the manufacturers over two thousand times a day for more than a year shows very little wear and is perfectly good yet.

Further particulars may be obtained from Messrs. J. S. Birch & Co., 38 Dey St., New York City.

THE GREAT SEA COW OF FLORIDA.

BY DANIEL C. BEARD.

Having heard that the New York Aquarium had made an interesting addition to its already large collection of curiosities, in the form of a huge submarine monster, the writer was induced to pay it a visit.

Entering the Aquarium and passing the many tanks, allowing their finny occupants to swim and flop unnoticed, he proceeded straight to the pit formerly occupied by the baby hippopotamus. As he stood looking into the water the floating reeds moved and disappeared mysteriously, indicating the presence of some creature beneath the surface feeding upon the floating vegetation.

Presently there was a ripple on the water, a great round cow-like nose appeared for a moment above the surface, and this was all that could be seen, until through the kindness of the keeper the water was drawn from the tank.

As the waters lowered an apparently shapeless mass, enveloped in a wrinkled, slate-colored skin, with white bristles scattered sparsely over it, was disclosed. When the tank was dry, and the writer could get a fair view of its occupant, he found it to be a large, uncouth animal, somewhat resembling a seal in shape, but the posterior limbs replaced by a broad, fleshy caudal fin, two flippers corresponding to anterior legs.

Bent down, with nose upon the bottom of the tank, was a rather small head, with an odd, wrinkled countenance. As the huge, unwieldy monster moved its body became corrugated with large wrinkles.

This is the manatee, or the great sea cow of Florida. The "finned mammalia" of M. Desmarest, the "woman fish" of the Spaniards, and cousin to the "little bearded man" of the Dutch.

It is entirely harmless and docile, readily tamed, for this one evidently knew its keeper and would move awkwardly around to greet him when he waded into the tank. The head is rounded, and on the muzzle are a number of bristles, each of which is said to connect with the brain by a nerve. The opening of the ears are very small and could not be detected from a position outside the tank. The eyes are so small that they were hidden by folds of skin. The hands of the manatee have five nails (see sketch in illustration); the structure of the bones allows the hand to turn in any direction at pleasure.

The tail is about one quarter of the length of the body, and in this specimen just the width at its broadest part, 3½ feet. The skin is remarkably thick and tough. It is used in the place of rawhide or leather in the manufacture of articles where great strength is required. The writer was shown a walking cane made from the skin of a manatee, killed at the head of navigation in the Magdalena River, by Mr. Soloman, of 1195 Broadway, while on one of his excursions after birds and insects in South America.

The oil from the fat is free from that rancid odor common to animal oils, and is held in high esteem. The flesh is edible, and pronounced by Humboldt and others sweet and palatable. When salted and sun dried it will keep for a year or more. By Catholics it is considered fish, and ate on fast days.

The true manatees, or lamantines, are confined to the Atlantic Ocean. The largest species (*M. latirostris*) is found in the United States upon the Florida coast; another inhabits the mouths of the rivers in South America.

The manatee is placed by Cuvier among the cetaceans, but Prof. Agassiz compares the skull of one with that of the mastodon and elephant, and in a discourse before the American Society for the Advancement of Science, in 1850, over a very perfect skeleton, he proved that Cuvier was wrong in many of his statements regarding the anatomy of the manatee, and ended by pronouncing it an embryonic type of the pachydermata or thick-skinned animals, such as the elephant, hippopotamus, etc.

The want of symmetry noticeable in all the cetacea is not found in the manatee. The bones of this animal are dense and heavy, while those of the whale are light and spongy. The unshapely rudimentary nasal bones of the cetaceans, and the opening on the top of the head, do not agree with the olfactory organs of the manatee, the bones of which, though small, are in their usual place. The nostrils, unlike those of the whale, are never used for blow holes, but, like those of the elephant, are placed at the end of the snout, while their mobility and general appearance would indicate a more refined sense of smell than that possessed by the cetaceans. On account of these and many other important differences they have lately been placed in a separate order called sirenoids, intermediate between the pachydermata and the cetacea. The sirenoids also include the dugongs and rytina. The latter, like the dodo, is now extinct. The last known specimen was killed in the year 1768, just twenty-seven years after they were discovered, on an island in Behring Straits, by some shipwrecked sailors.

The only account of the rytina is that furnished by Steller, one of the shipwrecked party. The dugong is found upon the eastern coast of Africa, and is rather common in the Indian Ocean. This is the animal known among the Dutch as the "little bearded man."

The fact that these sirenoids often swim with their heads and shoulders out of water, carrying their young in their arms, there can be little doubt has furnished foundation for the wild stories of old navigators of mermaids and tritons, such recitals as were treasured up by Maillet, Sachs, Valentyne, and others, who, as Cuvier said, "displayed more learning than judgment."

The specimen of the manatee at the Aquarium was captured in Florida. After chasing the animal up a small creek the hunters barricaded the mouth, and caught the creature in a strong rope net.

Office of the Queen.

Many have asked the question: "Does the queen govern the colony?" We answer, No. The economy of the colony is directed by the workers. It seems that the only necessity of the queen is to supply the hive with eggs, and the colony is entirely dependent on the queen for this. Curiosity has prompted me to scrutinize this subject very closely, and I am free to confess that I have failed to discover that she performs any other office in the hive except the one mentioned. I never discovered that she possessed any care of her offspring; not even manifesting any parental care whatever for their welfare; in fact, the workers, as a general thing, supply her with honey and other food necessary to sustain her, and it is the food in a very great measure, both quality and quantity, that stimulates the queen to breeding rapidly; and this food, as given by the worker, greatly affects the production of the eggs, either to increase or diminish the quantity. I think she has the power of regulating the amount of eggs necessary for her safety of the colony; when honey is abundant she will lay profusely, evidently having the power of regulating or repressing the development of her eggs. She will diminish the number and almost cease laying, and when circumstances require she will at once engage in active labor, depositing either in worker or drone cells, as circumstances may require. The eggs in drone cells are deposited in the season when such are required—generally commencing from the 1st to 10th of April—but this depends greatly on the season. If the swarm be strong and honey plenty in the forest, she is actively engaged in laying both in worker and drone cells; she evidently understands her business—nothing done at random. A fertile queen is one that has paired with the drone or male bee, and is capable of laying eggs that will produce workers, drones, or queens. Barren bees are often found in the hives. A queen's fertility lasts from three to five years, and then the workers frequently destroy her, and rear another. They are sometimes superseded when from two to three years old.
—*A. F. Moon, in the Bee-Keepers' Magazine.*

A Large Bee Farm.

The *Canada Farmer* pronounces the bee farm of D. A. Jones, near Beeton, Ontario, the most extensive and successful in the country. It consists of four bee yards, each covering about an acre of ground carefully inclosed, and contains, besides the hives and summer store rooms, a house for wintering the bees. The hives used are oblong, pine-wood boxes, with a cubic capacity of 3,240 in., the inside measure being 15 by 18 by 12. Mr. Jones's four bee yards contain 250, 150, 150, and 70 of such hives respectively, and he reckons 30,000 bees a good swarm for one of them. At the end of July Mr. Jones had secured 50,000 pounds of honey from 620 stocks of bees. He expects a total yield for the year of 70,000 pounds of honey from his 19,000,000 little

THE GREAT SEA COW OF FLORIDA.—(*Manatus Latirostris.*)

workers, in which case he would net between $7,000 and $10,000 for the year's product, without taking into account the sale of swarms or of queen bees. This successful apiarist estimates the year's total outlay at $2,100, nearly half of which, however, is interest on capital which has grown up with the business.

The Devil's Plant.

Emerson's definition of a weed, as a plant whose uses had not been discovered, seems to be happily applicable to the *Abutilon avicennæ*, politely known as "velvet leaf," but called by Jersey farmers "devil's plant." Gray describes it as tall; leaves roundish heart-shaped, taper-pointed, and velvety; peduncles shorter than leaf-stalks; corolla yellow; pods 12 to 15, hairy, beaked; annual; abounds in waste places, escaped from gardens. Imperfectly naturalized from India.

This thrifty weed has become a perfect nuisance in New Jersey and Pennsylvania; possibly in other States. It appears to survive almost any amount of hardship and ill treatment, and is heartily hated by farmers and gardeners. Yet, if recent reports are true, this troublesome plant promises to become one of the great sources of national profit, owing to the superior fiber it has been found to contain. The discovery of this fiber, the Philadelphia *Record* tells us, was brought about by a French gentleman, M. Emile Le Franc, who has resided in America for about nine years. He is an authority on fibrous plants, and has written several reports on the subject for the National Agricultural Department. During the Centennial he came to reside in Philadelphia, and devoted some of his spare time to an examination of the fibrous plants of New Jersey.

The *Abutilon avicennæ* attracted his attention, and a little investigation brought him to the conclusion that the plant possessed no inconsiderable value. He commenced operating by a secret process of his own invention, and found that the bark around the straight stem contained a valuable fiber. With a little more labor this fiber was brought to the condition required by manufacturers, and several, to whom it was shown, pronounced it equal to the jute imported by them from India. M. Le Franc also found that the short fibers could be made into a new tissue which can be employed in the manufacture of a new fabric.

