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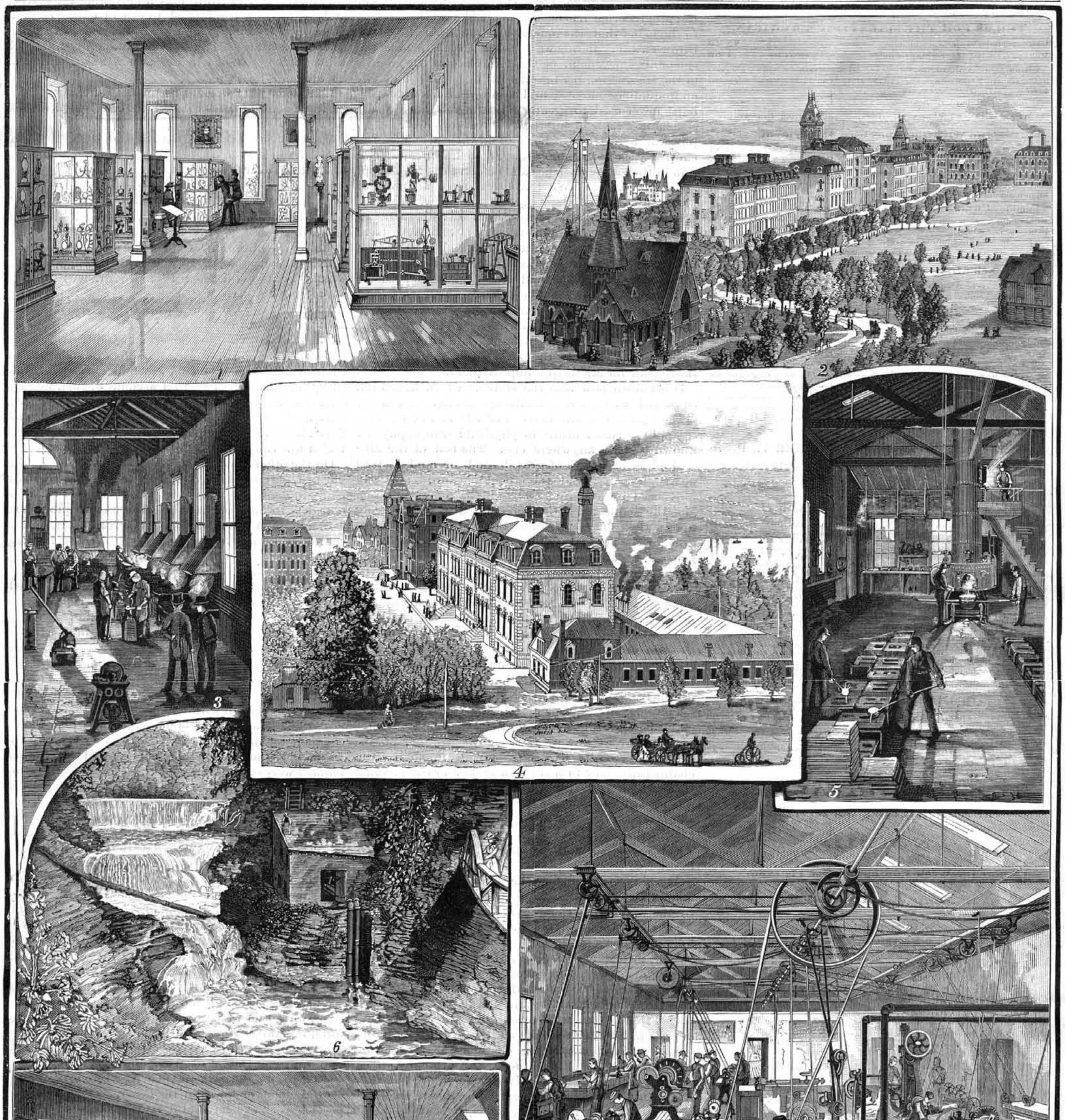

Buildings, Dr. R. H. Thurston, Director. 5. The Sibley College Foundry. 6. Fall Creek Reservoir and Water Supply. 7. The Sibley College Draughting Room. 8. The Sibley College Machine Shop.

ILLUSTRATIONS OF SIBLEY COLLEGE, CORNELL UNIVERSITY, ITHACA, N. Y.—[See page 247.]

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 17, 1885.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 511,

For the Week Ending October 17, 1885.

Price 10 cents. For sale by all newsdealers.

MISSISSIPPI RIVER IMPROVEMENTS.

Of the many waterways which Congress yearly provides the means of improving, none, perhaps, is more worthy than the Mississippi River. When we consider the vast extent of country drained by this great stream and its tributaries, and the amount and importance of the commerce of which it is the highway, the appropriations for improvements, were they many times as large as usual, could not, if judiciously expended, be looked upon as excessive.

That large sums have been wasted in abortive attempts at improvement there is no doubt; and yet those who have studied the subject, and are aware of the progress that has been made, will doubtless incline to the belief that the money has not been altogether thrown away. In this we do not mean to include the splendid achievement of Captain Eads at the mouths of the Mississippi, because the work at this point was an unqualified success, and appropriations were, perhaps, never used to greater advantage. But the success had by Eads in interpreting Nature's processes in physical hydrography has not always attended the efforts of those who have sought to improve navigation in the various reaches and bends of the Mississippi system of waters. We have seen large amounts of money expended in dredging and cutting, which, when the flood season came, was seen to have been ill-advised. In a few days, and even in a few hours, we have seen nature assert itself; the banks and shoals which had been dredged away were built up again in the same order and shape, and with similar dimensions; and where short cuts had been made, the waters, as if indignant at man's presumption, began once more to hollow out another curve to wind around as of yore.

Of late years, however, more careful students have devoted themselves to the problems to be met with in the scheme for Mississippi improvement.

It is known now that the systems which have been employed with success on European streams will not always prove effective here. For the fact is, the Mississippi presents features in physical hydrography not known to exist anywhere else. The bed of the Mississippi is made up of gravel, sand, or mud, instead of rock in place, and the stream is not in any way influenced by the tide. The quality of the bottom and the banks on either side has a direct bearing upon the characteristics of the various portions of the main body of waters and its tributaries. During the flood season, the waters load themselves with alluvial matter, which they bear down the stream, and deposit where the current slackens in the same manner as a glass of water taken from a muddy pond, if permitted to rest, lets fall its sediment. The constant erosion of the stream wears away its banks, and the great river, forsaking its original bed, makes frequent excursions to the one side or to the other; the lateral defections being limited only by the sides of the valley through which the stream is flowing.

The constant movement of large masses of sand and silt, and the changes in the direction and force of the current due to the varying contour of the shore line, results naturally enough in moving the channelways now to this side and now to that, so that the pilot on the Mississippi can neither run on ranges nor by any other established marks, beacons, monuments, or stakes. He must know how to follow the axis of the current, and to read the physical signs, which experience and good judgment alone will serve to interpret.

As said before, during the seasons of flood, large amounts of alluvial matter are carried down stream by the waters, and deposited at various points, which, when the waters fall, are found to have formed into bars and shoals that greatly impede navigation.

Now, instead of trying, as in the old way, to dredge these—an endless and bootless task—or to cut through the slim parts of the bends, which soon leads to physical changes presenting other and not less formidable obstacles to navigation, an ingenious scheme has been devised to feed and re-enforce the river during the dry season, and thus deepen the channel ways without interfering with the natural processes continually alive.

It is a plan almost original in its inception, and while it has not yet been sufficiently developed to decide upon its ultimate feasibility, offers, it is thought, no little promise of success.

This project, which is in charge of Major C. J. Allen, of the engineers, may be described as involving the construction of reservoirs upon the headwaters of the Mississippi River and its tributaries. Major Allen proposes, as he says:

"To collect surplus water, principally from the precipitation of winter, spring, and early summer, to be systematically released so as to benefit navigation upon the reaches of the several streams below the dams, and also that of the Mississippi below Saint Paul. Alleviation of floods, in localities near the proposed reservoirs, expected to obtain to some extent, but control of extended floods or freshets covering long reaches not expected.

"In order that navigation may be benefited upon the Mississippi above the mouth of the Saint Croix, upon the Saint Croix, the Chippewa, and the navigable reaches of the Wisconsin, the system of dams proposed for each must be carried out, and no benefit of consequence to the Mississippi below Lake Pepin can be predicted unless the entire system is built."

These reservoirs are nearly completed, and Major Allen speaks of them in a recent report as likely to perform a valuable service The gates of the Winnibigoshish dam were closed some time since for a period of a few weeks, as were also those of the Leech Lake dam. "During this short time," says Major Allen, "the surplus water collected in the two reservoirs amounted to about 12,000,000,000 cubic feet."

These dams constitute only a portion of the system of dams which it is proposed to use in aiding navigation on the Mississippi; and when their influence upon the main stream shall have been thoroughly tested, it will become apparent whether or not an extension of the system is advisable.

Like Eads' jetty work at the mouths of the Mississippi, the scheme of dams to feed the Mississippi during droughts is original only in its application; and while it has not excited the derision nor met with the opposition which Eads' encountered, it will, if it succeeds, be entitled to quite as much commendation.

A NECKLACE OF MUMMY EYES.

The material for a unique necklace is now in the hands of Messrs. Tiffany & Co., of New York, and is awaiting the attention of their workmen. It consists of a large collection of very beautiful mummy eyes, which were brought from Peru by Mr. W. E. Curtis, of the South American Commission. The majority of them came from Arica, where large cemeteries are filled with mummies of the ancient Incas.

Some little discussion has occurred in scientific circles as to whether they are mummified human eyes or those of some variety of fish, which had been substituted by the Inca embalmers on account of their less destructible nature. Mr. Curtis writes us that the local antiquaries from whom the eyes were purchased believed them to have belonged to a species of cuttle fish which was common on the Peruvian coast.

On the other hand, Prof. Ramondi, the most distinguished native ethnologist, maintains that they are really human eyes, and the Superintendent of the Ethnological Branch of the British Museum quotes Dr. Tschudi, of Vienna, a friend of Humboldt and a thorough student of Peruvian antiquities, as likewise supporting this theory. Since the eyes have been in this country, they have been examined by Mr. G. F. Kunz and by several of the gentlemen connected with the Smithsonian Institution, and they seem to agree in pronouncing them to be the crystalline lens of the eye of a cuttle fish or squid. They vary in size from 5 to 18 millimeters in diameter, and are therefore considerably larger than the lens of the human eye. Their excellent preservation would also seem to disprove a human origin, for the lens of the human eye is very perishable, and can with difficulty be preserved even a few days. The custom of embalming, which was so common among the Incas, was made very easy by the warm, dry climate of Peru, and it is stated that the embalmed were often simply placed in a sitting posture on the vast niter beds, and left exposed to the open air. For years after death they were visited by friends and relatives, and it was consequently important that the semblance of life should be maintained as perfectly as possible. Hence it was that the dried cuttle fish eye, which is almost indestructible, and possesses sufficient warmth and fire to partially simulate life, was substituted for the human organ.

So common are these mummies that they can be dug up almost anywhere, or can be purchased for four or five dollars apiece. In the rough state, the eyes are of a bronze yellow color, and quite opaque, but when the outer covering or skin is removed, and the inner lens carefully polished, it becomes translucent or even semi-transparent, and shows a handsome coloring varying from yellow to orange and reddish brown. In this form, it makes a very beautiful gem. The concentric arrangement of the different layers gives the eye the appearance of iridescent glass, and produces an effect similar to that formed by placing a series of minute crystal globes one within the other. Some of the less perfect specimens have also radial cracks, which add to the refractive power of the lens, but will probably detract from its durability. The crystalline lens of a squid possesses so much solid matter that, when removed from the eye, it becomes hard and dry in a very few days, and has a milky, opalescent appearance. Those taken from the mummies had been cut in two pieces, so as to expose the cross section. It is supposed that the darker and richer tints found in them are due either to an organic change within the eye, resulting from age, or to the absorption of juices or antiseptics from contact with the body.

The work of polishing the eyes has been interrupted by the illness of several of the lapidaries, which is attributed to poisons used in preserving the eyes. Opinions differ as to what the poison may be; some of the symptoms would indicate arsenic, but the opinion has also been advanced that it is due to some alkaloid generated by the decomposition of the organic constituents.

As no chemical analysis has been made, it is not yet possible to assign any definite cause for the illness of the workmen. It was sufficiently severe, however, to produce an unwillingness to resume the task, and for the present nothing is being done.

Bolts and Screw Threads.

In a recent communication to the American Institute of Mining Engineers, Major King, of the Government Corps, again calls attention to the evident weakening of bolts by cutting coarse "standard" threads upon them, and gives some experimental proof of the great advantage to be derived from the use of a finer standard. As a rule, bolts are the weakest part of a structure, and they are at present further weakened by cutting away too much metal for the screw threads. When the thread is cut deeper than is required to prevent stripping, the bolt is weakened by precisely the same method that the blacksmith employs when he wishes to break a bar of iron or steel, only it is to be noted that the standard thread is cut even deeper than the blacksmith nicks his bars. The standard sizes for V-shaped threads are much too coarse for nearly all purposes, and the nuts themselves are out of all proportion to the strains put upon them, as the bolt invariably breaks long before the thread or nut would yield.

In order to thoroughly verify these statements, Major King had three pairs of bolts made, having 6, 12, and 18 threads to the inch respectively. In all other respects they were entirely alike, being turned from bar iron 1⅝ x 2 inches square, so that no forging was required. When broken in a hydrostatic press, not a single nut showed signs of weakness, and the bolts with 18 threads to the inch showed unmistakably that they were the strongest, although they finally yielded by pulling out of the nut—not by stripping the threads, as is generally understood, but by drawing down the size of the bolt until the greater part of the threads were disengaged. The standard bolts broke at an average strain of 76,655 pounds, those with 12 threads at 92,991, and those with 18 threads at 94,248 pounds; or, taking the tensile strength in connection with the stretch, they showed a relative work of 1, 2, 9, and 4.

Major King thus sums up the advantages of increasing the number of threads per inch:

1. At least twenty per cent additional statical strength.
2. Three or four times the strength to resist impact.
3. The finer lines are easier to cut.
4. They are less liable to work loose.
5. In many cases this practice will take the place of upset or enlarged bolt ends.
6. In such cases it would have the advantage of filling the hole, or, rather, it would avoid the necessity of making the holes larger than the body of the bolts.
7. There will be a saving of fifty to sixty per cent in weight of heads and nuts, also in cost; and—
8. Bolts may be placed closer to angles in structures without chipping out for head or nut.