This important discovery was not to be allowed to slumber. M. Le Franc reported it to the New Jersey Bureau of Statistics of Labor and Industries, and also determined to go into the manufacture of jute and the raising of the "devil's plant." The Bureau gave its co-operation, and issued, under its seal, an offer from M. Le Franc to pay eight dollars per ton for straight jute stalks, not less than 3 or 4 feet in height, delivered in Camden. The circular also advised farmers to go into the cultivation of the plant, and gave important information relative to the sewing of seed, methods of planting, and other particulars. This circular was the first information which the Jersey agriculturists received of the prize which was contained in their former enemy.

The cultivation of the "devil's plant" is to be generally followed in different parts of New Jersey. As the plant is also to be found in Pennsylvania, it is anticipated that Pennsylvania farmers may find it to their profit to devote some attention to it. The discovery is calculated to have an important effect upon the trade of the country. Its ultimate result will undoubtedly be to render the United States independent of the world for a commodity which is now costing our manufacturers fully $10,000,000 annually. The total importations of hemp, flax, ramie, and jute into this country are valued at over $30,000,000 a year. The jute alone represents one-third of this amount. The supply comes exclusively from India, and the latter's trade in it has increased to such an extent that it has become the leading staple of Bengal. In this country jute is used for numberless purposes, among them for rope and carpet backs. It is also frequently mixed with linen in the manufacture of clothes. England, and in fact the whole of Europe, are dependent upon the Indian plantations for their supply.

The New Jersey Bureau is authority for the statement that "extensive jute rope manufactures of Philadelphia have offered to buy any quantity at the highest jute market price; that the long fiber is equivalent to that of the Calcutta prime jute, and that the manufacturers admit the superiority of the American variety over the imported." In the face of this testimony it is not too much to hazard the opinion that ere many years America will not only supply the home demand for the staple, but will also be able to inaugurate an export trade. At least so think those connected with the enterprise.

Porpoises and their Attending Gulls.

As we neared shore (Azores) a large shoal of porpoises was seen close by, going at great speed in full chase after fish, the whole shoal skipping together, four or five feet out of water for several successive bounds in hot pursuit. The shoal was closely attended by a flock of gulls, which follow in order to pick up the fish which are bitten or wounded by the porpoises, but which the porpoises have no time to stop to pick up.

In the Arafura Sea I have seen frigate birds hanging over a shoal of porpoises with the same object, and in just the same manner in the tropics terns and noddies follow the shoals of large predatory fish (Caranx) to pick up the crumbs.

The demeanor of a shoal of porpoises on the feed is a very different thing from their lazy rolling motion which one more commonly sees.—*Moseley.*

ARROW POISONS.

The rude knowledge of toxicology possessed by certain savage tribes has enabled them to compound various deadly poisons which have defied every attempt at analysis upon the part of chemists, for so cleverly have the various ingredients been combined that the most delicate quantitative analysis has failed to reveal the character either of the curare or woorari of South America, the carroval, or the more deadly Upas poison.

Curare, which comes to us as a resinous substance of a dark color, is contained in gourds or rude earthenware pots, and is full of impurities of various kinds, but chiefly of a vegetable character, and it is necessary to subject it to careful treatment with acidulated water to obtain the substance in anything like a pure condition. Prof. Jobert, of Paris, when at Caldera, Brazil, succeeded in bribing an Indian of the Tecuna tribe to disclose the secret of its preparation. He found it to be made of *urari uva*, a climbing plant of the order described by Weddell as the *Strychnos castelnæ; Eko*, or *Pain du maharao* (*Cocculus toxiferens*); *Taja, Eonê* (*Didelphys cancrivora*), and three of the *piperaceæ* of the genus *Arnante*, and a plant called *Tan magere*, or toucan's tongue. The powdered outer bark of the two former are ground together, and the leafy twigs of the taja are boiled together, and the other ingredients added. The product is a dark, muddy substance, which is curare.

Physiology has profited by the peculiar properties of some of these substances, and to the use of woorari some of the most valuable experimental results are due. For instance, when a very small quantity of this substance (less than a grain) is injected beneath the skin of a living animal there follows an utter abolition of motor power, the motor nerves being paralyzed, while sensibility is preserved. Respiration is stopped, so that no evidence of breathing is to be perceived; but the heart still beats, and if the dose be not too large, and artificial respiration be kept up, the animal will probably recover. The state is one of trance, consciousness probably being retained, while all the motor organs of expression are powerless and inactive. Strange to say, the poison has no effect if taken into the stomach.

Its physiological effects have suggested its use in medicine, and quite recently it has been employed in several convulsive and spasmodic diseases. Epilepsy, tetanus or lockjaw, and even hydrophobia have been cured, but great care should be taken in its administration.

The best plan is to make a solution in water acidulated with hydrochloric acid, and this, when mixed with glycerine and thrown beneath the skin daily, or several times a week, sometimes effects a cure.

It is occasionally possible to procure curare from the poisoned javelins which are brought here by travelers, but this is not often. A lance of this description is from 6 to 8 feet long, and is made of some strong, tough wood, and in a fissure at one end a sharp spike, made of a thorn or very hard species of black wood, is bound by grass ends. The spike is usually incrusted with a deposit of curare, about the sixteenth of an inch thick, and covered by a cap of reed, which prevents any danger of accident. A wound ever so slight from a weapon of this kind must produce death, and that of the most horrible kind, when we remember that consciousness and sensation are in no way blunted for some time, and the individual must appreciate the condition he is in.

The *Upas* poison is obtained from a tree growing in the East, known botanically as the *Antiaris toxicaria*. The expressed resinous substance possessing the poisonous properties is an oily, greenish fluid, and a very minute quantity is sufficient to produce instant death by paralysis of the heart. The poetical and entirely fanciful idea that the individual who ventures into the valleys in which these trees grow, or sits beneath the trees themselves, is certain to lose his life in the attempt, is in every sense erroneous, and these stories must be accepted only as "travelers' tales." It is probable that the only risk run by the individual is that which is incurred in subjecting himself to any malarial influence.

Among various savage tribes, notably the Australian natives who inhabit the lower Murray District, who are called *Narringeris*, the custom of killing their enemies with instruments known as *nielgerii*, is much in vogue. The specific poison is derived from the decomposing fluids of the human body, and the corpses of the dead are kept unburied for some time, until the process of decomposition has advanced to the proper point. From our knowledge of the accidents which follow dissecting wounds it would appear as if death by a wound of this kind would be exceptional, but such is reported not to be the case, and a scratch by the *nielgerii*, which is first dipped into the foul fluids of the body, is said to be rapidly fatal.

Some Facts about Cotton.

After noting the reasons for estimating the growing cotton crop at 5,000,000 bales or over, the President of the Mississippi Valley Cotton Planters' Association spoke as follows, at the late meeting of the association in Vicksburg, Miss.:

A crop of 5,000,000 bales, averaging three acres to produce a bale, would give us 15,000,000 acres, at $8 per acre, $120,000,000. One mule or horse to 25 acres, 800,000 mules, at $90, $72,000,000. Implements, harness, etc., and machinery, $50,000,000. Showing a permanent investment of $242,000,000.

Averaging three bales per hand would require 1,666,666 laborers, to feed and clothe which for a year with their dependents would average $50 each, $83,666,667. To feed team at $40 per mule, 800,000 mules, $32,000,000. Cost of bagging and ties at $1.40 per bale, $7,000,000. Cost of marketing crop at 1¼ cents per pound would give $25,000,000. Working capital, $146,777,777. Average price expected for present crop, 11 cents per pound, for 2,000,000,000 pounds, $220,000,000.

Recapitulation: Now we have—permanent investment of planters, $242,000,000; working capital, $145,777,777. Total capital invested exclusively in cotton cultivation, this estimate being made for the share system and not wages, $388,777,777.

Amount received for total crop, $220,000,000, which is divided equally between the planters and laborers. Planters therefore receive $110,000,000—from which deduct feed for team, $32,000,000; half cost bagging and ties, $3,500,000; half marketing crop as chargeable to planter, $12,500,000; 20 per cent in loss and decreased value stock, $14,400,000; 20 per cent in loss and decreased implements and machinery, $10,000,000—total $72,400,000. Repairing fences, houses, etc., at 10 per cent on permanent investment, $12,000,000. Taxes on permanent investment, 3 per cent, $7,260,000. Deduct these amounts from planters' share of crop, $110,000,000, which shows planters' profit on total investment for cotton alone is about 4¼ per cent, provided we get 11 cents for cotton, make 5,000,000 bales, and the laborer pays his accounts in full. Laborers' share of crop, $110,000,000; amount chargeable for food and clothes, $82,666,667; showing a profit for the laborer of $27,333,333.

It will thus be observed that the laborer receives $27,000,000 on investment on nothing but his muscle, while the planter receives $18,000,000 on an investment of $388,000,000 and his services.

Now we will omit the details of the number of slices that are plucked by the wayside, and suppose our crop has reached the factory, simply saying that about $25,000,000 more has been added thereby to the price to be paid by the manufacturer since it landed at the seaport from the planter. Our 5,000,000 bales now begin to loom up and assume some importance, for they run 12,500,000 spindles, which require nearly $1,000,000,000 in buildings, machinery, and working capital, and employ nearly 800,000 operatives and employes. The manufactured goods are sent to every part of the known world, creating a trade reciprocal business that can hardly be estimated, but without doing which, as can easily be seen, it will reach into the billions.

You can form no estimate of the number of banks, insurance companies, and trades of all sorts that are sustained in all the ramifications of this immense traffic, to say nothing of the fact that it serves to establish the equilibrium of the world's exchange and gives to the United States the balance of trade. Now, from the time the cotton leaves the planter every interest that touches or handles it has an organization for the sake of harmonious action and to protect itself; the transportation companies, the buyers and sellers, the compress men, insurance companies, bankers, shipping interests, and manufacturers and others too numerous to mention. And at last the foundation of all this mighty fabric of trade and commerce has awakened to the vital necessity of organizing our class for self-protection, and not only for self-protection, for all that is necessary in this respect is to show the world that we know our rights, and knowing dare maintain them, but also for the purpose of hereafter bringing more intelligence and interchange of thought to bear in the management of our business generally, in order that we may keep at home the millions we expend annually to feed and clothe our laborers, buy agricultural implements, teams and feed for teams, by diversifying our crops and encouraging manufactories.

To say nothing of the increased wealth and prosperity otherwise, if the cotton we raise was manufactured in the South it would save to the planter nearly $50,000,000 annually in transportation.

The manager of the Mississippi Mills, which uses 4,000 bales cotton, 350,000 pounds wool, and $800,000 capital, writes us that there is a difference of 15 to 20 per cent in favor of manufacturing cotton here over New England, and I judge there would be double this difference over Old England; and further, that while strikes and reductions of wages have occurred frequently of late years in New England, 600 operatives of the Mississippi Mills, all of whom, with the exception of three, are Mississippians, are contented and no reduction. Mill property is free from taxes ten years.

Mr. Richardson says it is the best paying property he has. Of course it can only be a question of time when the South will manufacture nearly if not all the cotton it raises. Circumstances may delay it, and we may not live to see it, but it will come.

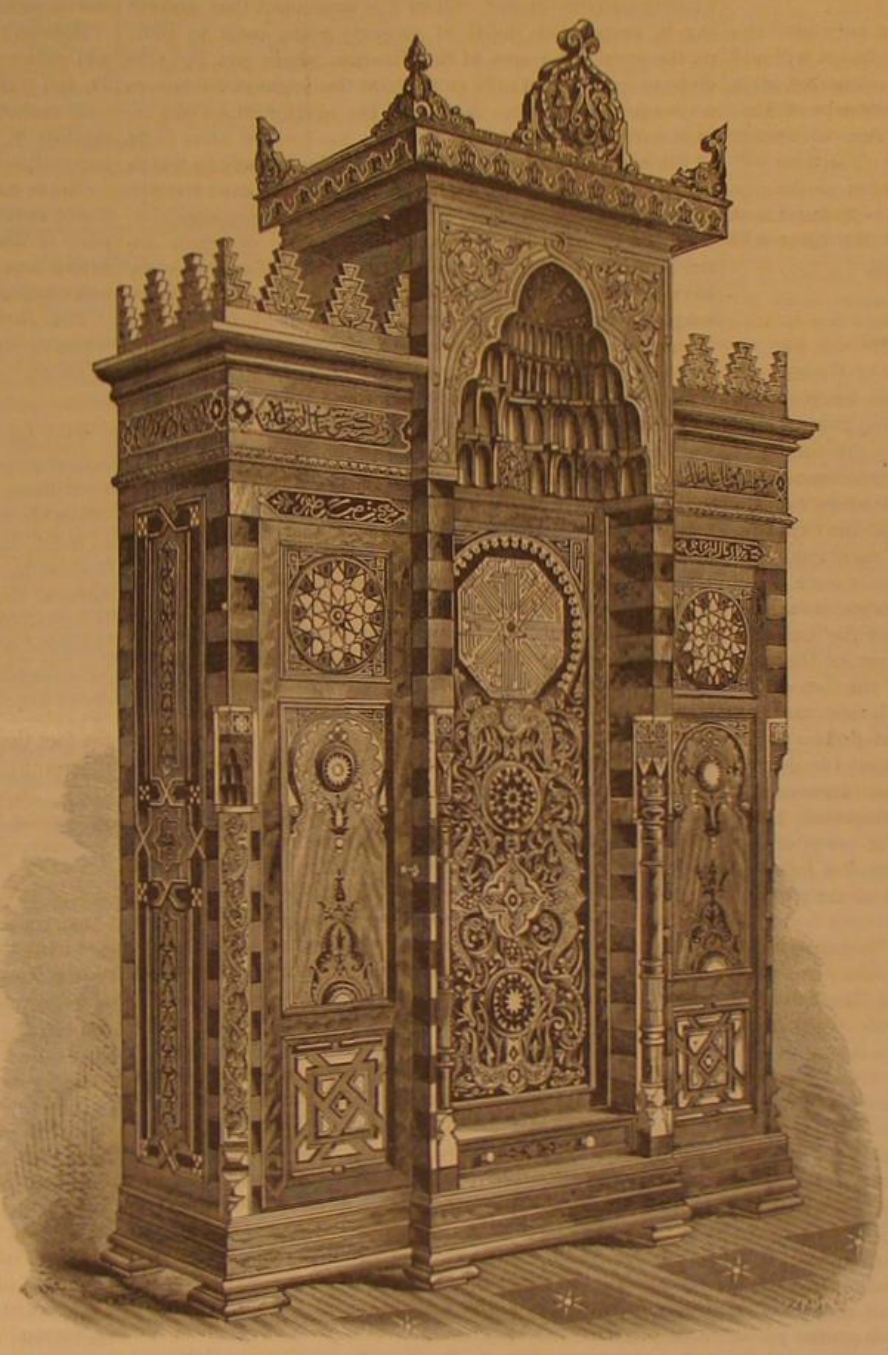
The Oleander.

This beautiful plant, when under proper culture, is truly a gem among flowers. This is a good time for making cuttings of it. The best way to root them is in a bottle of rain water set in the window. The cuttings should be no deeper in the water than half way up to the second joint, and when the rootlets get to be half an inch long, carefully pot in rich, sandy loam. After the plant blooms, cut back to within a foot or fifteen inches of the ground, when three branches will come out; let them grow until it again blossoms, after which cut them all back about six inches from the main stalk, and every time it blooms repeat cutting back, and in a few years a very beautiful plant will be the result; in fact with proper care, it will grow more beautiful with age.

ARABESQUE CABINET.

The accompanying engraving represents a cabinet, in a style of the purest Arabic, made by the celebrated Parvis of Cairo, whose *atelier* is well known to all art lovers who have visited the interesting city of the East. This fine example of the cabinetmaker's skill is built of sycamore wood and ebony. It is inlaid with ivory and mother-of-pearl, in those highly effective patterns that are at once the admiration and the wonder of other nations. Every detail has been worked up and studied from the specimens of the best period of Arabic art. Nothing could be more effective than the result. There is but little carving—none indeed in high relief—and yet an effect has been produced more ornate than any carving. The richness of the tracery in the central panel is particularly fine, and taken as a whole it deserves commendation of the highest description. The possessor of such a piece of work as this cabinet would never tire of it, simply because the harmony of its parts would be constantly asserting themselves, and, like in a good picture, new beauties would constantly be revealing themselves.

This form of decoration, consisting of fantastic combinations of flowers, fruits, and branches, or, indeed, of almost any intertwinings of graceful forms and lines in a repetition of the same pattern, is a characteristic of Moorish architecture that has been given a distinctive name, arabesque. Ornamentation of this kind, either in sculpture or painting, has been found wonderfully effective; but it requires the exercise of the nicest discrimination.



ARABESQUE CABINET.

Coloring and Finishing Brass Work.

To prevent the every-day rusting of brass goods, the trade has long resorted to means for protecting the surface from the action of the atmosphere, the first plan of which is to force a change to take place. Thus, if brass is left in damp sand, it acquires a beautiful brown color, which, when polished with a dry brush, remains permanent and requires no cleaning. It is also possible to impart a green and light coating of verdigris on the surface of the brass by means of dilute acids, allowed to dry spontaneously. The antique appearance thus given is very pleasing, and more or less permanent. But it is not always possible to wait for goods so long as such processes require, and hence more speedy methods became necessary, many of which had to be further protected by a coat of varnish. Before bronzing, however, all the requisite fitting is finished and the brass annealed, pickled in old or dilute nitric acid, till the scales can be removed from the surface, scoured with sand and water, and dried. Bronzing is then performed according to the color desired; for although the word means a brown color, being taken from the Italian *bronzino*, signifying burnt brown, yet in commercial language it includes all colors.