He mentions among the disadvantages the cost of changing taps and dies; the additional time required to put on or remove nuts, which, of course, is hardly worthy of notice; and the greater loss in strength from wear and rust of surfaces of thread. In some cases, such as the bolts which secure the cylinder heads of a steam engine, the coarse thread will probably be preferable; but for all other ordinary uses the finer thread seems undoubtedly the more desirable.

In establishing a new standard, it is suggested that instead of introducing such complications as fractional threads to the inch, whole numbers be agreed upon for each quarter inch of bolt diameter, and that each of the intermediate sizes of bolts have the same number of threads as the bolt next below it in size.

The Brotherhood of Locomotive Engineers.

The Brotherhood of Locomotive Engineers has a membership of over 17,000 engineers, and 294 subdivisions in the United States, Canada, and Mexico. Its head officer is Grand Chief Engineer Arthur, who for twenty years has ruled it.

One of the engineers at the reunion of the Brotherhood, speaking privately of engineers' work, said: "The boys are all lovely so far as the Brotherhood is concerned, but when they get back to work they are the most jealous set of men in the world. No one could help it. Engineers are governed by innumerable rules, the breaking of the least of which means suspension or discharge. No excuse will be taken. Only a perfect and a lucky man can hold his place. Scores of good men are waiting to take it. The jealousy between engineers is often so bitter that their wives, although old acquaintances, will not speak. One engineer may be in luck; the other, without blame, may have had the series of three accidents that sometimes come to an engine. If she has one, she is sure not to stop till she has had three, and the engineer may be in danger of discharge.

"This intense rivalry sometimes leads to acts of meanness. A young man just promoted fears even the old engineer that he fired for, and that loved him like a brother—when he was a fireman—and will not run out his engine until he has inspected every inch of her, to see that no one has put up a job on him. A young engineer on the Nickel Plate cut out all the bearings of his engine on the first trip, and was laid off. He was a close observer, and found that some wretch had put emery in his oil can. He was able to prove this fact, and regained his situation. Another new engineer was suspended for burning out the flues of his boiler. He had worked and waited for years for promotion, and to have the coveted prize snatched from him just as he had grasped it drove him into the grave. He had insisted that the engine's gauges had registered plenty of water, but the master mechanic disbelieved him. When he was dead, it was found that he had told the truth. A conscience-stricken rival confessed that he had put oil in the tank, so that it foamed and showed water at the top gauge when there was scarcely a quart in the boiler. Another method of meanness is to choke up the water hose leading from the tank to the boiler with cotton waste.

"It is a great event in the life of an engineer when he gets a chance to make some special run that will give him a record, and he becomes a special object of envy. When the Nickel Plate was the rival of the Lake Shore, a Nickel Plate engineer made the run with thirty cars of stock, leaving Chicago at the same hour that the Lake Shore train did, and beating it into Buffalo more than ten hours. That engineer got promoted.

"An accident often makes an engineer famous and prosperous, and then he becomes an object of envy. Dan McGuire, one of the luckiest of men, was running the front engine of the double header that pulled the Lake Shore train the night of the Ashtabula accident. His engine managed to get across the bridge just as the train went down. The engine was saved, but stopped so near the awful brink that the tender hung poised over the edge. This crowning piece of good fortune called McGuire into prominence, and now, whenever Vanderbilt's train takes a trip over the road, McGuire is generally chosen to run it over his division. McGuire, by the way, is quite a prominent name among engineers. Shandy McGuire, an engineer running out of Elmira, N. Y., has become famous, not only as a good runner, but as the writer of poetry."

American Forests.

The agricultural, climatic, and commercial importance of preserving the country's forests was clearly brought out and emphasized at the meeting of the American Forestry Congress, held in Boston on September 22. The climatic changes induced by the destruction of our trees are already noticeable in the greater variability of the annual rainfall, the lengthened periods of drought, and the increased power of floods and cloud bursts. These are sufficient to offer a warning voice against any further depredations, and to demand an immediate and systematic restoration of the normal amount of forest vegetation. Several communications of interest were read by the president, the one from Dr. Oliver Wendell Holmes stating that he hoped the people would allow the country to retain "leaves enough to hide its nakedness, of which it is already becoming to be ashamed." Rev. N. H. Eggleston, of the Department of Agriculture, presented some suggestive facts in regard to the forests of the country and their consumption. The national domain, omitting Alaska, contain 1,856,070,400 acres. Of this large territory, 440,990,000 acres are covered with forests, and 295,650,000 acres are devoted to agriculture, or about five acres to each inhabitant. The unimproved and waste lands, including fallow fields, amount to 1,115,430,400 acres. To traverse this domain 150,000 miles of railway are employed, which have required 396,000,000 ties for their construction. Supposing that these ties require renewal once in every six years, and that 10,000 miles of new road are built annually, if twenty-five years be taken as the average age of trees fit for ties, it would require 15,000,000 acres of standing timber to supply the annual demand for ties, or an area equal to that of Vermont, New Hampshire, Connecticut, and Rhode Island. But with the increase of railroads, unless glass and steel and other materials for ties come into use, it must be remembered that the timber area required for their supply is likewise continually increasing. In other departments an even greater consumption of wood is taking place. The annual supply of timber consumed as fuel alone amounts to 145,778,137 cords of wood and 74,000,000 bushels of charcoal, which would clear the forests from 30,000,000 acres, or an area equal to that of New York and North Carolina together. To this estimate must be added the purely wasteful consumption of timber in the great forest fires which are a recognized feature in the year's catastrophies. This would add 10,000,000 to the grand total, and possibly more. The timber cut for lumber, though an immense drain, is comparatively small when the other statistics are considered. It would lay bare 5,600,000 acres. Altogether, then, it appears that the forest area in America is subject to an annual decrease of over 50,000,000 acres. These figures, taken in conjunction with our total forestry, furnish the material for very serious reflection.

Operations of the Patent Office.

From a statement prepared by Commissioner Montgomery, showing the operations of the Patent Office during the fiscal year ended June 30, it appears that the number of applications for patents received was 32,662, for designs 1,071, for reissues of patents 156, for trademarks 1,126, and for labels 673, making a total of 35,688, against 28,822 during the preceding year.

The number of caveats filed was 2,515. The number of patents granted, including reissues, was 22,928, of trademarks registered 1,092, and of labels, 337, making a total issue of 24,357. Patents numbering 2,828 were withheld for payment of final fees, and 13,332 patents expired during the year. The receipts of the Office from all sources were $1,074,974, as against $1,145,433 during the preceding year, while the expenditures were $934,123, leaving a surplus of $140,851. The number of applications for patents awaiting action on July 1, 1885, was 5,766, a decrease of 41 per cent as compared with the number awaiting action at the beginning of the last fiscal year.

The Reis Telephone.

The Orange, N. J., *Chronicle* says: Professor J. R. Paddock, of Stevens Institute, who resides on East Park Street, East Orange, has been engaged the past summer in important investigations as expert for the Overland Telephone Companies of New Jersey and Pennsylvania, in the suits pending in the United States Courts for infringement of Bell's patents. The defense rests in part upon the inventions of one, Philipp Reis, of Germany, who it is claimed invented a talking telephone fifteen years before Bell's telephones were patented. Professor Paddock received some time since the *original instruments of Philipp Reis* from Frankfort, Germany, and has been engaged with E. W. Smith, of New York, in testing their efficiency as regards this much disputed point. In their testimony before C. N. Williams, special examiner, who has been taking testimony in the case, Professor Paddock and Mr. Smith proved that for four months they had been experimenting with the Reis instruments in various forms. They gave the results in detail, and showed more clearly than has ever been done before that these instruments without any change are perfectly capable of transmitting speech. One sentence of fifty-six words was spoken by Professor Paddock and received by Mr. Smith by a Reis transmitter of the cubical box form without carbon points, and a knitting needle receiver. They also proved that *the identical telephone used by Reis at his lecture in* 1861 will transmit speech without any alteration. They stated that they had used it in Professor Paddock's laboratory on a line from the house to the stable, 350 feet, and had succeeded in sending many words and short sentences and the words and music of various songs. They were surprised at the result, because they did not think it probable that the actual membrane and electrodes used by Reis twenty-five years ago would retain their properties sufficiently for actual use at this time.

White of Egg in Obstinate Diarrhœa.

From the *Allg. Meg. Cent. Zeit.*, we learn that Celli has recently called attention to the curative properties of the albumen of hens' eggs in severe diarrhœal affections. In a discussion before a medical society at Rome he advocated its use, and related two cases of chronic enteritis and diarrhœa which, having resisted all treatment, speedily made complete recoveries under the use of egg albumen. The same diet is strongly recommended in the diarrhœa accompanying febrile cachexia, and in that of phthisis. In two cases of diarrhœa dependent upon tertiary syphilis, it was found of no avail. On post-mortem examination diffuse amyloid degeneration of the arterioles of the villi was found in these cases. The whites of eight or ten eggs are beaten up and made into an emulsion with a pint of water. This is to be taken in divided quantities during the day. More may be given if desired. The insipid taste can be improved with lemon, anise, or sugar. In case of colic, a few drops of tincture of opium may be added.—*Medical Compendium.*

Coating the Cages of Hydro-extractors.

Messrs. Marting et Cie. have taken out a French patent for the coating of the metallic cages of the hydro-extractors in such a way that they resist the action of the chemicals. The inventors employ a coating of caoutchouc; they first apply a solution of India rubber, and before it has time to dry they apply on the same a caoutchouc sheet, which is thus strongly bound to the metal. The perforations of the interior of the cage are also coated with India rubber, and so is the exterior of the cage itself. The whole is exposed to vulcanization, and the holes bored or cut in such a way that the holes in the caoutchouc are smaller than those on the metal.

Russian Saltpeter.

Rich deposits of saltpeter of very high quality were recently discovered in the transcaspian region near the Atreck River and in the neighborhood of Sukum.

A HAND-PROTECTING SAD IRON HOLDER.

This holder is one which may be quickly attached to the handles of smoothing or other heated irons, to protect the hand from heat, either in contact or by radiation. The handle portion is in two sections, hinged together along one side, and is made preferably of sheet metal, such as heavy tin, its edges beaded or wired, or having a narrow flange, which incloses an outer covering of plush, felt, or cloth. In the upper section of the holder-handle is a lining of felt, or other non-conductor of heat, over which is a layer of hard pasteboard, to receive directly the pressure of the operator on the iron handle. To the ends of the holder is attached a guard, which curves around and broadens in its lower portion, so as to shield the hand from the heat arising from the body of the iron, and prevent contact with the hot

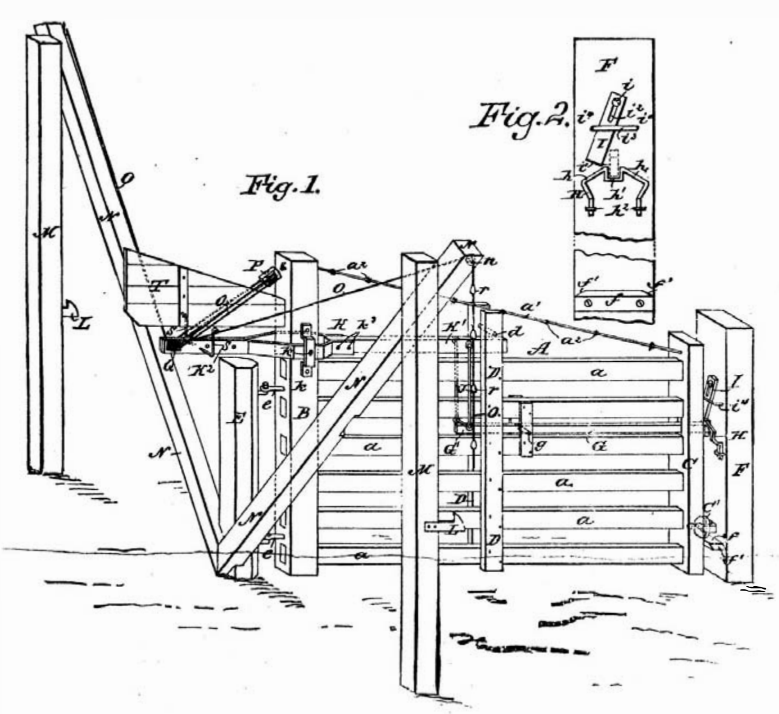
McINTYRE'S SAD IRON HOLDER.

shanks. The holder is soft to the hand, holds the iron firmly, and will fit different sizes of handles.

This invention has been patented by Mr. William M. McIntyre, of Room 3, Union Station, Pittsburg, Pa.

AN IMPROVED GATE.

The invention herewith illustrated provides for the construction of a gate which may be opened and closed by persons in vehicles or on horseback without dismounting, as well as those on foot. Fig. 1 is a perspective view showing the gate closed in position, and Fig. 2 is a broken face view of the latch post. A is the gate, with rails, a, an inner upright, B, an outer upright, C, and intermediate ones, D, at either side of the gate in the middle, made fast to the rails. A brace rod, a^1, connects the uprights, and is provided with barbs, a^2, to prevent stock from rubbing against the lever which



STONE'S IMPROVED GATE.

unlatches the gate. E is the hinge post at one side of the roadway, from which bars, N, extend, carrying gate operating cords, which may also be used as braces for the posts, M, set along the side of the roadway, and carrying catches, L, on which the gate may be latched open. G is the latch bar of the gate, pivoted at g, and is connected at its inner end by links, J, with a weighted lever, K, pivoted to the upright, B. O O indicate the operating cords of the gate, attached to the back end of the weighted lever, K, and passing through a double sheave or pulley block, P, swiveled to the head of the upright, B, thence through separate sheaves at the back end of the lever, and over pulleys, n, one at the head of each brace, N, on the roadway at either side of the gate, and terminating in the hand grasps, r. In connection with the latch, shown in detail in Fig. 2, is a lock bar, I, which stops the swing of the gate with the latch bar directly over the notch made for it.

A wind vane, or fan, T, is fixed to the rear upright of the gate, to assist in opening and closing it when the wind is strong. By pulling the cord, O, the gate may be opened till it latches on the post, M, opposite the side of approach, and after passing through the gate may be closed by the similar cord on that side.