Browns of all shades are obtained by immersion in a solution of nitrate or the perchloride of iron, the strength of the solution determining the depth of the color. Violets are produced by dipping in a solution of chloride of antimony. Chocolate is obtained by burning on the surface of the brass moist red oxide of iron, and polished with a very small quantity of blacklead.

Olive green results from making the surface black by means of a solution of iron and arsenic in muriatic acid, polished with a blacklead brush, and coating it, when warm, with a lacquer composed of one part lac varnish, four of turmeric, and one of gamboge.

A steel-gray color is deposited on brass from a dilute boiling solution of chloride of arsenic; and a blue by careful treatment with strong hydrosulphate of soda.

Black is much used for optical brass work, and is obtained by coating the brass with a solution of platinum, or with chloride of gold mixed with nitrate of tin. The Japanese bronze their brass by boiling it in a solution of sulphate of copper, alum, and verdigris.

Success in the art of bronzing greatly depends on circumstances, such as the temperature of the alloy or of the solution, the proportions of the metals used in forming the alloy, and the quality of the materials. The moment at which to withdraw the goods, the drying of them, and a hundred little items of care and manipulation, require attention which experience alone can impart.

To avoid giving any artificial color to brass and yet to preserve it from being tarnished, it is usual to cover properly cleaned brass with a varnish called "lacquer." To prepare the brass for this, the goods, after being annealed, pickled, scoured, and washed, as already explained, are either dipped for an instant in pure commercial nitrous acid, washed in clean water, and dried in sawdust, or immersed in a mixture of one part of nitric acid with four of water, till a white curd covers the surface, at which moment the goods are withdrawn, washed in clear water, and dried in sawdust. In the first case the brass will be bright; in the latter, a dead flat, which is usually relieved by burnishing the prominent part. Then the goods are dipped for an instant in commercial nitric acid, and well washed in water containing argol (to preserve the color till lacquered, and dried in warm sawdust. So prepared, the goods are conveyed to the lacquer room, where they are heated on a plate and varnished.

The varnish used is one of spirit, consisting, in its simple form, of one ounce of shellac dissolved in one pint of alcohol. To this simple varnish are added such coloring substances as red sanders, dragon's blood, and annatto for imparting richness of color. To lower the tone of color, turmeric, gamboge, saffron, Cape aloes, and sandarac are used. The first group reddens, the second yellows the varnish, while a mixture of the two gives a pleasing orange.

A good pale lacquer consists of three parts of Cape aloes and one of turmeric to one of simple lac varnish. A full yellow contains four of turmeric and one of annatto to one of lac varnish. A gold lacquer, four of dragon's blood, and one of turmeric to one of lac varnish. A red, thirty-two parts of annatto and eight of dragon's blood to one of lac varnish.

Lacquers suffer a chemical change by heat and light, and must therefore be kept in a cool place and in dark vessels. The pans in use are either of glass or earthenware, and the brushes of camel's hair with no metal fittings.—*Ironmonger's Review.*

The National Museum.

Hidden from sight by the noble trees which make the Smithsonian grounds the pleasantest retreat in Washington is a large but modest brick structure, which, when it shall be completed and filled with the treasures now hidden away in packing boxes, will be one of the finest museums in the world. For the past three years Professor Baird has worked for this building with great energy and perseverance, and last winter Congress rewarded his efforts with an appropriation of $250,000. A model of the new building, which is displayed in the main corridor of the Smithsonian Institute building, shows a square, red-brick building, all but the central part one story high. "The idea of the building," writes Professor Baird, "is due to General Meigs, although the details and special adaptations were worked out by Messrs. Cluss & Schultz, the architects, the principal feature being the arrangement of everything on one floor of a square building of great extent, in which there shall be no interruption to the drainage of the water from the center of the roof to the exterior. I do not know an edifice constructed precisely like our new building, and I am confident that it will make a new era in public architecture in its economy of space combined with a minimum of expense, being at the same time entirely fire-proof."

The building is relieved by the straw-colored Milwaukee and blue-faced brick, and the Ohio sandstone lintels and cornices. Between the arched windows are bosses of stone with foliated ornaments. The supports of the roof are substantial brick columns, and the interior is arranged to utilize all the space possible for the exhibition of specimens. It is intended that the new building shall be devoted more particularly to industrial exhibits, the natural history objects being retained in the Smithsonian where they now are. Special space will be given to the display of mineral wealth, arranged by States, counties, and mines. There will also be a complete exhibit of the American fisheries, showing every imaginable device for the pursuit, capture, and mode of preservation of the inhabitants of the waters. Plaster and *papier maché* casts of fishes and other aquatic objects will be exhibited, and illustrations of every preparation of fish for food.

Under the law the National Museum receives all specimens and objects of interest that are gathered by persons in the employ of the government, but with all its advantages in this respect the museum has been up to a short time ago but a weak and struggling adjunct of the Smithsonian, but little known or appreciated. In 1875 there was, as the annual report expresses it, "a sudden and abrupt augmentation," which culminated in 1876 after the close of the Centennial Exhibition. The exhibits of foreign countries, of States, and of individuals were kindly given to it, and the armory building is literally packed with the boxes containing the specimens which have been presented or bought with the $100,000 appropriated to the museum to enable it to make a creditable showing at the Centennial. When properly arranged this wealth of curious and beautiful objects will fill the building going up, leaving the collection now in the Smithsonian as it is.

A week or more might be profitably spent in Washington, even when Congress is in session, by examining the collections in the National Museum. The domestic exhibit is almost perfect. The exhibit of fishes is quite complete, Professor Baird being at the head of the Fish Commission. The day of stuffed animals has gone by, and most of the specimens are plaster casts, with the colors copied from nature. The birds and reptiles of the country are almost completely represented, and there are a few skeletons of mastodons, large turtles, American elephants, Irish elks, and other creatures of a primeval age, with here and there one of Waterhouse Hawkins's clever reproductions.

The method of arranging industrial exhibits needs but one illustration. The Alaska Fur Company has supplied the institution with specimens of the skin of the seal in every step of its progress, from the rough protecting coat of the animal to the luxurious over-garments of fashion. First, there is the rough skin, a grayish fur with a blacker hair marking the course of the backbone, and stretching out, finger-like, toward the fins; then the plucked skin, all gray, the black hairs having been removed; then the dressed skins, and then the rich lustrous black fur ready to be made into garments. This is the method of showing the stages through which the seal's skin passes. The same method is employed with all the products of the country which can be treated in this way. The silver is traced from its embedding ore to the shining "dollar of our fathers," and we can follow the duller iron from its rocky surrounding into the most useful of metals.

Back through the longer halls is a room in which is gathered some of the pottery brought from the Centennial. A great group in clay, representing the "Progress of America," stands in the center, and on either side a pulpit and baptismal font of Doulton ware, while in cases around the room are grouped specimens of the pottery of different countries. A huge Japanese punch bowl of blue, with figures of flying pigeons engraved upon it, is a wonderful specimen of Japanese art. One end of the room is devoted to the clay models of the houses of the cliff and cave dwellers of our extreme southwestern country. Most of these casts were made by the Hayden Survey.

On an upper floor of the present building is the ethnological collection, one of the finest in the world, and without question the richest in the world in illustrations of American ethnology. The Indians of the country are almost completely represented in their pottery, dresses, ornaments,

weapons, and stone implements. Here is another specimen of Japanese art in the shape of four beautiful figures, two of a nobleman and lady, richly dressed, and smirking at each other with the conventional theatrical expression of the Japanese. The other two are of an old farmer and his wife. These figures make a striking contrast with the Chinese figures in the case beyond. Among the African exhibits may be seen the charms and fetishes, as dear and dread to the negro of to-day as they were to his fathers in the jungle, worn even now by the negroes of Washington after generations have lived and died since their ancestors were brought from their barbarian homes.

These specimens of the different ages of the various human races are worked upon by skilled ethnologists, and every year something is added to the history of ancient man by Professor Foreman and his assistant, Mr. Cushing. The latter is now among the Pueblo Indians studying their customs and laws, and living their life as one of them. It is the most reticent of all the tribes of that reticent race, and if Mr. Cushing secures their confidence it will be more than any one has yet done.

When the new building is up it will not only give the public an exhibition worthy of the country, but it will add tenfold to the facilities of the gentlemen connected with the Smithsonian who are following in the footsteps of Professor Henry, and adding greatly to the sum of human knowledge by their original investigations. The time will soon come when another building, a companion to the one now erecting, will be demanded. The plan is to build it at the other end of the Smithsonian, so that the three will form a symmetrical whole.—*New York World.*

The Law of Dust Explosions.