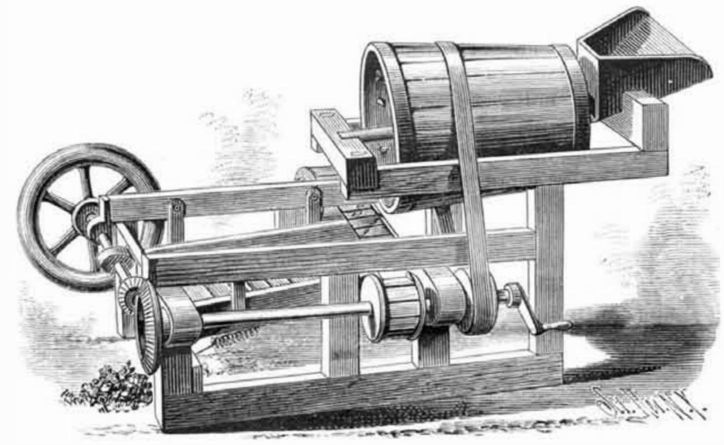
This invention has been patented by Mr. William G. Stone, of Ellisville, Ill.

ORE SEPARATING MACHINE.

This machine separates the dry gold dust from the sand, dirt, gravel, etc., with which it may be mixed. The shaft carrying the drum, which is cone-shaped, is journaled at a slight inclination in the supporting frame. The larger lower end of the drum is open, and the smaller upper end is closed by a head having a central aperture, through which projects the spout of the hopper. Spikes project from the inner surface of the drum for the purpose of breaking up the lumps of dirt, etc., passed through. Below and in the rear of the drum is a pan suspended by links, so that it can rock in the direction of its length. The end next the drum is higher than the other. The bottom of the pan is formed with transverse pockets. A spring secured to the frame and pan is so arranged as to pull an end plate on the latter against a cam mounted on a shaft journaled on the end of the frame, and provided at one end with a fly wheel, and at the opposite end with a beveled gear wheel engaging with a beveled wheel on a shaft extending along the side of the frame and provided with a crank for turning it. A belt passes around a pulley on this shaft and around the drum. An endless screen belt passes around a second pulley on this shaft and around a pulley at the other side of the machine, this belt being directly below the larger end of the drum.

The sand, dirt, etc., containing the gold dust is dumped into the hopper, from which it passes into the drum, which is revolved by its belt. The lumps are broken up, and drop from the drum upon the screen belt; the larger ones are carried by the belt to one side of the machine and deposited, while the sand, etc., drops upon the pan, which is vibrated by the cam and spring; the sand slides down the bottom of the pan, and drops from the lower end, and the gold dust collects in the grooves or pockets. The drum, screen belt, and pan are all operated from the side shaft, which can be turned by hand or by power.

For information concerning this invention, address the Gideon Ore Separating Machine Company, care of Mr. Jacob Sims, Council Bluffs, Iowa.



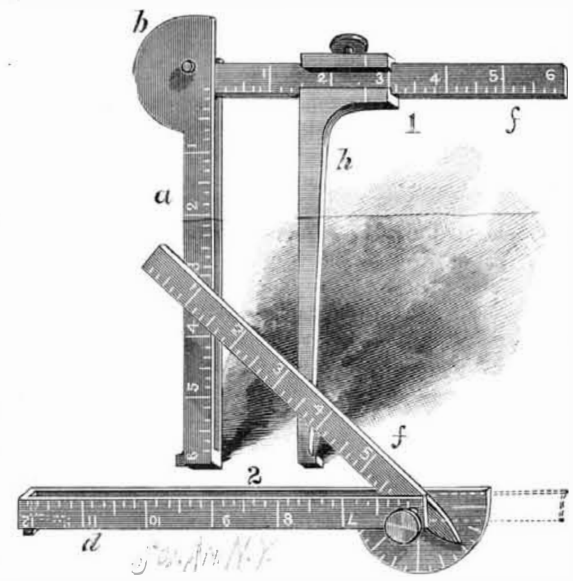
GIDEON'S ORE SEPARATING MACHINE.

Compressed Steel.

Further tests of the new French treatment of steel for rendering it tough appear to confirm its value, imparting to it also a fineness of grain, an increased hardness, and a notable accession of strength to withstand rupture; this effect being most marked in the case of highly carbonated steel, and in this respect the metal is made to resemble tempered steel, without being in all points identical with it. The cause of this alteration in physical condition is attributed to the rapid heating and no less rapid cooling of the metal; that is, when the red hot steel is first strongly compressed, which is the peculiar feature of this process, the conversion of the mechanical energy into heat serves to raise the temperature of the entire mass, at the same time that the particles of the metal are more closely cemented together; this effect is followed by a rapid cooling, due to the contact of the plates of the hydraulic press with the surfaces of the metal, and the very close pressure materially increases this conducting effect of the cold metal.

COMBINED CALIPER, PROTRACTOR, AND BEVEL.

Formed on one end of the graduated arm, a, is a protractor, through the center of which passes a thumbscrew, on which is placed one end of the arm, d, the other end being attached to a pointer riveted to the arm, a, on the opposite end from the protractor; the outer face of the arm, d, is graduated. On the thumbscrew, and between the arms, a and d, is placed the arm, f, having graduations on both faces, and being formed with a pointer which indicates on the graduation, representing degrees and subdivisions on the protractor. The caliper arm, h, slides on the arm, f, upon which it may be held by means of the thumbscrew. The slotted arm is provided with a mark to read the measurement of the inside caliper, and the outer end is formed with a point. When the caliper arm is detached, the tool can be used as a common rule by turning the arm, f, in the opposite direction from the arms, a and d, and fastening the three together in this position by the thumbscrew; the graduations then indicate a continuous measure from one end to the other. The arms, f and a and d, are used to measure bevels with, the degrees being shown on the protractor by the pointer. By setting the arm, f, at right angles to the others, a square can be formed. When arranged as shown in Fig. 1, the tool can be used as inside or outside calipers; the outside caliper is taken between the edges of the arms, and the measurement is read on the arm, f, as indicated by the inner edge of the caliper arm, h; the inside caliper is taken between the pointers on the arms, a and h, and the measurement is indicated by the mark on the slotted arm.

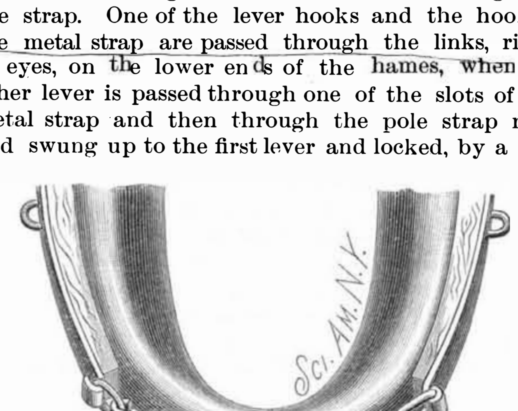


COMBINED CALIPER, PROTRACTOR, AND BEVEL.

This invention has been patented by Mr. Frederick W Woodhull, of Lincoln University, Pa.

AN IMPROVED HAME FASTENER.

The principle on which this hame fastener operates is plainly shown in the illustration herewith. It consists of two levers pivoted together, each having a differently projecting hook at its outer end, together with a metal strap, also carrying a hook, and provided with a series of corrugations, in each of which is a slot extending in the direction of the length of the strap. One of the lever hooks and the hook of the metal strap are passed through the links, rings, or eyes, on the lower ends of the hames, when the other lever is passed through one of the slots of the metal strap and then through the pole strap ring, and swung up to the first lever and locked, by a ring



KILLEBREW'S HAME FASTENER.

passing over the hooks of both levers, thus holding the pole strap ring in one of the corrugations. The device is especially designed not to cut the collar, and so the hame will not get loose when once fastened.

This invention has been patented by Mr. Samuel Killebrew, of Brownsville, Tenn.

FLOOD ROCK BLOWN UP.

Last Saturday morning, October 10, at 11 o'clock and 16 minutes, the 150 tons of dynamite and rack-a-rock stored in the excavation under Flood Rock, Hell Gate, N. Y., were exploded. The volume of water that rose in the air seemed to most fittingly terminate, by its vast proportions, the most stupendous piece of engineering, of its kind, the world has yet seen. The volume rose in irregular masses, seemingly as if many gigantic fountains, each playing independently, were at work beneath the surface; it measured at least 1,400 feet in length, 800 feet in width, and 200 feet in height. There was one heavy report, followed by a lighter one from the northern end of the work; along each of the shores but one severe shock was felt; there was no series of vibrations.

The engraving, Fig. 1, represents Flood Rock immediately before the explosion; Fig. 2 is immediately after; Figs. 3 and 4 show the water rising, and in the former may be seen the derrick just toppling over; in Fig. 5 the water is about at its height. Figs. 1, 2, and 5 are on precisely the same scale, and taking the total length of Flood Rock (Fig. 1) as 300 feet, our readers have an accurate scale by which to measure the water. The volume of water shown in Fig. 5 is at least 1,100 feet in length. An examination of the rock shows it to be shattered, proving that the explosion was successful.

We are indebted to Messrs. F. C. Beach, President; Geo. H. Ripley, Frank G. Dubois, Wm. Darrow, Jr., members of the Society of Amateur Photographers of this city, for the excellent instantaneous photographs of the explosion, from which our engravings were made.

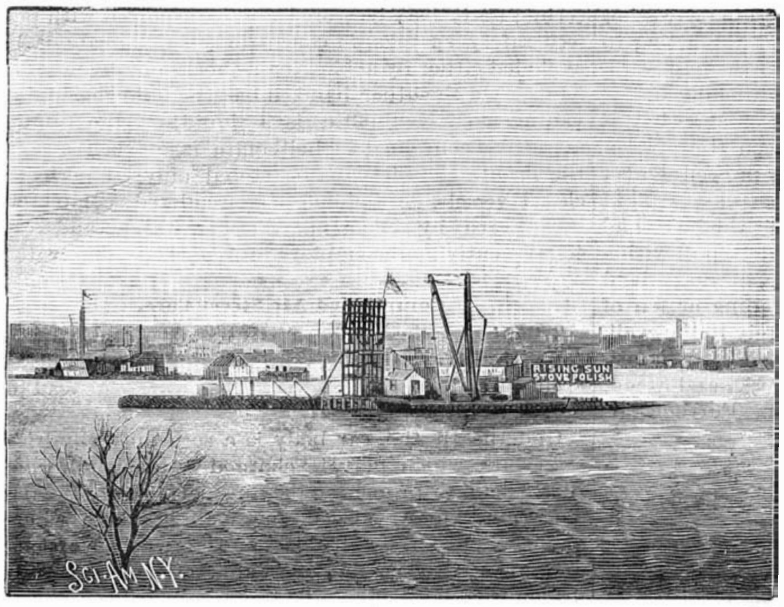


Fig. 1.—JUST BEFORE THE EXPLOSION.

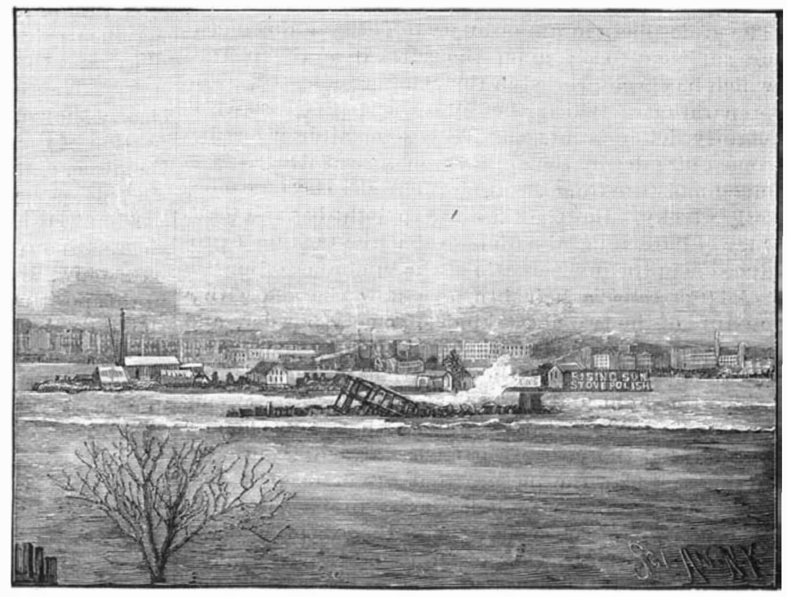


Fig. 2.—JUST AFTER THE EXPLOSION.

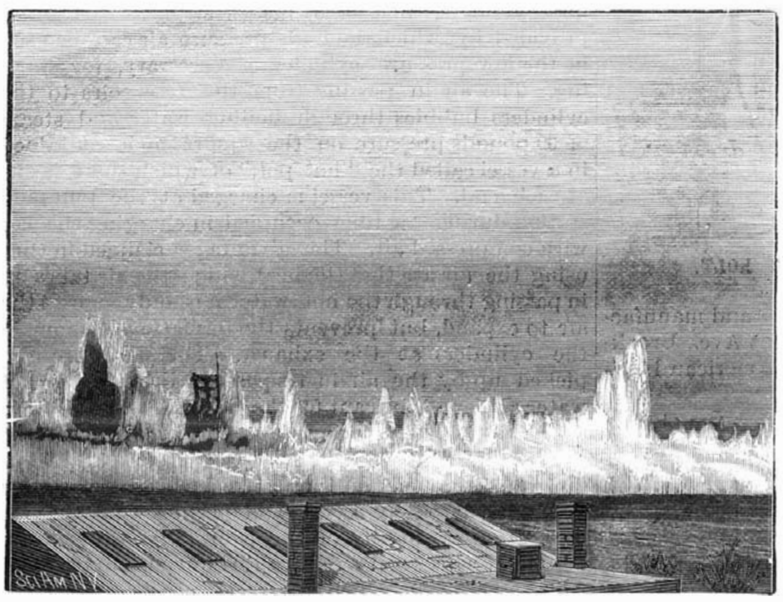


Fig. 3.—THE WATER RISING.

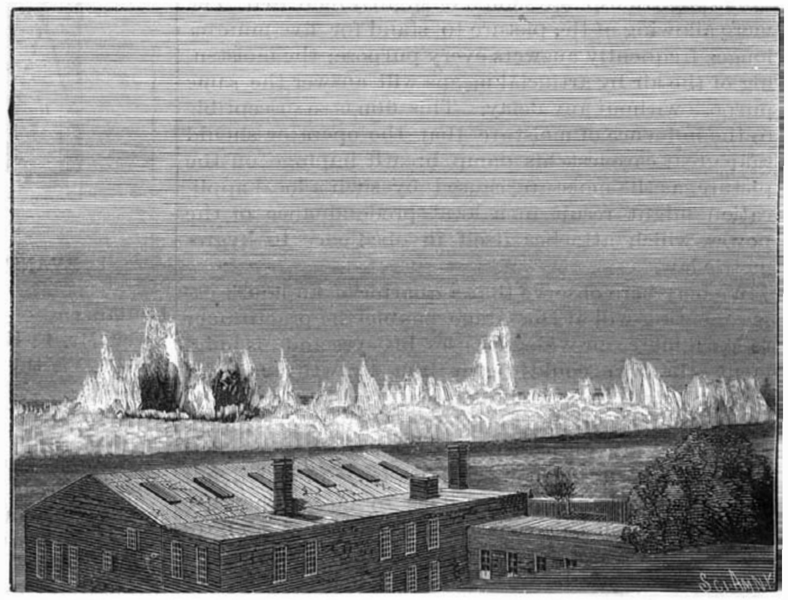


Fig. 4.—THE WATER NEARLY AT ITS HEIGHT.

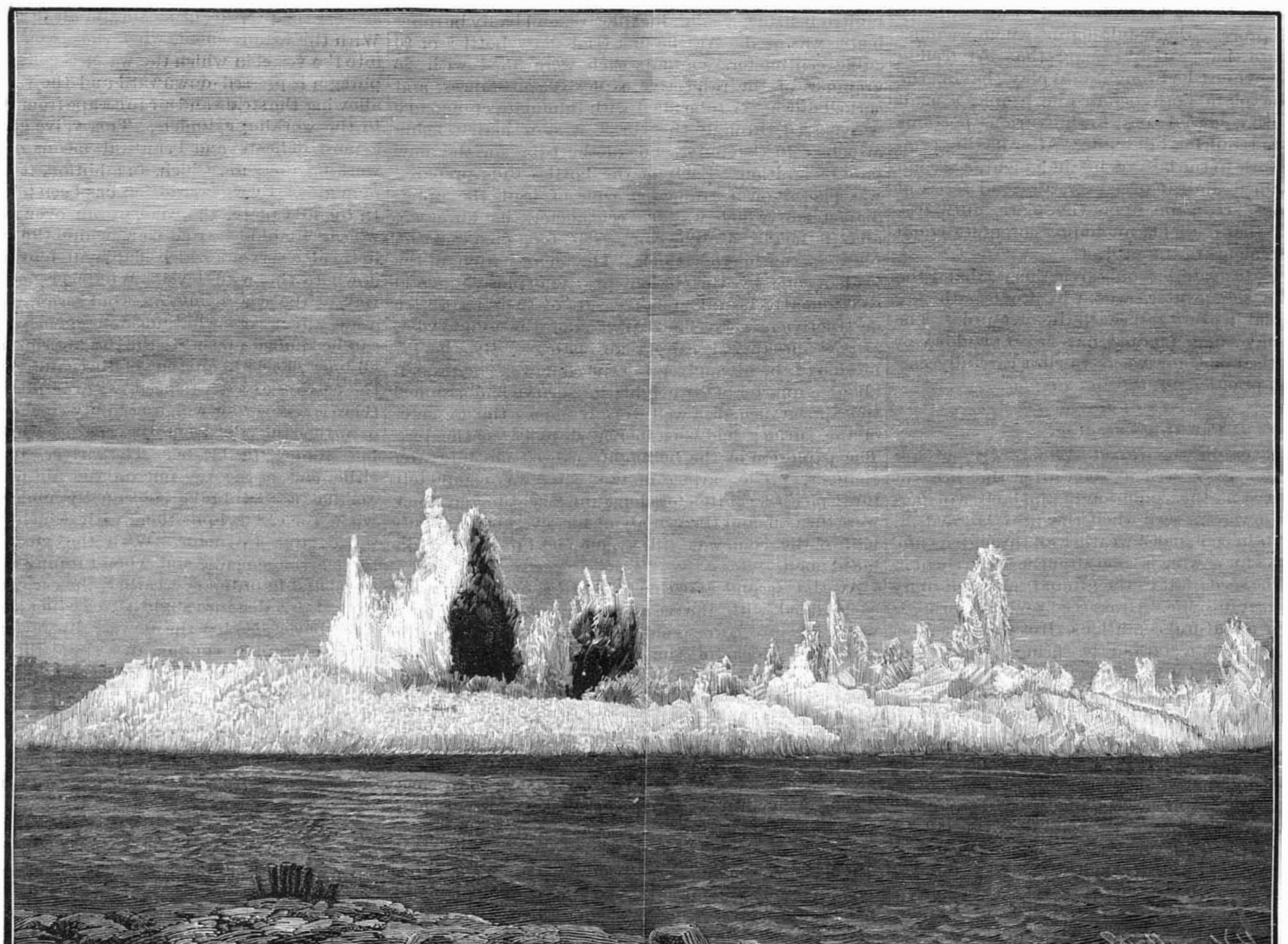


Fig. 5.—FLOOD ROCK EXPLOSION—THE WATER AT ITS HEIGHT.

JUMBO'S death has been chronicled in obituary notices in the London newspapers longer than is usually accorded to men of science and statesmen.

Photo-Mezzotint Engraving.

Upon a polished steel plate, spread a thin coating of:

Saturated solution of bichromate of ammonia	5 drachms.
Honey	3 "
Albumen	3 "
Water	1½ pints.

Let this be dried by gentle heat, and when thoroughly dry, expose to light under a transparency. Now remove the plate to a place in which the air is moist. The atmosphere in an ordinary room contains moisture sufficient to act upon the surface of the picture which has been printed in the manner indicated. The preparation of which the formula is given above is slightly deliquescent, and very soon after it has become quite dry by the application of heat it attracts so much moisture from the atmosphere as to become more or less tacky. But the exposure to light has the tendency of hardening the film; so that the tackiness produced is in the inverse ratio of the luminous action.

A large camel's hair brush is now charged with a mixture of the two finest kinds of emery powder, and applied with a circular kind of whisking motion all over the surface. As those portions of the plate on which the light did not act are the first to become tacky, the emery powder will first adhere to them, and we find that the coarsest particles attach themselves to those parts of the picture that are in deepest shadow. The exposure to light ought to be such that every portion of the surface—with the exception of the extreme high lights—becomes in a condition to "take" the powder. If the image be slow in becoming developed under this pulverulent treatment, then the moisture in the atmosphere should be slightly increased. The mere allowing of the picture to stand for five minutes longer frequently answers every purpose; the moistening of the air by artificial means will answer the same purpose without any delay. This film is so susceptible to the influence of moisture that the operator should take great care lest his damp breath impinge on the picture, as the moisture caused by such a local application might result in a local predominance of the power which attaches itself in obedience to hygrometric law.

We may here observe that a quarter of an hour's experimenting will at this stage enable the practitioner to learn more—provided he uses his eyes and his judgment—than we could teach him by writing at far greater length than would here be expedient.

Assuming, then, that the picture has been developed, a polished plate of metal, softer than that upon which the picture is formed, must have been procured and laid down upon the other, face to face. They are passed between a pair of rollers screwed so well together as to insure the setting off on to, or indentation of, the emery powder image into the polished plate of metal. This latter plate is now precisely similar to the one produced by the mezzotint engraver.

An impression having been obtained by an ordinary copper plate process, the manipulator (whom we must now designate the "artist," seeing that art feeling and knowledge must be brought into play), having the proof and the plate both before him, applies a small burnisher with a curved point to the various portions of the picture requiring lightening. After having completed this work to the best of his judgment, a second proof is obtained, and, if necessary, a second series of the alterations are made upon the plate, until it is finally found that it yields an impression quite equal to the requirements of the subject.

This being the case, it only remains to hand the plate over to the printer, who will produce the impressions equal in every respect to the first proof. The method we have here pointed out is no shadowy or mere theoretical one, for we have most carefully carried it out in practice.—*Lith. and Printer.*

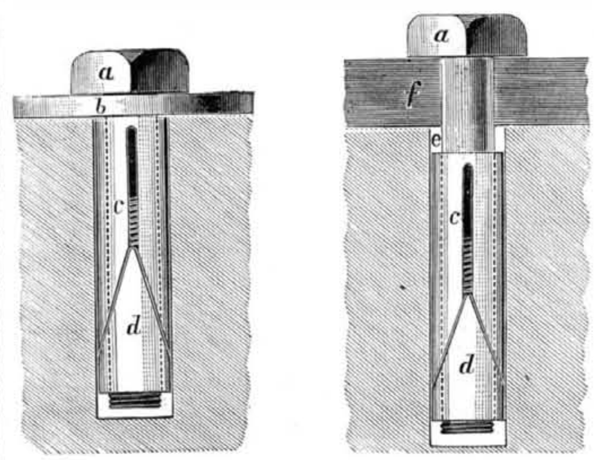
Fall Grass Seeding.

A. W. Cheever, in the *Rural New-Yorker*, advises farmers to sow grass seed as soon after the heat of summer is past as the condition of the land will permit. Don't sow grass seed when the heat is greatest. Grass delights in cool, moist weather all through its life. Nature's time for sowing is soon after the seeds ripen in summer. The seeds fall to the ground, and wait only for rain to start into life. Grass seed sown in spring is placed under unnatural conditions. Hot weather is before it, and if it gets a start in the spring, it will try to produce seed the first year. This practice affects grass plants as it affects heifers to have calves at an early age. Grass sown in spring and cut for hay in July has been killed outright by the operation. The hot sun dried the surface, and the root growth being shallow and scanty, the plants were killed. Nothing is gained by spring seeding, except the labor in replowing after grain is harvested. Grass sown alone this fall, on well tilled and well enriched land, should produce a full crop of hay next July. Fall sown grass has the advantage over spring sown in this, that the annual weeds which may come up with it will soon be killed by frost and be out of the way of the grass, while in spring the chances are usually more favorable to the weeds than to the grass, as the weeds are starting at their natural season, while the grass is not.

IMPROVED EXPANSION BOLT.

The greatest use of the bolt herewith shown is in places where it is not practicable or desirable to bore through the material to which the fastenings are to be made. With this bolt any piece of work can be drawn down and tightened; the manner in which this is done is shown in the cuts. The bolt is put in the hole with the collar, *b*, between the base of the jaw piece, *c*, and the head to tighten against; an ordinary washer may be used for this, as it is only to get the fitting in place, and the same washer will do for any number of bolts. The shape of the piece, *c*, and the nut, *d*, are clearly shown. By turning the bolt the wedge-shaped portion of the nut, *d*, is brought between the jaws of the piece, *c*, the latter being thus firmly pressed against the side of the hole.

The piece, *c*, will be spread out to fit the hole, and then with any convenient tool may be driven in with a light blow, leaving a space, *e*; the piece, *c*, will be held in this position in the hole by the spreading action of the nut. A plate, *f*, may be held securely to the wall. This expansion bolt has been used extensively in fastening objects to stone, iron, brick work, and wood, and has given the utmost satisfaction. Further particulars can be had from the patentee and manufacturer, Mr. F. H. Evans, of 124 to 136 Kent Ave., Brooklyn, N. Y.; the bolt can be seen at the American Institute Fair.



EVANS' IMPROVED EXPANSION BOLT.

A New Explosive.

A new explosive, known as hellhoffite, which has been invented by Hellhoff and Gruson, has been subjected to comparative trials at St. Petersburg, together with nitro-glycerine and ordinary gunpowder. It is described in the London *Times* as a solution of a nitrated organic combination—naphthaline, phenol, benzine, etc.—in fuming nitric acid.

In preparing the hellhoffite tried in the experiments, binitro-benzine, a solid, inexplosive, and badly burning body, was used. At the first trial glass bottles of 20 cubic centimeters contents each were filled with 20 grammes of the respective explosive substances, and corked down. A tube filled with fulminate of mercury was passed through the corks, a slow match being attached to the outer end of the tube for the purpose of ignition. Each of the bottles thus prepared was placed on a truncated cone of lead, the upper diameter of which was 3·5 centimeters, its lower 4·5, and its height 6. The cone itself stood on a cast iron plate 2·5 centimeters thick. The deformation of the leaden cone by the action of the explosives could consequently be taken as measure of their respective destructive power. The explosion of the gunpowder, as was anticipated, caused no changes. By the explosion of the nitro-glycerine the cone was compressed about a quarter of its height; its surface had assumed the appearance of a well worn hammer; the diameter of the surface had been increased to 5·5 centimeters The explosion of the hellhoffite caused much greater changes. The surface of the cone was completely torn; pieces 5 centimeters long and 2 centimeters thick were torn off and thrown about for several paces; only half of the cone was still a compact but entirely defaced mass.

At the second experiment, bottles of 25 grammes each, filled with the various explosive substances, were let into corresponding cavities bored into the face of fir blocks of similar dimensions. In exploding the gunpowder, the block was torn into four pieces as if split with a hatchet, the several pieces were thrown about for 18, 12, 11, and 10 paces. In exploding the nitro-glycerine, the block was split into several pieces. The upper portion of the block, as far as the bottle was let into it, was torn off perpendicularly in the direction of the fiber in such a manner that a smooth cut was formed. The explosion of the hellhoffite likewise tore the portion of the block surrounding the bottle perpendicularly in the direction of the fiber, and splintered the remainder of the block into a large number of thin fibers. The following experiments were also made with hellhoffite alone: A slow match was passed through the tube in the cork, which was without fulminate of mercury, as far as the surface of the hellhoffite in the glass bottle; no explosion followed on igniting the slow match. A quantity of hellhoffite poured into a bowl could not be exploded by a lighted match. Finally a few drops of hellhoffite were poured on an anvil, and exposed to heavy blows with a hammer, and no explosion followed. The hellhoffite consequently possesses the following advantages: (1) In igniting it with fulminate of mercury, it acts more powerfully than nitro-glycerine; (2) it may be stored and transported with perfect safety as regards concussion, as it cannot be exploded either by a blow or a shock, nor by an open flame. On the other hand, it has the following disadvantages: (1) Hellhoffite is a liquid; (2) the fuming nitric acid contained in hellhoffite is of such a volatile nature that it can be stored only in perfectly closed vessels; (3) hellhoffite is rendered completely inexplosive by being mixed with water, and can consequently not be employed for works under water.

Compressed Air Street Cars.

The line of the London Street Tramways Company from Holloway to King's Cross is about to be worked exclusively by compressed air machinery instead of horses, as hitherto.