The cause which produced the explosion of Greenfield's large candy factory, in this city, two years ago, has remained a mystery from that day to this. Many experts insisted, and the *Insurance Monitor*, from which we give the following facts, indorsed the theory, that the cause of the disaster was to be found in the almost impalpable dust arising from the starch used in the manufacture of candy; that the explosive properties of the flour mill were shared by these risks, and the same agent, viz., starch or flour, was active in each. But the fire marshal, after an investigation extending over several months, declared his inability to discover the cause of the accident. An explosion in another factory of the same kind last month has apparently furnished a solution of the mystery The circumstances connected with this case were well observed. The drying-room, containing the candies stored on shelves, had a temperature of about 160 degrees Fahrenheit. Near the center stood a red-hot furnace. A workman engaged in removing the candies stumbled, upsetting the trays he was carrying, and sending a cloud of fine starch powder over the furnace. An explosion followed instantly, attended by a body of flame rising from the stove, filling the room, and, pouring through the open door, setting fire to the building. The flames were fortunately extinguished before serious damage had been done, except to the workmen in the room, but this practical illustration of the explosive action of powdered starch was worth more than all the theories and scientific discussions that have been advanced on this subject.

It is one thing to know that powdered starch contains explosive properties, and quite another to know that the conditions under which such an explosion will occur may be present in the factory. The case illustrates the remarks we made on this subject a few months since. It is not essential to an explosion of this kind that the pulverized dust be distributed in explosive proportions through the whole body of the air. All that is needed is that a sufficient body of the dust be ignited to produce a volume of flame. This will fire the remaining dust scattered through the room, even though comparatively small in quantity. We find the law illustrated in our every-day experience when kindling an ordinary fire. The wood will not catch from the small light of a match, but requires a body of flame induced by kindlings. The gas in the cellar does not explode from the light which is carried through it until a body of it is met with mixed air in explosive proportions; then the flame that is generated lights the whole. The same was true in the Washburn Mill. The flour dust which created the explosion was small in quantity from a single hopper, but the flames, once kindled, flashed through the dust of that entire portion of the mill. So in the Greenfield factory. Employes in the portion where the explosion occurred describe a sudden flash of light preceding the explosion.

All these cases show that in every factory and mill where the air is permeated with powdered starch, whether a candy factory or flour mill, the sudden generation of a volume of flame may produce an explosion throughout the whole. The prominent point of danger is the starting point of the fire.

Underwriters should understand that an intensely heated stove or furnace in such establishments is a special source of danger, and such stoves should be placed where there is no exposure to a body of dust. An instructive experiment may be made by taking a handful of finely-powdered starch and allowing it to descend in a cloud on a heated furnace. The result will be an explosion such as occurred in these factories. Take another handful and throw it bodily on the fire, and there will be only an ordinary combustion. In the one case we have the light kindlings ready to burst into flame, in the other the solid stick of the same material slowly consumed. If the explosive character of flour dust remained in doubt before, the experience of this New York candy factory has finally settled the question.

The Climate of Europe.

Naturally the bad season in Europe calls out no little speculation in devising replies to the very common query, "What ails the weather?" A French writer seriously argues that the climate of France, at least, is deteriorating. The argument is based on historic as well as prehistoric phenomena. For instance, the nakedness of the ancient Gauls is attributed not to their barbaric condition, but to the circumstance that they enjoyed a charming climate, which rendered clothing a mere superfluity. Passing, however, to facts which may be regarded as authentically ascertained, Arago is quoted as remarking that in his day the vine was no longer cultivated on the shores of the "Gulf of Bristol," or in Flanders, or in Brittany; and that those countries which, according to old chronicles, one produced exquisite wines, no longer yielded ripe grapes, unless the season were exceptionally favorable. Then it is mentioned that, according to certain title deeds of property going back to 1561, on the mountain slopes of the Vivarais, where now the vine crops of grapes used to be gathered at the height of 600 meters no longer bears fruit. Again, in the neighborhood of Carcassonne, the cultivation of the olive has receded some 15 or 16 kilometers to the southward from the latitude to which it extended a hundred years ago. The sugar cane has disappeared from Provence, where it had been acclimatized. The orange trees of Hyeres, the cultivation of which extended in the sixteenth century as far as the village of Cuers, have been smitten with disease under a sky which is no longer favorable to their growth, and have had to be replaced by hardier fruit trees, such as peaches and almonds. In the Swiss Alps the ice line has invaded summits formerly covered with magnificent forests, of which the massive trunks and sturdy roots are still found *in situ*. In Germany the vegetation of the steppe shows itself in our own day in the midst of tracts formerly fertile. All botanists have remarked this; and in support of their observations the meteorologists prove by daily, monthly, and yearly averages of temperature that cold has perceptibly increased in those regions. Iceland and Eastern Greenland have become much colder since the fourteenth century; for in the former large trees have ceased to grow, while on the opposite shores of the latter a great number of valleys, once inhabited, are now completely inaccessible, owing to the intrusion of glaciers. Not to multiply instances, continues this writer, interrogate the old men, and none of them will find in the recollection of his youth rigors analogous to those we now endure. Within human memory one has never before seen snow cover on the 15th of May the plateaux of Central France. Formerly winter was a sort of sequel to autumn, and spring gradually glided into summer; but nowadays the hoar frosts commence in October and last to the first days of June.

Waste of Petroleum.

A press dispatch from Bradford, Pa., dated October 2, estimated that as much as 150,000 gallons of petroleum was running to waste every day in the McKean County oil regions. The tanks, with capacity for several million barrels, were filled to overflowing. The market was overstocked, and still production went on at the rate of at least 25,000 barrels a day, 5,000 more than the pipe lines could handle. The United Tidewater Pipe Lines had iron tankage in the Bradford districts for 3,000,000 barrels of oil, and were able to take care of all the oil of individuals and companies owning tankage in connection with them. The heavy loss fell chiefly on small producers, who could not afford to build tanks. All the streams of McKean County were literally rivers of oil; and in the marshy places the ground was a mass of greasy mud several inches deep.

In some parts of the region the streams were dammed and the oil collected in large ponds, at places as far distant as possible from derricks and buildings. These ponds were set on fire daily. Thus a large quantity of the waste oil was disposed of. It was not uncommon for fire to be communicated to the combustible rivers by sparks from locomotives. Sometimes they were fired by malicious persons and tramps. Derricks and other property had thus been destroyed, resulting in losses of thousands of dollars. All efforts to limit the production of oil and stop this great waste had been unavailing; and though the overproduction was excessive, new wells were going down in all parts of the district.

Origin of Language.

A Frenchman named Clairefond has published a small work in which he revives the argument that the earliest attempts at human speech were imitations of natural sounds or the cries of animals; and he contends that out of recollections and repetitions of those sounds the names of certain natural phenomena, and of animals and other objects, originated. He finds numerous examples in the French language, and thinks that proofs might be found in other languages if search were made, and suggests that the Geographical Society of Paris might furnish instructions to their travelers to collect from among the natives of different countries all the sounds traceable to the source indicated above. M. Clairefond is of opinion that the series of sounds, words, and expressions thus collected would aid in the discovery of the origin of language. Taken in connection with natural sounds, the origin of words in our own language—such as thunder, sigh, whisper—becomes evident.

Washing Powders.

Hager, in *Phar. Centralhalle*, gives the following analyses:

The so called *English Washing Crystal* is an impure, half-efflorescent crystallized soda, containing a large proportion of sulphate of soda and common salt.

Under the name of *Washing Crystals* simply a filtered solution of borax and soda has been introduced.

The *English Patent Cleansing Crystal Washing Powder* is a half-efflorescent soda, containing about twenty-five per cent of Glauber's salts.

The *Washing and Cleansing Crystals* (Harper Twelvetrees and Sons) are pure crystallized soda, with one to two per cent of borax.

Krimmelbein's *Wool Washing Composition* is a mixture of thirty-five parts of dried soda, ten parts of soap powder, and ten parts of sal ammoniac.

Ward's *Wool Washer* is a mixture of ninety parts of effloresced soda crystals, with ten parts of soap powder.

The *Universal Washing Powder* (Henkel's) is a water-glass containing soda, with a small percentage of tallow soap and starch powder.

Hudson's *Soap Extract* is a mixture of crystallized soda and soda soap, containing water (soap 14·3, anhydrous soda 30, and water 55).

A washing powder for the finest white linen is a powdery mixture of ninety parts of effloresced soda, with ten parts of hyposulphite of soda, and two parts of borax.

The so-called *Finest Brilliant Elastic Starch* is a mixture of about seven to eight parts of stearine, with one hundred parts of wheaten starch (melted stearine is mixed with about fifteen times its weight of starch, and after cooling powdered and combined with the rest of the starch).

The *Berlin Prepared Brilliant Dressing Starch* is good wheaten starch mixed with two to two and a half per cent of borax.

Brilliant Relief Printing.

This interesting invention, which is claimed by several manufacturers, and especially by Thuillier, of Rouen, and Petit-Didier, of St. Denis, has been applied since 1866 to silken tissues, which are scattered over with brilliant points in relief, and of different colors so as to imitate embroidery. This style, which produces very pretty effects in a very economical manner, has had a very extraordinary demand. It is executed with a resinous matter, either colored or left colorless, which is deposited upon the tissue in melted drops by means of a plate engraved in relief. On cooling, these drops acquire hardness enough to form, so to speak, a part of the tissue and to resist friction.

Depouilly and Meyer have devised something analogous for fixing upon very light tissues, like tulles, brilliant drops in relief, which by their limpidity recall pearls or precious stones. They are obtained by means of gelatine or gums deposited while liquid by means of pins arranged symmetrically. This style has been named "diamond tulle."—*Teinturier Pratique.*

Manufacture of Clothing.

It is estimated that 50,000 men and women are employed in Philadelphia in the manufacture of clothing, and 20,000,000 suits are made there every year. Cutting machines are gradually finding their way into all of the large manufacturing establishments of the city. The machines have a capability of cutting nearly eighteen hundred garments in a day of twelve hours, or about equal to the combined results of the labor of eight men. Buttonholes also can be worked by machinery at the rate of one hundred and eighty per hour, while by hand it would take the same period to complete three holes. By the cutting machines folds of cloth forty ply thickness can be easily cut through. An instance of the value of machinery in expediting manufacture is afforded in the fact that the establishment where cutting and buttonhole machines are used turns out one hundred suits ready for wear inside of twelve hours.

Ancient Glass.

The London *Saturday Review* is of the opinion that the oldest specimen of pure glass known is a little moulded lion's head, bearing the name of an Egyptian king of the eleventh dynasty, in the Slade collection at the British Museum. It was probably fashioned more than 2,000 years B.C., and the skill displayed in it is sufficient evidence that the art of glass making was not then in its infancy. Glazed pottery and beads as old as the first Egyptian dynasty have been found.

Of later glass there are numerous examples, such as the bead found at Thebes, which has the name of Queen Hatasoo or Hashop, of the eighteenth dynasty. Of the same period are vases and goblets and many fragments. It cannot be doubted that the story prepared by Pliny, which assigns the credit of the invention to the Phœnicians is so far true that these adventurous merchants brought specimens to other countries from Egypt. Dr. Schliemann found disks of glass in the excavations at Mycenæ, though Homer does not mention it as a substance known to him. That the modern art of the glass blower was known long before is certain from representations among the pictures on the walls of a tomb at Beni Hassan, of the twelfth Egyptian dynasty; but a much older picture, which probably represented the same manufacture, is among the half obliterated scenes in a chamber of a tomb of Thy at Sakkara, and dates from the time of the fifth dynasty, a time so remote that it is not possible, in spite of the assiduous researches of many Egyptologers, to give it a date in years.

Business and Personal.

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

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NEW BOOKS AND PUBLICATIONS.

LECTURES ON POPULAR AND SCIENTIFIC SUBJECTS. Trubner & Co., London.

It is not often that a member of the English House of Lords takes sufficient interest in scientific and mechanical matters to write and lecture on these subjects. The Earl of Caithness, author of the above work, is unlike in this respect most of the members of the English Parliament, and it is perhaps to this fact that the volume before us possesses increased interest. The work is composed of several chapters devoted to such subjects as Coal and the Coal Mines of Great Britain; Science applied to Art; Past and Present Means of Communication; The Steam Engine, etc. The chapter on coal and coal mining, with the author's graphic description of the dangers and hardships of the miner's life, and his detailed account of the *modus operandi* of excavating and raising the coal to the surface, is of special interest. The author has visited this country several times, and while here spent considerable of his time among our manufacturing establishments and machine shops, investigating and studying into our ways of conducting industrial enterprises of all kinds. Lord Caithness takes a lively interest in all new inventions, and is the patentee of several ingenious contrivances, some of which have been illustrated in this paper. He was among the first to introduce steam plows and other agricultural machinery operated by steam. The Earl of Caithness owns large estates in the northern part of Scotland, where the producing season is short, hence the necessity, as well as his taste for new improvements, impels his adoption of the best and quickest working agricultural machines that are made.

ELECTRO-MAGNETS.—The most minute, complete, and practical description of electro-magnets and their armatures ever printed, illustrated by 51 engravings. SUPPLEMENT, No. 182. This article describes every known form of electro-magnet, and contains full directions for making magnets for telegraphic instruments, call bells, electric engines, experimental purposes, etc., giving method of winding; the proper size of wire for magnets for different purposes; the resistance of wires; the method of calculating the strength of electro-magnets; proportions of armatures; arrangement of polarized armatures, and other items of valuable information.

ELECTRICAL CABINET.—Directions for making a few pieces that may be arranged in several different combinations, forming a great variety of interesting and instructive instruments, including an electro-magnet; two keys and sounders; a call bell; an electric motor; a magneto machine; an induction coil; an interrupter; a telephone; a microphone; an electrical pendulum; a galvanometer, and other interesting and amusing pieces of apparatus. In SUPPLEMENT No. 191.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) N. C. writes: In SUPPLEMENT, No. 105, page 167, Dr. D. C. Chapman gave directions for silvering on glass which does not work for me. You will oblige an old subscriber by directing him where or how the process of silvering and gilding on glass can be learned—the kind of work that is done on patent medicine cards and signs. If there is any book that will give the desired information, please give title and place where it can be procured. A. Your failures were probably due to lack of manipulative skill. Consult Collingham's "Sign Writing and Glass Embossing" and "The Painter's and Gilder's Companion." Address the booksellers who advertise in these columns.

(2) C. V. asks how to color horn any color. A. Horn may be dyed a great variety of colors by means of hot solutions of the aniline (coal tar) dyes.

(3) C. T. G. asks: 1. What kind of cement or compound can I make or procure cheaply, that will do, in place of fire brick, in furnaces subjected to much internal wear and great heat? A. Use a mixture of 200 parts fine clay (kaolin), 80 parts quartz sand, and one part iron oxide, passed through an 80 mesh sieve and made into a smooth paste with water. Must be dried slowly. 2. What books are the best for the purpose of self learning assaying and metallurgy? A. Address the booksellers who advertise in these columns.

(4) P. V. Q. asks how to prepare a cement for hard rubber. I wish something that will resist the action of the solution composing a photographer's bath. A. Melt together equal parts of pitch, gutta percha, and orange shellac. Use hot, and press the parts firmly together until the cement has hardened.

(5) T. E. C. asks if there is any known gas, when exposed to the air, or common coal gas, that will take fire. If there is any such, please tell me what it is, and how made. A. Phosphureted hydrogen inflames spontaneously on contact with air. It may be prepared by boiling together in a small retort caustic potassa or slaked lime, water, and scraps of phosphorus. The beak of the retort should dip beneath the surface of water, and the air in the retort should be carefully displaced by carbonic acid or coal gas before heat is applied, otherwise an explosion may occur. The gas is slightly soluble in water, possesses an odor resembling garlic, and burns in air with a very brilliant white flame, forming water and phosphoric acid.

(6) E. C. writes: 1. In answer to D. H., on February 23, 1878, page 124 (27), you give a cement for leather, made of equal parts of pitch and gutta percha, to be softened with naphtha. How is the naphtha mixed with it, and in what is the proportion? A. Cut the cooled mixture into shreds, cover with naphtha, and keep in a warm place (away from fire) until properly softened. 2. Can I clean leaves of books without injuring the leaves or print? A. Press between the leaves strips of clean blotting paper (white) previously moistened with strong clear solution of bleaching powder (calcium hypochlorite) in cold water. When properly bleached remove traces of adhering "bleach" with moist blotting paper moistened with water containing a trace of sulphite or hyposulphite of soda.

(7) J. C. asks for instructions as to electroplating with nickel and silver. The articles to be plated are such as are described in SCIENTIFIC AMERICAN of August 16, 1879 (brass and Britannia spun articles). I want to know how to make a battery, what chemicals are used, and how long the articles are left in. In fact I want to know the whole process. A. You will find a comprehensive article on nickel plating, on p. 209, vol. 38. See also pp. 76 (23), 139 (27), 219 (6), 250 (14), 251 (56), and (61), same volume. For description of batteries see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 157, 158, 159, and 167, p. 208 (21), current volume SCIENTIFIC AMERICAN.

(8) H. G. writes: 1. I intend to build a boat about 20 feet long, with two engines, diameter 1½ by 3 stroke, 350 revolutions, 75 lb. pressure. How can I obtain the most speed, by using a screw or side wheels? A. A screw. 2. Please give dimensions of screw. A. About 15 or 16 inches diameter. 3. Which is best, wood or tin, for hull? A. Wood. 4. Will I need license for her? The engines are plain slide valve engines. A. Yes. Apply for information to the steamboat inspectors of your district. 5. Inclosed find a puzzle that I can't get any one to solve. A. The puzzle is the old well-known square puzzle. The loss or gain of one square is owing to a cause which you will discover when you measure the squares accurately in both positions.

(9) W. D. R. asks for a cement which will repair a broken meerschaum pipe, the fracture being where it is thoroughly saturated with nicotine. A. Moisten fine zinc oxide with a hot saturated solution of zinc chloride to form a thin paste. Use hot, and press the parts firmly together until the cement has hardened.

(10) J. N. B. asks (1) how the dark spots can be made on horn to make it represent tortoise shell. A. Use a strong aqueous solution of silver nitrate mixed with gum arabic so as to flow properly from a brush. A little red lead may be mixed with it to give it body. After standing an hour soak in soft water for several hours before finishing. Pieces of horn may be united by softening the edges with boiling water and then submitting to powerful pressure while surrounded with boiling water. 2. Where can loadstone be obtained? A. Loadstone or magnetite may be obtained of any mineralogist. Immense bodies of it occur in Northern New York State.