Underneath the car body is a series of cylindrical reservoirs, which may be charged with enough compressed air to propel it a distance of 10 or 12 miles. The car is four wheeled, one pair of these wheels alone being used for driving; and, to save the expense and inconvenience of turn tables, the car may be driven from both ends. To the driving wheels are attached a pair of high and low pressure ordinary working cylinders, each of 8 inches stroke. Means are provided by which the high pressure air can be used in the low pressure cylinder, if necessary, for starting. The air in passing from the reservoirs to the cylinders bubbles through boiling water and steam of 60 pounds pressure on the square inch, contained in a vessel called the "hot pot," of which there is one at each end. This vessel is charged at the pumping station during the time occupied in charging the car with compressed air. The advantages claimed in thus using the air are that the heat which the air takes up in passing through the hot water not only causes the air to expand, but prevents the formation of snow in the cylinders at the exhaust. The moisture also picked up by the air in its passage through the hot water acts as a lubricant for the side valves and pistons.

The working pressure in the high pressure cylinder can be varied at will; it is usually from 120 pounds down to 50 pounds on the square inch, the variation being regulated by a valve of peculiar construction, consisting essentially of a piston, which, by means of a hand wheel and screw, can be forced into or raised from a vessel in which water and air are contained. The bottom of this vessel is made of an India rubber diaphragm, which is connected to a valve opening against the pressure of steam and air in the "hot pot." With this arrangement, when the piston is forced down into the vessel in which the water is contained, the diaphragm is pressed downward and the valve is opened, allowing the steam and air to escape from the "hot pot" to the working cylinders. This valve gives the driver a most delicate and beautiful means of varying the working pressure, which, in addition, it automatically regulates. Every precaution has been taken for safety. In the first place, the car can run over nobody. The wheels are hidden from view behind the capacious cylindrical reservoirs which flank all four sides, almost down to the road level. Whatever may get in the way of the car in motion would simply be shunted aside, albeit somewhat unceremoniously. But the car can be pulled up short; the brakes can be applied to all four wheels in any one of three different ways. In the case of excessive speed, as over 10 miles an hour, there is a governor which not only cuts off all steam, or rather the air, from the engines working the car, but applies the brakes. The driver, too, can, from either end of the car, put on the air pressure brake, and has a foot brake continually under his control when the car is in motion, with which ordinary passenger stops are made. With the most powerful of these arrangements, and when running at its greatest speed and in ordinary weather, the car can be brought to rest in a distance slightly exceeding its own length. The driver also has the power, by reversing the engines, of rapidly coming to a standstill. The car as constructed carries 38 passengers, and weighs about 6½ tons unloaded. The tramway is regarded as one of the most difficult for the purpose, on account of its varied gradients and a sharp curve in its course, not to mention the fact that the thoroughfare is one of the busiest in London.—*Railway and Tramway Express.*

Another Lightning Photo.

Mr. A. W. Manning, of Edena, Mo., sends a photograph of a "streak of lightning," which exhibits the waviness shown in our recent illustration; but there is only one sinuous line. The upper end of the streak, however, exhibits several faintly defined branches, as if the discharge had resulted from the coalition of several tributaries.

Correspondence.

The Word "Atlantic."

To the Editor of the Scientific American:

In an article by Dr. Le Plongeon, in SUPPLEMENT No. 509, there is, among several remarkable etymologies, one of so wonderful a nature that it ought not to be passed over without comment. Dr. Le Plongeon, speaking of the "Lands of the West" of the Troano and Dresden MSS., says that they were "surrounded by or [were] near the water, the *Atlan* of the Nahuatl, from which the *Atlantic* Ocean derives its name" (!) I had supposed that every intelligent person who cares to know the meaning of words knew that *Atlantic* was, through Latin, from ἀτλαντικόν, the adjectival prefix in the Greek name of the Atlantic Ocean—'Ατλαντικὸν πέλαγος, *i. e.*, the sea beyond Mt. Atlas. Deriving the word from a North American Indian language is carrying a hobby too far.

G. W. R.

The New Star.

To the Editor of the Scientific American:

In your SCIENTIFIC AMERICAN of September 19, 1885, I read a communication from Mr. Wm. R. Brooks, of the Red House Observatory, concerning the new star in Andromeda. I have since that time been watching the papers, hoping someone would suggest whether this new star might not be the Pilgrim, which appeared in the years 945, 1262, and 1572. Allowing it to be a variable star, with a period of 310 to 315 years, it would be *due* again in 1885. Some years ago I read in H. W. Warren's "Recreations in Astronomy," the following:

"In November, 1572, a new star blazed out in Cassiopea. This star was visible in noonday, and was brighter than any other star in the heavens. In January, 1573, it was less bright than Jupiter; in April it was below the second magnitude; the last of May it utterly disappeared. A bright star was seen near the place of the Pilgrim, as the star of 1573 was called, in 1264 and 945. A star of the tenth magnitude is now seen, brightening slowly, almost in the same place. It is possible this is a variable star of a period of about three hundred and ten years, and will blaze out again about 1885."

About the time I read Mr. Warren's book, I saw another notice of the Pilgrim, which traced it *further* back, to the years 630 and 320, and suggesting it might very possibly be the veritable Star of Bethlehem! I cannot lay my hand upon the author of this suggestion, but if it really *can* be traced back to 320 A.D., *why* may it not be?

If the present new star "*does* blaze out brighter than any other star," it will be a most interesting event, especially if it can be connected in any way with that most wonderful of all stars which shone in the East 1885 years ago. Can you or any of your readers throw any further light upon the subject?

S. W. MILLER.

Media, Penn., October, 1885.

American Whale Fishery.

To the Editor of the Scientific American:

An article in the issue of your paper for August 8, 1885, on the "Right Whale of the North Atlantic," taken from *Science et Nature*, represents so incorrectly the present condition of our whale fishery that a reply and correction ought, in fairness, to be made. The writer, evidently, was not well informed as to matters on this side of the Atlantic. After referring to the former great extent of American whaling, he says:

"In 1856 they still had 655 ships on the sea, but today the industry is almost completely abandoned for lack of whales. Fishing is no longer done, except by a few rare ships from the ports of Scotland, that go out to the polar sea for seal, and fish for whales incidentally. In the large seas of the temperate zones, the South Atlantic, the Pacific, and the Indian Ocean, . . . the whale is now so rare that it may almost be said there is none."

Now, these are by no means fair representations. There are at this moment 130 American vessels engaged in whaling, having an aggregate tonnage of 29,424 tons. New Bedford alone has 82 vessels, of 20,302 tons, and San Francisco sends out 20, of 6,155 tons.

Thus much for the vessels employed; but the whaling grounds are well worthy of notice. Twenty-two New Bedford whalers have spent the season this year "in the Arctic," that is, northward and mostly eastward of Behring's Strait; 16 have been on the South Pacific whaling grounds; 21 have cruised the Atlantic below the line, everywhere from the African coast to South America; while 3 have been engaged in that which is the successor of the old Greenland whaling, their field being Hudson's Bay.

The San Francisco whalers have been in the Arctic, with a single exception. They do not seem to consider that "in the South Atlantic and the Pacific the whale is so rare that it may almost be said there is none." The reports from various ships in the Atlantic of this season, up to the latest dates, read like this: 850 sperm, 185 whale; 290 sperm, 10 whale; 299 sperm, 30 whale; 510 sperm, etc. In the Arctic it has read: 2 whales, 2 whales, 4 whales, 9 whales, etc.; but it must be remembered that these reports necessarily comprise only the earlier part of the season.

The returns for the total whaling fleet of the United States, as reported for this year, from January 1 to September 15, have been 13,366 barrels sperm, 15,749 whale, and 242,780 pounds bone. These, at current rates, are worth $1,131,000, bringing the value of the year's fishery easily up to $1,500,000.

This is certainly far below the returns of forty years ago, when our fleet exceeded 500 vessels, but it indicates a branch of industry by no means to be despised, and one not at all likely to die of inanition. M. Jouan's statement of "655 ships still on the sea in 1856" is another error. Even in the strongest days of the whale fishery, previous to 1845, the entire number was never quite 600, and that total had grown very decidedly less up to 1856.

The whales captured in the Arctic are the long known right whale, commonly called by the whalers "steeple top" and "bowhead," which, by the way, is the species represented in your woodcut accompanying the article quoted. It belongs only to the high northern waters, and is never found in our mid-Atlantic regions. Sperm whales, southern right whales, humpbacks, and California gray are the objects of chase in the lower waters.

W. O. A.

The Aim and End of Machinery.

At the recent meeting of the Institution of Mechanical Engineers at Lincoln, England, a special musical service was held in the cathedral, to which the members were invited by the Dean and Chapter. An address of welcome by the Bishop, Dr. King, formed a part of the evening's service, and in the course of his remarks the Reverend Doctor gave expression to his thoughts in a manner which showed that he had studied the matter from a correct standpoint. Looking at the occupation of the mechanical engineers as one involving the subjugation of natural forces to the will of man, it appeared to him that we were tending toward a state of things in which toil of a severe nature would be annihilated, as even already time and distance had been annihilated by the subjugation of electricity, so that by its action even the very tone of the human voice could be transmitted through long distances. All this, in his opinion, placed the mechanical engineer in a high position among his fellow men. Such was the general drift of the Bishop's remarks.

Let us consider how it is that, with all the aid of steam and electricity, we still toil as hard as we ever did. Is it because machinery does not perform more work than could be performed by hand? This certainly cannot be the case, for it is self-evident that machinery does work that it would be impossible to do otherwise. The truth is that we have gone the wrong way to work. Quality has been subjected to quantity, as one consequence of our original error.

Before the days of steam power, and when the loom, for example, was wholly driven by manual labor, one individual worker could not possibly attend to more than one machine, for the constant presence of the worker was required in order to keep the machine at work. The labor was often severe and protracted. What did steam power do for the weaver? It relieved him of his severe labor, and left him with nothing to do but the light work of piecing broken threads, or refilling the shuttle and generally watching the good performance of the work of the machine. But it was very soon found that one man or woman could do more than this, and in place of tending a single machine it became the custom for one worker to superintend two machines; and as the machine improved in quality, and the turning of the steam engine also improved in regularity, another and another loom was added to the charge of each worker, until now it is not uncommon for one worker to superintend perhaps 4 to 7 looms, while at the same time the rate of work of each loom has progressed rapidly; the number of picks, from being perhaps 20 to 40 per minute in the hand loom, having attained from 100 to 300 in the most modern machines of a like width. Thus the number of yards produced has increased say fifty fold, and the only extra labor which has been employed to produce the steam power which has done this has been the proportionate fraction of the work of the engine driver and fireman, and of the coal carter or other carrier, and the collier. Now, so long as a large number of the earth's inhabitants require clothing which they cannot provide for themselves, the above state of affairs may, and will, continue; but during the last few years, more especially we in this country, who have for long had a supremacy in trade, have been confronted with the fact that many of our old customers have begun to make for themselves, and not only this, but they also aim at making for others who still buy from us. As civilization progresses, the disproportion between makers and users will become smaller still, and perhaps finally disappear; and the nearer we approach to the time when all shall make for themselves, the more tense will become the situation. Long before such a time comes, however, we shall have some alteration. We cannot go on making millions of yards of cloth which no one will buy, and the weavers will have to turn to other pursuits. Such, however, are not open, for every worker will be confronted with the fact that his productions are not required, and all will be seeking other pursuits and not finding them. It is therefore evident that changes must be made before this state of affairs is reached. The change required is lessened production. As the world now stands, it would not be practicable for us as a country to say we will at once reduce our productions one-half. It would be the signal for our downfall, for the Germans and the French would at once seize the opportunity to produce a great part of our relinquished half. But the time even then would still surely arrive when they also would have to restrain production; and it is clear that some day all manufacturers will have to do this. When this time arrives, it will then be seen how machinery has reduced toil. So far the employment of machinery appears to have simply tended to the production of more goods. We have used it simply as a means to assist us in doing more work, but not, as we ought to have done, to enable us to do in one day the work of a whole week. We have been content to work along at the old strain with an assistant that has done 98 per cent of the labor, the remaining 2 per cent alone having devolved upon us; but we have put into the 2 per cent remnant the whole of the energy which we formerly expended upon the 98 per cent, which the machine now does for us. Thoughtful minds may perhaps long have foreseen what must inevitably be the result of this, to use a familiar phrase, "keeping of a dog and barking ourselves." We have kept our dog with a vengeance, but we have not ceased to bark as lustily as before we possessed a whole pack of hounds.

This cannot continue. We must either do away with machinery, or employ it to do in one hour the work that would take us a day. To dispense with machinery is out of the question, and this leaves only the other course open to us. How such a mighty revolution can take place we do not clearly see; we only see that the question is looming up more distinctly day by day and week by week. The distant rumbling of the storm has been heard this month in Oldham. When the storm has passed, which it will do, though not in our time nor perhaps for centuries, yet it will leave the world better for the change. The work of the mechanical engineer will have accomplished the end which the Bishop of Lincoln prophetically indicated.

It is well that the church should recognize facts which are becoming palpable to many thoughtful men. We live in an era of overproduction. The only way that we have yet been able to find to reduce the surfeit has been to find a fresh market. This we have found from time to time, and in the present strait all eyes are turned toward Africa as a new and extensive outlet for goods. Open up Africa, say our merchants, and it will absorb all and more than we can produce, and leave enough for our Continental rivals also. Granted, we exclaim, but when Africa has been opened up, what next? Let Australia first be filled with people. So be it; but how when, like the United States, they become their own producers? What must next be done? Where shall we turn for a fresh market when the whole earth is civilized throughout? Some nations must, of course, hold pre-eminence in certain pursuits, but the final result to the world at large can be but one—a cessation from toil. We shall have to do less and learn more. What we do will have to be done well. What we produce will have to carry the impress of beauty. We shall have to change many things now existing, but the change will be for the better. The force of competition will have run its course, for it is not possible that it should last forever.—*Textile Manufacturer.*

Singular Effect of Naphtha.

Recently at the American Rubber Company's Works, Cambridge, Mass., a number of the girls in the coat room were suddenly overcome by the fumes of the naphtha used in the cement on the seams of the coats.

One of the girls suddenly began to laugh loudly and acted strangely, and then fainted. Several others also dropped upon the floor, and before physicians could be summoned more than thirty employes were unconscious or in hysterics. The alarm spread to the other employes, but they were soon quieted by the foremen in charge, and the girls most seriously affected were sent to their homes in carriages. No serious results are anticipated in any of the cases. Under certain conditions the naphtha produces effects somewhat similar to laughing gas.