(11) T. M. J. writes: 1. I am sinking a shaft in a coal mine 150 feet deep. At 100 feet from the bottom I have struck a spring making 2 barrels of water per hour. As I am going to place a boiler (and engines) at the bottom of the shaft, to haul coal, would the 100 feet be full enough to force the water into the boiler in any way, and how? A. If your boiler pressure is much over 40 lb. you cannot do it without the aid of a force pump. 2. How great a pressure of steam could the water be forced against by its own weight? A. About 40 lb. pressure. 3. If we place a tank at the spring, would a large pipe be better than a small one (or any advantage) in leading the water down to the boiler? A. There will be no advantage in using a very large pipe, but it must be large enough to supply whatever pump you may use.

(12) S. E. P. asks: What is meant by the term "ohms," so often used in describing electric apparatus? A. An ohm is the unit of resistance to the passage of an electric current. It is about equal to a cylindrical wire of pure copper, one twentieth of an inch in diameter and 350 feet in length, or of 330 feet of iron wire 0·155 of an inch diameter.

(13) W. H. S. asks: What will remove old putty from old sash (wood sash, of course)? I want something that will do it quick and not break the glass, as I am liable to with a hot iron. Is there an acid that I can use that is quick in its action and cheap? A. We know of nothing better than the iron.

(14) C. B. L. asks how to get rid of fleas in the house? They were first noticed in the garret, but have since spread themselves through the house, and are a perfect pest. A. Try placing sprigs of pennyroyal in different places around the house, or sprinkle essence of pennyroyal about.

(15) W. E. F. writes: In No. 196, SCIENTIFIC AMERICAN SUPPLEMENT, you state that "starch boiled long in water is transferred into 9-10 dextrose and 1-10 dextrin." Will you please state what these two articles are? Are they insoluble in water? Can they be deposited in paper pulp or in textile fabrics with alum or acid, or would the union be mechanical, if any, and be washed out with the water? Will it add to the finish of the articles? Are they like a gum or paraffine? A. Dextrine is British gum, used as a substitute for gum arabic on postage stamps and envelopes. Dextrose—dextroglucose—ordinary glucose or grape sugar (starch or corn sugar). Both of these are quite soluble in cold water, and both are commercial articles. The former is extensively used for sizing cotton goods.

(16) A. C. E. writes: 1. I have a 36 gallon barrel, a pipe 3 inches diameter, 7 feet long. If I raise the barrel 7 feet, and tap in bottom with pipe, can I get 20 lb. pressure at bottom of pipe to run a 11-inch Backus water motor, using ¾ inch jet? A. No; you will have but 4 lb. pressure. 2. How can I fill the barrel or keep it full? A. Pump up the water into your barrel. To get 20 lb. pressure you must raise your barrel about 44 feet above the lower end of the pipe. Cannot you catch water from the roof of some building?

(17) G. H. writes: We experience difficulty in getting sound brass castings when cast on iron pump plungers etc. Can you suggest a remedy? A. The iron should be clean and free from rust, and before placing in the mould it should be warmed so that no moisture will condense on it.

(18) H. F. J.—The plant you send is the dog fennel (*Eupatorium faniculaceum*, Willd.), a common weed in fields and damp soils, ranging from Virginia to Florida.

(19) M. O. asks (1) how to test the purity of castor oil. A. Castor oil is sometimes adulterated with rape seed oil; this may be detected by its not dissolving in strong alcohol and also by its diminished density. Pure castor oil is soluble in an equal weight of alcohol specific gravity 0·82. 2. How can I purify and sweeten castor oil? A. Take 1,000 parts of the oil, 25 parts of purified bone black, 10 parts of calcined magnesia. Mix them carefully in a vessel of glass or tinned iron, and let it stand for three days with occasional agitation, then filter through paper or felt.

(20) E. S. F. asks for the processes for blacking or browning gun barrels. Is there any process that an amateur can apply other than by heating, that is, by means of acids or other chemicals? A. To give iron a blue tint, apply nitric acid, and allow it to act until the iron is covered with a thin film of oxide, then wash the barrel dry and oil it. To give it a brown color, dissolve 2 parts of chloride of iron, 2 parts of chloride of antimony, and 1 part of gallic acid, in 4 parts of water; apply to the barrel with a sponge, and allow it to dry. Repeat the coating until the desired color is attained. Wash with water, dry, and finally rub the surface with boiled linseed oil. The chloride of antimony should be as nearly neutral as possible.

(21) E. T. W. asks: What will prevent boiler tubes from leaking? I have a good tube expander, and can expand them so as to prevent leaking until the furnace begins to cool down, then they will leak as long as any steam is in the boiler. The tubes are 3 inch, and the boiler of the locomotive style, and the water we are using strongly impregnated with sulphur or other mineral. A. It is possible that the sulphuric acid in the water is the cause of your trouble; if so, the addition of carbonate of soda to the water will counteract the effect. Locomotive engineers sometimes stop such leaks by introducing through the supply pipe or hand hole a small quantity of cotton waste (lint). The escape through the leak soon carries the cotton to that point and plugs the aperture. Bran and meal are also used for this purpose.

(22) C. L. B. writes: I notice in No. 160 of the SCIENTIFIC AMERICAN SUPPLEMENT, a cheap induction coil. 1. What would such a machine cost? A. $35 to $40. 2. Could it be improved upon by winding the primary in sections, and so increasing the magnetism of the core of iron wires? A. We think not. 3. Would a larger core of iron wires be beneficial? A. No. 4. Would it heighten the effect if with the same amount of wire a shorter and thicker coil should be made? A. No. 5. Would it improve it to increase the condenser? A. It would be well to have a large condenser made in sections, so that more or less of it might be used.

(23) A. P. asks: Can you tell me what cheap material I can use to unite coal broken very small, and coal dust, to make it in the shape of bricks or blocks that would bear transportation on wagons or cars, without breaking? A. A mixture of hot tar (bitumen or asphaltum) and dry clay has been successfully employed for this purpose, we believe.

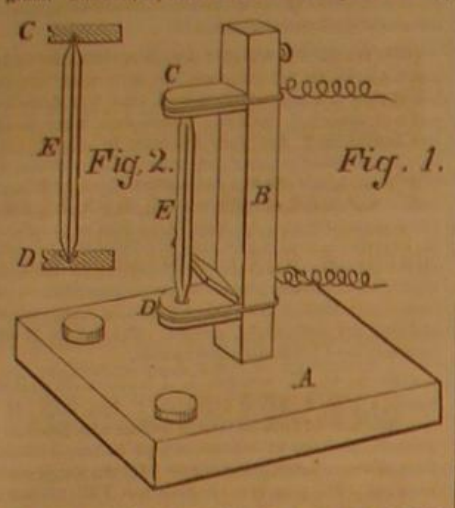
(24) F. H. writes: Some time ago I saw in your paper an item about barometer handkerchiefs, so-called because the device printed on them changes color as the weather changes. Won't you please tell me how to put the device on? What chemical shall I use? Can I do it with an ordinary printing press? A. Use a dilute solution chloride of cobalt and dextrine. Try applying it with a rubber stamp.

(25) C. L. W. writes: In SCIENTIFIC AMERICAN SUPPLEMENT, No. 149, you describe a battery in which a flower pot is used for the porous cell. Would such a battery do for an electric call bell, on a fifty foot

circuit, and if so, how many cells would be needed? A. The battery referred to will answer very well; but the Fuller battery, described in SUPPLEMENT, 159, would be much better for the purpose named.

(26) L. asks whether an ice boat in any circumstances can sail faster than the wind which propels it, and if it can, why? A. For a full explanation of this subject you are referred to SUPPLEMENT, Nos. 54 and 61.

(27) G. M. G.—A Hughes microphone of simple construction is shown in the accompanying diagram. The box, A, which is six inches square and 1¼



inch deep, is made of pine, the sides being ¼ inch thick and the top ⅛ inch thick. It has no bottom. The post, B, also of pine, ⅝ inch square and 5 inches long, is secured to the middle of the top of the box by a screw passing upward from below. The carbon ears, C D, which hold the carbon pencil, E, are secured to the standard, B, by fine copper wires wound in the groove in the edge of the carbon and around the standard, B. These wires are connected with a battery and a telephone, or with a battery and the primary wire of an induction coil, the secondary wire of the coil being connected with a telephone. The cavity in which the lower end of the carbon pencil rests has a much wider angle than the end of the carbon pencil. The cavity which receives the upper end of the carbon pencil is nearly of the same form as the end of the pencil, fitting it loosely, however, so that it may be free to vibrate. The form of the carbon pencil and of the cavities in carbon cars may be seen in Fig. 2. The carbon pencil is 3 inches long and ¼ inch in diameter. It may be either round or square. Battery carbon answers well for this purpose. Between the carbon, E, and the standard, B, there is a piece of ordinary felt, which may be pressed down more or less to modify the action of the microphone. Two disks of felt are glued to the box cover for receiving the ends of tuning forks. A pin projects from the back of the standard, B, to receive a small clock or watch. When it is desired to hear the tramp of insects they are placed in a paper pill box, which is secured to the top of the standard, B, by means of an ordinary pin.