THE new water works at Bismarck, Dak., are estimated to cost $100,000, and will not be completed this year. The water of the Missouri is to be pumped into a reservoir 144 feet above the business part of the city, which will carry it to any building.

A SUBSTITUTE FOR GLASS IN PHOTOGRAPHY.

In addition to the value of photography as a means of recreation, it is also found to be an invaluable aid to professional men. Engineers, architects, and draughtsmen use it for recording the progress of their work, making pictures of machinery, buildings, copying, drawings, and an infinite variety of work, which saves a vast amount of hand labor. Physicians find it useful in making memoranda of surgical operations. Insurance men use it in inspecting risks and adjusting losses by fire. Artists find it indispensable as an aid to sketching. Correspondents for illustrated papers and magazines now carry cameras as a part of their outfits, and even traveling sign painters photograph their work and send in the picture as a voucher on which to draw their pay.

All this has been accomplished by the introduction of the gelatine dry plate; but there are many who are still prevented from practicing the art by the weight of the apparatus and material, which has to be carried about to make even a few pictures. The weight of the glass is such a serious burden, especially in the larger sizes, that it discourages even the most enthusiastic after a few trials, and many cameras have been laid aside for this reason when they would otherwise be a source of unending satisfaction to their owners.

By reason of several recent improvements it has been found possible to prepare paper of fine and close texture upon a large scale, with an even coating of an extremely sensitive bromide of silver gelatine emulsion, so perfectly that positive silver prints made from the paper negatives will show no grain in the half tones, and be equally as clear and perfect as if made from glass.

The sensitive paper is prepared in sheets for use in ordinary plate holders, as shown in the pile to the right in Fig. 8, and in spools, as shown in Fig. 11. The film carrier in Fig. 8 is a flat board made of several strips of narrow wood glued together edgewise to prevent warping, between which and the spring metal frame lying flat, the sensitive sheet is clamped, as shown, by laying the board over the back of the paper. The whole is then slid into an ordinary plate holder like a plate.

When used in long strips, the paper is wound upon a wood spool, arranged for use in an instrument termed a roll holder, the principle of which is to draw the sensitive paper from the supply spool at one end over an exposing platform, occupying the same place as the focusing ground glass, to a winding-up reel at the other end.

These parts are inclosed in a highly finished mahogany case, shown in Fig. 6, with the vulcanite slide partially withdrawn, exposing to view the sensitive paper lying smooth and flat upon the exposing platform. A removable back supporting the working parts is attached to the case by four flat spring catches, plainly seen in Figs. 1, 2, and 3.

In taking the holder apart in the dark room to either insert a new spool or remove a reel of exposures, these catches are thrown out, the key socket and indicator knob on the side pulled out, and the case lifted off. (Fig. 3 shows it partly raised. Fig. 2 shows position when entirely removed.)

The light, blackened frame of brass holding the various parts is pivoted to the back by two pairs of sliding spring bolts, one pair being shown at the right in Fig. 1. Supposing that the frame occupies the position in Fig. 2, we draw inward with the right hand the sliding bolts, and with the left raise the whole, as shown in Fig. 1; this affords access to the spool mechanism. The supply spool is next inserted, as in Fig. 4, by raising the pressure spring brake, and pushing the end of the spool upon a projecting plug, seen upon the left, the opposite end being fastened by a thumb-screw. A suitable spring friction mechanism is provided, not shown, for giving tension to the paper when unwound from spools. After insertion the frame is lowered, locked to the back with the spring bolts, and the opposite end raised. The free end of the paper is then drawn up over an exposing platform and down to the reel under a flat brass pivoted clamp. When the paper is properly centered, the clamp is pressed down, holding and drawing the paper as soon as the reel is rotated. The reel is inserted and removed in a manner similar to the supply spool, but is constructed so that it will be impossible to put it in the same plane as the latter.

A spring pawl bears upon the head of reel and a gravity pawl upon that of the spool (see Fig. 2); these are thrown off during the process of changing spools.

A guide roll is placed at each end of the platform, the one on the right, Fig. 2, being termed a measuring guide roll, in which is a longitudinal slot used as a guide for the point of the knife in cutting off the exposed from the unexposed paper. The roll has a pin at one end for operating a flat spring, making a sound alarm, and in addition on its axis a spur wheel geared with a larger wheel for rotating the indicator. Metal points project slightly above the surface of the reel at each end, which puncture the margin of the paper at each revolution. As the circumference of the roll is one-fourth the length of the picture, four alarms are sounded, and the indicator at the same time makes one revolution, when one exposure has been wound up. Fig. 12 is a cross section showing the light flat brass springs which bear against margin of the paper, preventing the same from curling up. Fig. 7 shows the manner of operating the holder; a key with a screw thread is inserted in the key valve and rotated like the winding of a clock, revolving the reel, which winds up the exposed sheet, and brings a fresh surface into place ready for the next exposure. When the indicator has made one revolution, and the fourth click been heard, then the operator knows that the change has been accomplished.

After exposure, the paper on the reel may be readily removed, and a new one inserted to take up the balance of the unexposed paper. By counting four dots on the margin from the end after the sheet has been severed, as in Fig. 2, the length of the picture is easily determined, and may be cut off with a pair of scissors.

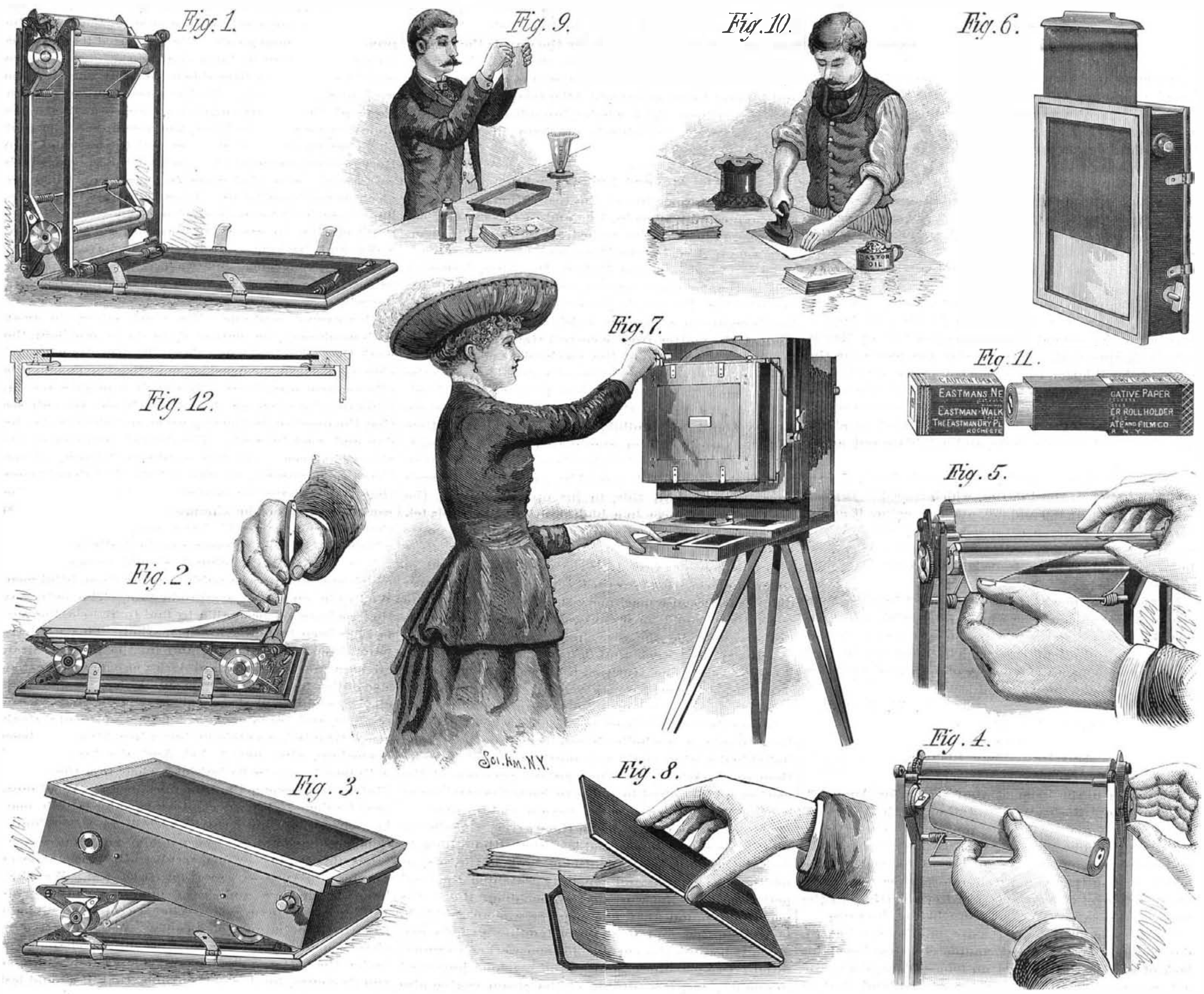


Fig. 1.—Roll Holder Thrown Back. Fig. 2.—Cutting off the Film. Fig. 3.—The Case Partly Raised. Fig. 4.—Putting in the Spool. Fig. 5.—Inserting the Free End. Fig. 6.—The Case—Slide partly drawn. Fig. 7.—Operating the Holder. Fig. 8.—Single Film Carrier. Fig. 9.—Developing. Fig. 10.—Making Films Transparent. Fig. 11.—The Package. Fig. 12.—Cross Section of Slide Aperture.

NEW PHOTOGRAPHIC APPARATUS FOR MAKING NEGATIVES ON PAPER.

The exposed sheets, as they are cut off, can be developed several at a time in one tray, with the usual pyro developer; Cooper's developer, described on page 197, No. 13, vol. 53, of the SCIENTIFIC AMERICAN, being preferred. Fig. 9 shows the tray, the developed negative being held up for examination to the red light. The developer is sold ready mixed, thereby insuring to the novice success at the outset.

After the negative is fixed and dried, positive silver prints may be made from it in the usual way; but to quicken the process, oiling the paper with castor oil and a hot iron, as shown in Fig. 10, is recommended, which renders it translucent. Paraffine wax may be used in place of oil.

The primary advantage of paper over glass is its extreme lightness. An 8 x 10 apparatus complete, with camera, lens, roll holder for 24 exposures, tripod, and case, weighs 28½ pounds less than a glass equipped outfit.

Such a saving makes the taking of large photographs attractive, and enables the amateur to obtain panoramic or other views of inaccessible regions with considerable comfort. The danger of breakage is avoided, thereby making rough transportation of the negatives perfectly safe.

The compact way in which the negatives can be packed should not be overlooked; they can be kept in books, thereby affording as easy a means of reference as if they were in a photographic album—a point of much value in any large concern. They can be used in photographic ink printing processes without the need of transfer, so common with glass plates. They are splendidly adapted for large work, and, as an instance of their success in this respect, we have but to refer to the very fine exhibition of life-sized direct portraits which was given at the Buffalo Photographers' Convention, in Buffalo, N. Y., last July.

The softness and delicacy of the shadows and the brilliancy of the high lights were specially noticeable.

The retouching of paper negatives is more easily done than on glass, for the back of the negative is worked upon by a pencil; any mistake can be readily erased. With crayon stubs very pretty cloud effects can be worked into the sky of landscape negatives. Perfect freedom from halation is one of the special characteristics of the paper, making it valuable in the photographing of interiors. All portions of the holder are made interchangeable.

The enterprise of the Eastman Company in introducing so noteworthy an invention as their roll holder, and the excellent sensitive paper film used with it, is illustrative of the characteristic push and energy so often displayed by American inventors; we bespeak for their improvement an important future, and consider it an advance in the art of photography which will be welcomed both by the amateur and professional. A silver medal was awarded the company at the London International Inventions Exhibition for the novelty of the invention and the fine workmanship displayed.

Particulars as to the sizes and prices of the paper may be found in our advertising columns. Further information may be had from the Eastman Dry Plate and Film Company, 1347 State Street, Rochester, N. Y.

Bread Mixtures.

Even in the most ancient times different foreign matters were mixed with bread.

In Thracia, bread was mixed with powdered dried roots, in Syria with dried mulberries, in Egypt with whole grains.

In modern times, in Sweden they add to the bread powdered dried fish; in Ireland and in Iceland, moss, which besides being nutritious keeps the bread from drying; in Prussia, white clay, which contains alkali salts and makes bread very light; in Russia, powdered bark or finely chopped straw. On western shore of England certain kind of sea weed (*Porphyra laciniata*) is gathered, washed, boiled, and then baked with oat meal flour.

In Africa, powdered dried locusts are mixed with bread, in India potatoes and pea flour, and during the famine even stones ground to fine powder were used in the latter country.

SIBLEY COLLEGE, CORNELL UNIVERSITY.

THE NEW SCHOOLS OF MECHANICAL ENGINEERING AND THE MECHANIC ARTS.

Cornell University, notwithstanding its youth, has already, just twenty years after the date of its incorporation, become one of the distinctively great collegiate institutions of the United States. Whether considered with reference to the number and magnitude of its buildings, the extent and beauty of its grounds, the largeness of its endowments, the munificence of its founders and benefactors, the number and completeness of its courses of instruction, the practical usefulness of its outfit of apparatus and machinery, the number of its students, or, most important of all, the number and character and fame of its little army of professors and teachers, it stands well among the three or four admittedly pre-eminent colleges and universities of our country. Cornell enjoys the proud distinction of being the first of all universities, whether in this country or in Europe, founded explicitly as a university, designed to give a real and broad university training, in which the needs of the people are fully recognized by the provisions of its charter, and in which the "leading objects" are asserted to be the instruction of students, "without excluding other scientific and classical studies, and including military tactics," in "such branches of learning as are related to agriculture and the mechanic arts." Thus, while giving opportunity for securing an education of the broadest and most liberal character, its founders intended to make sure that the special needs of a nation of workers should be recognized, and that schools of agriculture and the mechanic arts, of the several branches of construction and of the highest departments of engineering, should take their place beside the schools of classical and of scientific learning. From the first, it was intended to become a real university, of such scope as should give to the citizens of this country the means of educating their sons and their daughters in such manner as should best fit them for the work of meeting the difficulties of life. It has been thus organized, and is now a great institution of learning, exhibiting the novel feature of schools of engineering and of the useful arts side by side with those departments which usually constitute, alone, the older colleges.

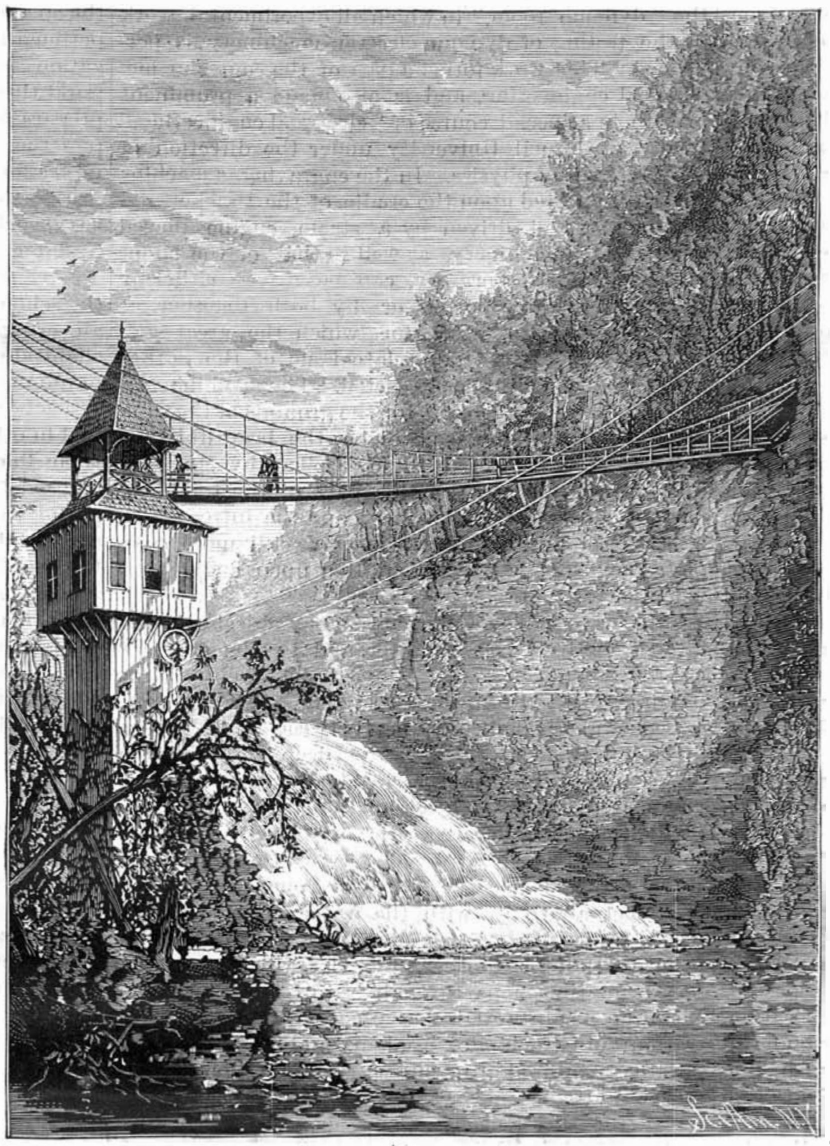


Fig. 9.—SIBLEY COLLEGE WATER WHEEL HOUSE.

Cornell University was incorporated in the year 1865, endowed by the State of New York with its land scrip, representing nine hundred and ninety thousand acres, and by Ezra Cornell with a half million of dollars in money and two hundred acres of land, adjacent to the city of Ithaca. Since that date this endowment has been amplified by the generosity of Henry W. Sage, John McGraw, the late Mrs. J. McGraw Fiske, Hiram Sibley, Andrew D. White, and others. The university is beautifully located, above the city of Ithaca and overlooking the forty miles length of Cayuga Lake; is conveniently accessible, from every direction, by the six lines of railroad intersecting each other at Ithaca. Fig. 2 gives a striking view of the grounds of the university, as seen from the top of the tower of Sage College, the college endowed by Mr. Sage for the benefit of the young women among the students. Sage Chapel, in which the most distinguished clergymen of the country are invited from Sunday to Sunday to preach non-sectarian discourses, is in the foreground; the library building, known as the McGraw Building, flanked by Morrill Hall and White Hall, beyond, while in the distance may be seen the great laboratory building and a corner of Sibley College. Away beyond, apparently not far from the lake, but, in fact, nearly a mile from it, is the house of Mrs. Jennie McGraw Fiske, the magnificent mansion of a lady whose philanthropy left nearly a million of dollars for the erection and endowment of a hospital and a great university library.

Cayuga Lake, with its picturesque banks and gorges, fills the distance. The grounds themselves are among the most beautiful in the country, if not in the world, and are bounded at the right and left by wonderfully picturesque canyons, through which the rushing waters fall some four hundred feet to the lake below.

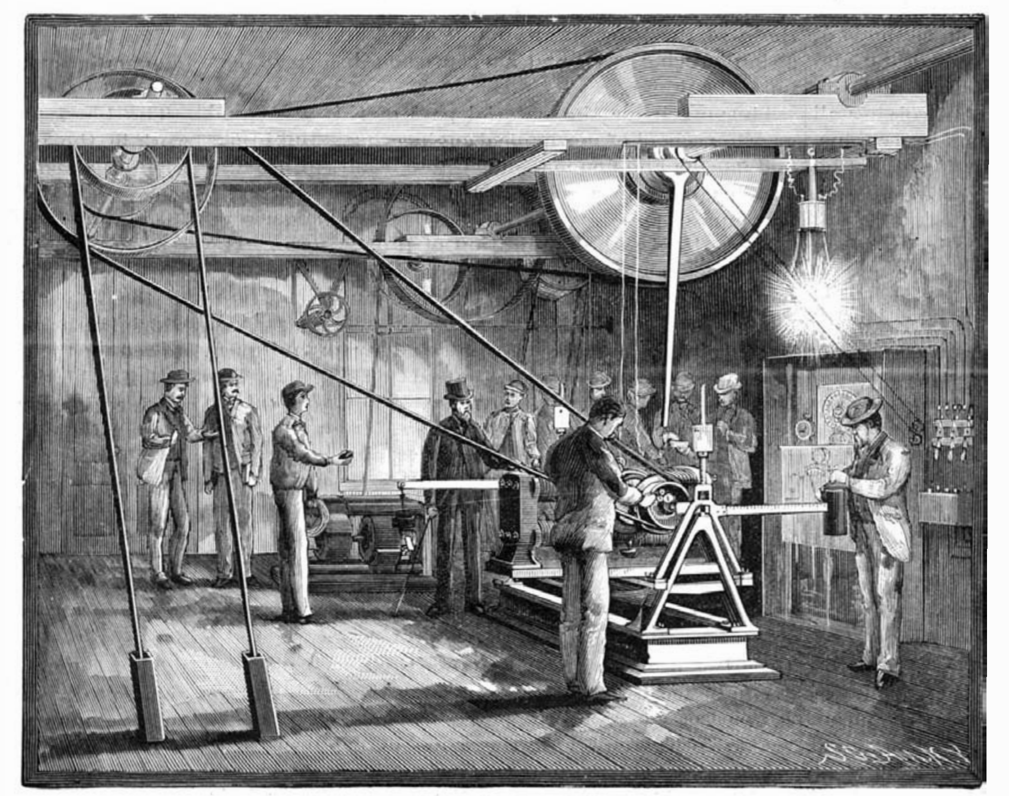


Fig. 10.—SIBLEY COLLEGE DYNAMO AND ELECTRICAL ROOM.

Sibley College is the school of mechanical engineering and of the mechanic arts of Cornell University. It was built and endowed, and supplied with a splendid outfit of machinery, workshops, models, and apparatus by the Hon. Hiram Sibley, of Rochester, himself a mechanic by original occupation and training, and later one of those princely men who built up the existing great systems of telegraphy in this country. Like Cornell himself, he turned a good proportion of his profits into the hands of the Trustees of the University, for the benefit of the youth of the present generation, in remembrance of those earlier days when he would have given so much for such opportunities, then not to be found anywhere in the land.

The Sibley buildings were designed by Prof. Morris; as shown in Fig. 4, they consist of a main building 160 feet long by 40 feet wide and three stories high, in which are the lecture rooms, the drawing rooms, and the museums of the college; and of a series of workshops seen in the rear and at the side, consisting of a wood working shop, a machine shop, a blacksmith shop, and a foundry, and also including a very extensive "mechanical laboratory." These shops are usually about forty feet wide by forty to sixty long, are well equipped, and are still receiving new machinery and tools of all the forms familiar to the engineer as used in the trades. Before the close of the present college year, they will be practically complete, and are already sufficiently so to permit the instruction of sections of twenty-five students at one time. They will be extended and new tools added as the growing classes may make it necessary. Fig. 1 shows one of the museums, that of mechanism, containing the Reauleaux collection of models illustrating the course in "kinematics," of "pure mechanism," or of the motions of machines. The second, the museum of machines, is similarly fitted up with cases containing models of machines, and also with book cases and tables, thus serving as a reading room as well as a museum and room in which to sketch machinery. These models are used in the lecture rooms in the illustration of the courses of instruction in mechanism and in machine design. One of the drawing rooms is seen in Fig. 7, the freehand or fine art room. Four large rooms are devoted the department of drawing and machine design.

The lecture rooms are also fitted up with cases for apparatus especially intended for illustration in special subjects. For example, that of the professor of mechanical engineering contains principally models and apparatus used in the course of lectures upon the steam engine and other motors. Some of the workshops are shown in Figs. 3, 5, and 8. At the left is seen the blacksmith shop, with its ten forges and its tools; at the right is the foundry, with its stock of flasks and accessories, and its cupola in which the iron is melted as required. Both of these departments greatly interest the young mechanics, who, under the careful and systematic instruction of their skilled teachers, often do wonderfully good work, and learn with singular rapidity.

The machine shop is seen at the lower part of our multiple illustration; and here, as well as in the carpenter's and pattern maker's shop, many a young successor to the great mechanics of to-day is finding his way into the mysteries of fine work and construction, to gauge size with a facility and ease that makes his elders regret that this epoch of true technical education had not come a generation earlier. It is here that the real mechanic at once separates himself from the youth who has mistaken his vocation, and shows that marvelous sleight and that wonderful accuracy of hand and eye that distinguish him from his less fortunate fellows. Such a student often acquires more knowledge and more skill in handling tools and in doing good work in a week than his classmate of the other type can attain in months. Nevertheless, here, as in every other department, it is not certain that the race is to be won by the swift; for steady, patient, earnest work does wonders for many who, at the first, give little promise of success.

The machine shop of Sibley College is fitted up with lathes and planers, milling machine and slotter, and with all the needed hand tools. The engine seen in the foreground of Fig. 8 is not intended to drive the machinery of the shop, although it may be so used, as the shop is ordinarily driven by water power; but is placed here for the purpose of serving as an experimental engine, with which the students may be made familiar with the methods of taking indicator cards, of using the Prony brake, and of testing engines to determine their power and efficiency, the position of their valves, and of solving all questions that arise in the operation of the steam engine. This was made by the students, under the direction of Professor Sweet, and was exhibited at the Centennial Exhibition of 1876.

Adjacent to the machine shop is the boiler room, containing the steam boilers used for heating and experimental purposes. One of the boilers is fitted up with all the apparatus required for boiler trials, where students are taught its management, the determination of its power and economical efficiency, and to ascertain the character of the steam made, by the best known methods. It is expected that, as the old boilers wear out, the new boilers introduced in their place, and to supply steam for the new buildings to be erected, will illustrate all the forms made by the best builders, including the so-called "safety boilers," as well as the older "shell" boilers. The work of the closing term of the regular course brings in this and a large amount of other experimental work.

A "mechanical laboratory," a large room, some sixty by forty feet, is fitted up adjacent to the workshops, also, in which are placed a variety of testing machines, including the Fairbanks, Riehle, and Olsen forms, for determining the strength, elasticity, ductility, and "resilience," or shock resisting power, of iron, steel, or other materials of construction, Thurston's "autographic" and lubricant testing machines, meters, indicators, scales, dynamometers, and all forms of apparatus for determining the quality of the materials used by the engineer and the power given or demanded by machines of all kinds, and their efficiency. This department forms a very prominent part of the establishment, and the course of instruction includes a considerable amount of work of this kind. The laboratory is one of the most interesting of all the interesting apartments in this great college, and is deserving of separate and independent illustration and description; it is therefore reserved for a later occasion.

In the main building is still another exceedingly important department, illustrated in Fig. 10. This is the "dynamo room," in which all experimental work in the testing of dynamo-electric machinery is performed. This work forms a part of the course in mechanical engineering, and is also made a prominent feature in a special course of "electrical engineering," taught at Cornell University under the direction of the professor of physics. In the engraving, a machine is seen supported upon the cradle of the Brackett dynamometer, and driven by a steam engine placed below. This machinery, as well as that of the shops and mechanical laboratory, can be driven either by steam or by water power, or by both together, as has been done in work for which the great galvanometer illustrated in a late issue of the SCIENTIFIC AMERICAN was constructed. The machine furnishing the electric lights for the grounds of the university is placed here, as will be the beautiful machinery lately presented Sibley College by Mr. Edison. A reconstruction of this part of the establishment, about to be undertaken, and the introduction of a new engine, are expected to give still more complete facilities for experimentation upon engine and machinery.

Exterior to Sibley College are many objects of great interest both to the engineer and to the ordinary unprofessional visitor. Immediately behind the buildings, and within a stone's throw, is Fall Creek, a beautiful stream, rushing between high banks, precipitating itself through the deep gorge over a dozen high ledges, and furnishing such picturesque views as delight the heart of the artist, while supplying the utilitarian necessities of the college. Here, as seen in Fig. 6, is placed the water supply machinery furnishing the reservoir, one or two hundred feet above it, with the water needed by the whole university. A few hundred feet below this beautiful fall is another, Fig. 9, which furnishes power for the shops through a turbine wheel, inclosed in a substantial house, as shown in the illustration; in which, also, are kept and used all the apparatus required to make determination of the power and efficiency of the wheel. The trial and test of the turbine is thus capable of being made a matter of class instruction and illustration. Such exercises will be made a part of the regular course when the plans now in hand are fully carried out. The Director is now engaged in improving the channels of supply, putting in a larger and more powerful wheel to drive the considerable amount of machinery to be introduced, and inclosing the wheel in a new house of sufficient size to permit the instruction of classes to be carried on within it. Our artist has given a very excellent view of this beautiful lower fall, and lack of space only prevents our introduction of other views from this interesting locality, which is but a sample of many in the neighborhood of the university. The wheel house and suspension bridge represent our artist's plans rather than those of the Director, who will adopt architecture of a simpler character and a suspension bridge of less imposing design.