(28) A. L. writes: I have every year a quantity of acid fruit which might be used in the manufacture of citric acid, but it is now allowed to waste. Can you give a simple process for making citric acid? A. Citric acid is generally manufactured from lemon juice, which is imported in a concentrated state, produced by evaporation by a gentle heat. It consists of citric acid 6 to 7 per cent, alcohol 5 to 6, and the remainder water, inorganic salts, etc. By some manufacturers it is allowed to partially ferment for the purpose of evaporating the clear liquor from the mucilage, or it may be clarified in the usual method by the use of albumen in the form of the white of an egg. Carbonate of lime in fine powder is then gradually added, and stirred in so long as effervescence continues. Citrate of lime forms, and after being separated by drawing off the watery liquor is well washed with warm water. It is then ultimately mixed with strong sulphuric acid diluted with 6 parts of water. After some hours the citrate is decomposed, the sulphuric acid having taken up the lime and formed an insoluble sulphate, setting the citric acid free. This, separated by decanting and filtering, is evaporated in leaden pans till it attains the specific gravity 1·13. The evaporation is afterward continued by a water or steam bath till the liquor begins to be sirupy, or to be covered with a thin pellicle. It is then removed from the fire, and put aside to crystallize, the mother liquor after a few days being evaporated as above, and again set to crystallize, and so on as long as clear crystals are obtained. To obtain pure citric acid, all the crystals should be redissolved and recrystallized, it may be several times, and the solution digested with bone black. A gallon of lemon juice should make about eight ounces of crystals. Limes and lemons constitute the source from which citric acid is generally made, yet it may be extracted from oranges, currants, gooseberries, raspberries, tamarinds, etc. The machinery and cost of manufacture will depend upon circumstances which any one about to go into the business can best judge.

(29) E. J. M. asks for directions for whitewashing. A. Well wash the ceiling by wetting it twice with water, laying on as much as can well be floated on, then rub the old color up with a stumpy brush and wipe off with a large sponge. When this is done, stop all the cracks with whiting and plaster of Paris. When dry, claircole with size and a little of the whitewash. If very much stained, when this is dry, paint those parts with turps, color, and, if necessary, claircole again. To make the whitewash, take a dozen lb. of whiting (in large balls), break them up in a pail, and cover with water to soak. During this time melt over a slow fire 4 lb. common size, and at the same time, with a palette knife or small trowel, rub up fine about a dessertspoonful of blue black with water to a fine paste; then pour the water off the top of the whiting, and with a stick stir in the black; when well mixed, stir in the melted size and strain. When cold it is fit for use. If the jelly is too stiff for use, beat it well up and add a little cold water. Commence whitewashing over the window, and so work from the light; lay off the work into that done, and not all in one direction as in painting. Distemper color of any tint may be made by using any other color instead of the blue black—as ocher, chrome, Dutch pink, raw sienna for yellows and buff; Venetian red, burnt sienna, Indian red, or purple brown for reds; celestial blue, ultramarine, indigo for blues; red and blue for purple, gray, or lavender; red lead and chrome for orange; Brunswick green for greens.

(30) W. H. L. asks (1) for directions for making an induction coil to produce a spark ¼ inch long, or simply give the sizes and quantity of wire. A. On page 208, volume 39, SCIENTIFIC AMERICAN, directions are given for making a small induction coil. If to this coil is added a condenser, consisting of four or six square feet of tin foil, a spark ⅛ inch or more in length may be produced. 2. Will cotton covered wire do if each layer is thickly coated with shellac? A. Yes.

(31) C. A. W. asks: 1. What are the proportions of peroxide of manganese and carbon in the Leclanche porous cup? A. About equal parts. 2. What is the difference between the Prud'homme and the Leclanche batteries? A. The porous cell in the Prud'homme battery is filled with carbon only.

(32) G. M. B. sends us the following, clipped from the N. Y. *Evening Post*, and asks if the reply is correct:

"*To the Editors of the Evening Post:*

Will you tell me if an ice boat can possibly go faster than the wind? L. R. W.

School of Mines, Columbia College, New York, October 1, 1879.

[Yes, if it is carried upon a fast express train when the wind is not high. If you mean to ask whether or not an ice boat can sail faster than the wind which propels it, the answer is no, and a member of the School of Mines should be ready with a demonstration of the fact.—EDS. *Evening Post*.]"

A. The reply is incorrect. In all cases, excepting when the wind is directly astern, it is possible to sail faster than the wind. The fact is so well known that we wonder that it has escaped the notice of the editor of the *Evening Post*. By referring to SUPPLEMENTS 54 and 61 you will find a full explanation of this apparent anomaly.

(33) F. W. W. writes: A tree is 30 feet in length and of uniform thickness. Where should a lever be placed so that two men at the lever and one at the other end would carry equal parts? A friend says 7½, I say 10. Am I correct? A. Your friend is right: 7½ feet.

(34) E. N. asks: 1. Will 75 insulated telegraph wires, bound together and put underground, work as well as the same number on a single line of poles? A. Yes, if properly insulated and protected. Underground lines are in quite extensive use in England, but the wires are insulated with great care and protected by iron or stoneware pipes. 2. Will the telephone work well underground with a number of wires together? A. No, on account of the sensitiveness of the telephone to currents induced in one wire by that of another wire.

(35) M. & Co. write: We wish to correct you in one thing. We notice once in a while that you advise some one, from the pages of the SCIENTIFIC AMERICAN, to saw out the crack in a broken bell in order that the tone may be restored. The only remedy for a broken bell is in recasting; the plan above noted has been tried for years, and never with success.

(36) B. F. M. writes: In a description which I have of a microscope, it is said, "to easily resolve *Pleurosigma angulatum*." What is meant by the expression? A. *Pleurosigma angulatum* is a diatom whose silicious envelope is filled with minute hexagonal areolations.

(37) G. H. C. asks: How is the beautiful black stain and polish put on light-colored woods, as seen notably on French boxes, clock cases, etc? I do not see how the polish can be obtained without ever rubbing through to the wood underneath, even on the sharpest angles. A. Ebonize the wood according to the process given on p. 91, vol. 40, then polish it by applying a mixture of alcoholic shellac varnish 2 parts, boiled linseed oil 1 part. Shake well together and apply with a rubber made of woolen cloth. Put only a little of the polish at a time on the rubber, and rub briskly on the wooden surface until the varnish is bright and hard.

(38) H. B. asks (1) how to put an electric bell on a telegraph line he has got in use now. A. Use a single stroke bell, and place it in the line in the same way as you now have the sounder. 2. Also how to make the bell in the cheapest and best manner? A. Make it similar to a sounder using the armature lever to carry the bell hammer. 3. What preparation can I put on an earthen jar to make it suitable for a battery jar? I have some on my battery and they are too porous. A. If you employ them as outer jars, you can render them non-porous by applying asphaltum varnish, or by warming them and applying paraffine or wax.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. N.—Nos. 1, 2, 3, and 5 are auriferous (gold bearing) quartz. No. 4 contains stephanite—a silver ore. An assay would be required to determine the value of the ores.—J. G.—It is the native alloy of platinum, indium, and osmium, the principal ore of platinum. If found in any considerable quantity, worth about $4 per ounce. —G. S.—1. It is a potash feldspar. The clear mineral is used to some extent in porcelain and pottery manufacture. 2. The mica is the variety known as muscovite; of little value unless in large plates. 3. Banded agate.—E. F. B.—1. The ore contains lead and a small amount of silver. It would be impossible to judge of the amount from the sample. 2. It is a variety of porphyry. 3. Jasper and hornblend. 4. Probably contains silver.—B.—It is composed chiefly of carbonate of and caustic lime, with a small quantity of aluminum silicate.

COMMUNICATIONS RECEIVED.

On Coming Transit of Venus. By L. G.

On the Explosion of the Alaska. By J. H. R.

[OFFICIAL.]

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Refrigerator, J. M. Dalton, Philadelphia, Pa.
Screw propeller, E. A. Heath, New York city.
Stone crusher, Blake Crusher Co., New Haven, Conn.
Strainers, making, E. P. Wood *et al*., Lowell, Mass.

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A SHORT BIOGRAPHY OF THE MENHADEN. By Prof. G. BROWNE GOODE, U. S. Fish Commissioner. A paper read before the American Association for the Advancement of Science, August, 1879. An essay full of interest not only to the scientist but to the general reader. The fish here treated of is known under at least 30 popular names in this country, and is of great industrial importance, not only for the oil which it yields, but also as a food, being used as such in either a fresh or salted state or in oil under the name of "sardines." The habits of the fish are somewhat anomalous, and very little has hitherto been known or written about them. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 194. Price 10 cents. To be had at this office, and from all newsdealers.