Thus much for the material part of this great and growing school of mechanical engineering. But bricks and mortar and fine machinery and beautiful apparatus do not make a school. Brains, not buildings and museums of apparatus and machines, give real success, if worked into an organization of proper form. The organization and *personnel* of the establishment are of more importance than the buildings and plant, however elaborate. The trustees of Cornell University, recognizing this fact, have effected an organization upon which they rely for the successful conduct of this mighty educational machine. They place at its head a "Director," whose title indicates his office and his unusual powers. He organizes the college, determines the work and the limits of its several departments, arranges the courses of instruction, prescribes the methods, selects the right men, and assigns them their lines of work. The college, with the approval of the Trustees, has been divided by the Director into three principal departments: a department of drawing, a department of mechanic arts or of shopwork, and a department of mechanical engineering; each of which is conducted by a professor versed in the art taught in his part of the establishment. Each of these departments forms a part of the school of engineering, in which the regular course of instruction is given, and each contributes its part in the organization of the several advanced schools of special branches of mechanical engineering, conducted under the general supervision of the Director or by members of the college faculty especially fitted for such lines of work.

The regular course in mechanical engineering begins with two years of preparatory work, in which the students, coming from the preparatory and high schools of the country, are taught the higher mathematics and such branches of science and literature as are best adapted to their needs. Thenceforth the instruction in this department is made very largely professional, and includes lecture room and experimental study of the materials of engineering, of kinematics or motions of mechanism, of machine design, and of the principles, the theory, and the structure of the steam engine and other machines and motors. Experimental work and appropriate laboratory investigations accompany every step in the progress of the pupil throughout the course, and the final work is the preparation of a graduating thesis, which mainly occupies the last term of the course. Accompanying the professional work, also, a large amount of laboratory work is done in the departments of physics and chemistry, such as the engineer finds continually useful in his later practice.

Advanced courses are also given, where desired, in the school of marine engineering, in that of steam engineering, or in the post-graduate course in the mechanical engineering of railroads. As the college grows in number of students and instructors, and such advance becomes practicable, new schools will be organized in other branches of mechanical engineering. It is possible that special courses may, in time, also be organized for the benefit of young men desirous of preparing themselves to become superintendents of shops and establishments, or, as is common in Europe, for the benefit of young proprietors. Possibly, also, trade schools, as of carpentry, pattern making, machine work, may be organized for the purpose of teaching the higher branches of the several arts, thus combining schools for the mechanic arts in the same system with the present schools of engineering.

The officers of Sibley College are: Dr. R. H. Thurston, M.A., Doc. Eng., Director, and Professor of Mechanical Engineering; J. L. Morris, M.A., C.E., Sibley Professor of Practical Mechanics, or of the Mechanic Arts; E. C. Cleaves, B.S., Professor of Drawing; F. H. Bailey, U.S.N., Assistant Professor of Mechanical Engineering and of Marine Engineering; F. Van Vleck, M.E., Assistant to the Director and Instructor in the Mechanical Laboratory; R. Anderson, B.M.E., in charge of the workshop; and various skilled mechanics in the several shops. For all information our readers may address either the Director, the President of the University, Dr. Chas. Kendall Adams, or the Treasurer, Mr. E. L. Williams.

Blacksmith's Hammer Signals.

There are few persons, either in the city or country, who have not at times watched a blacksmith at work in his shop with his assistant, or striker. They have noticed that the smith keeps up a constant succession of motions and taps with a small hand hammer, while with his left hand he turns and moves the hot iron which the assistant is striking with a sledge. The taps are not purposeless, but given entirely for the direction of the striker. According to a writer in the *Hardware Reporter*, the signals, as given by the blacksmith and wheelwright, are as follows:

When the blacksmith gives the anvil quick, light blows, it is a signal to the helper to use the sledge or to strike quicker.

The force of the blows given by the blacksmith's hammer indicates the force of blow it is required to give the sledge.

The blacksmith's helper is supposed to strike the work in the middle of the width of the anvil, and when this requires to be varied the blacksmith indicates where the sledge blows are to fall by touching the required spot with his hand hammer.

If the sledge is required to have a lateral motion while descending, the blacksmith indicates the same to the helper by delivering hand hammer blows in which the hand hammer moves in the direction required for the sledge to move.

If the blacksmith delivers a heavy blow upon the work and an intermediate light blow on the anvil, it denotes that heavy sledge blows are required.

If there are two or more helpers, the blacksmith strikes a blow between each helper's sledge hammer blow, the object being to merely denote where the sledge blows are to fall.

When the blacksmith desires the sledge blows to cease, he lets the hand hammer head fall upon the anvil and continue its rebound upon the same until it ceases.

Thus the movements of the hand hammer constitute signals to the helper, and what appear desultory blows to the common observer constitute the method of communication between the blacksmith and his helper.

A RECENT compilation of fires caused by the explosions of petroleum lamps used for illuminating purposes in the city of Philadelphia during the last five years gives the following results: In 1880, 125 fires; in 1881, 79 fires; in 1882, 53 fires; in 1883, 72 fires; and in 1884, 66 fires; making a total of 395 fires. The numerous other fires caused by plumbers' and painters' pots, oil stoves, etc., are not contained in the above list.

MACHINES FOR BAKERIES.

We illustrate herewith some improved apparatus of Mr. Dathis for kneading and baking bread, and which may be seen in operation at a fine establishment on Opera Avenue, Paris.

Kneading by hand, usually employed in all bakeries, is here replaced by machinery. The apparatus consists of a receptacle that revolves around an axis in such a way as to present all parts of the dough that it contains to the action of the kneading instruments. These latter, which are like forks, continuously lift the dough, in order to first stiffen it, and then knead it by drawing it out, aerating it, and inflating it, without ever compressing it. This mode of operating makes the dough very spongy and light.

The kneading tools are fixed to the extremity of levers by means of regulating screws. These levers are actuated by cranks mounted upon a shaft driven by belting or by hand power. The dough pan, with the different pieces that move it, and the flywheels and cranks that actuate the kneaders, rests as a whole upon a cast iron frame.

The maneuver of the machine is very simple: A certain quantity of tepid water is first put into the lower vessel, in order to give a proper temperature to the dough that is to be kneaded in the pan above. The yeast, flour, liquid, and accessories having been put in, the apparatus is revolved, slowly at first in order to give the flour time to absorb the liquid, and then the speed is increased until it is 60 revolutions per minute. After ten minutes have elapsed, the dough is allowed to rest two or three minutes, and then the kneading is continued for another ten minutes. The operation is now finished, and the dough is taken out and put into a basket to rise. The machine is next thoroughly washed with water.

When the dough has risen sufficiently, the fact is announced by an electric bell, which is set ringing through a contact being formed by a movable piston that rests upon the dough.

The yeast is preserved in a wooden vat provided with a cover having a hermetical joint. In the center there is a screw plug, whose aperture is closed with cotton that filters the air coming into contact with the yeast.

In Fig. 2 is shown a Dathis bread oven, which consists of three parts, viz., a lower part forming a base and containing the fireplace and chimney, the oven properly so called, and the cover, with its lifting mechanism.

The lower part is supported by four iron legs in the small size and by four cast iron columns in the large size. It consists of a circular bottom formed of refractory plates arranged upon iron plate. This bottom is provided with a cylindrical double rim composed of refractory plates and tiles held together by an angle iron.

The fireplace is in front of the center of this circular bottom, and beneath it. It consists of a fire-bridge, flues, and an ordinary horizontal grate with ash pan.

The oven properly so called rests upon this lower part, and consists of an iron plate cylinder, having a double base of convex form, made of iron plate. This latter receives the direct heat of the fireplace, whose bridge, being in contact with it, obliges the flames to form a double ring of fire, that embraces the entire surface of the metal. The hot gases escape up the chimney, through the intermedium of a special conduit.

Above the iron plate there is arranged another hollow diaphragm, which is open in the center, and designed to distribute the heat throughout the entire mass of the oven. Water is introduced into the iron plate receptacle through a funnel provided with a cock and pipe. This water at the moment of charging the oven, produces steam, and this latter, condensing upon the cold bread, glazes it and facilitates its development.

Over this diaphragm there is a plano-convex iron plate arrangement, whose contained air equalizes the heat over the entire surface of the sides. Above the plane surface of this piece is placed the wire cloth designed to receive the loaves. As the bread is completely isolated from the dead plate of the oven, it does not become soiled by those impurities that this usually imperfectly cleaned piece usually contains.

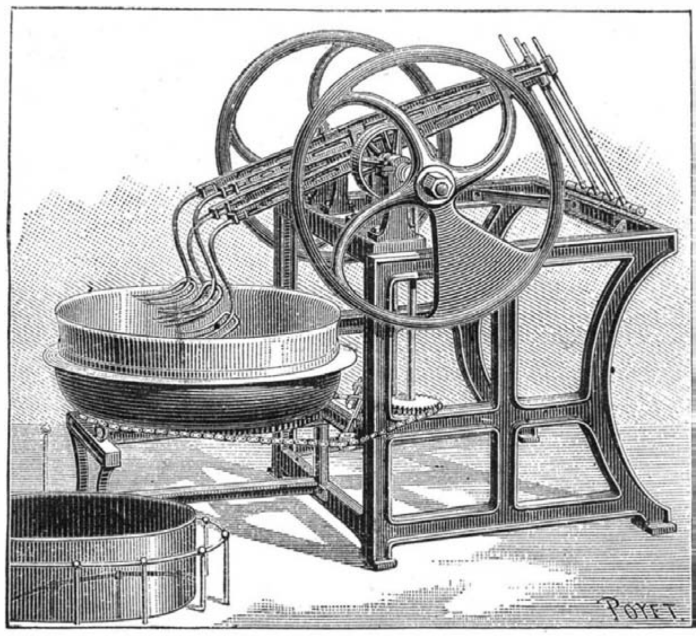


Fig. 1.—KNEADING MACHINE.

The cover, which is of cast iron, and convex in form, is provided externally with an isolating jacket, and serves to reflect the heat to the outer surface of the loaves.

It is lifted and lowered by means of a lever and counterpoise, supported by a column. It is provided with handles, sight holes for watching the interior, and a thermometer. In some cases an electric lamp may be arranged upon the cover, so that the interior of the oven may be lighted up and the baking observed.

In the six foot furnaces the wire-cloth bread support is removed by means of a sort of crane, as shown in the figure.

There are three sizes of these ovens, of the following diameters: 6 feet, 3 feet, and $1\frac{1}{2}$ feet.

The fuel used is either coal, coke, or wood. The baking is not begun until the oven has reached a temperature of between 230° and 260° C. The quantity of coke necessary to obtain such temperature in a six foot oven is not over 18 pounds.—*La Nature.*

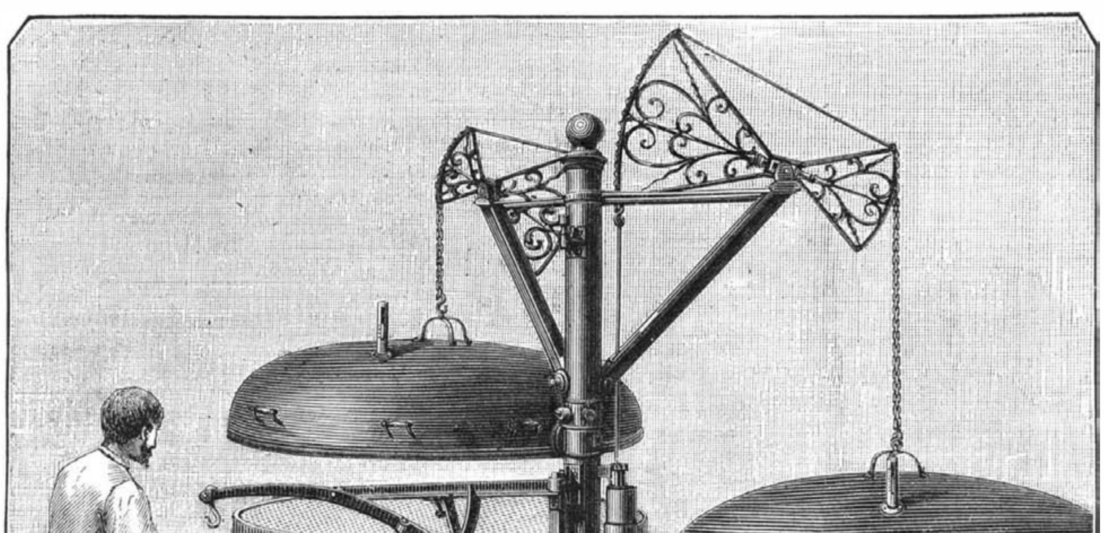


Fig. 2.—DATHIS'S BREAD OVEN.

IN the course of last year 3,284 ships passed through the Suez Canal. Of these vessels, 1,669 passed from the Mediterranean to the Red Sea, and 1,615 from the Red Sea to the Mediterranean.

A Government Signal Lamp.

Major Heap, of the Government Lighthouse Board, has devised a new arrangement of the electric light in its application to lighthouses, which may prove of some value. There are objections to the use of the arc lamp for this purpose, as it can penetrate fogs but little further than ordinary and weaker lamps now in use, and is about three times as expensive to maintain. The experiments made by the Trinity House Board, at South Fouland, England, showed that a 15,000 candle power arc lamp gave but little greater penetration in a fog than an oil or gas light of 2,500 candle power. The explanation offered for this singular deficiency of penetration is that the arc light is composed mainly of rays toward the violet end of the spectrum, while the light given from burning hydrocarbons is composed of rays toward the red end, and these possess the greater fog penetrating qualities.

If one looks at an arc light through a piece of red glass he will no longer see any arc, but only the two carbons heated to the point of incandescence, and the light will consequently be very much diminished. The sun, seen through a fog, appears decidedly red, indicating that only the red rays manage to penetrate. A lighthouse needs, therefore, not only a very powerful light, but also one rich in red and yellow rays. The latter of these conditions are not fulfilled by the arc lamp, but seem capable of realization in the incandescent electric lamp. Up to the present time, however, these have not been made to exceed 300 candle power, and would be too weak for use in lighthouses.

Major Heap's proposition is simply to increase the power of the incandescent lamp by using several carbon filaments in the same bulb. It is not new qualitatively, for there are lamps now in the market in which two filaments are employed in the same vacuum, but the multiple system has never been carried out as far as he suggests.

In a coast light of the third order, the flame at present is a cylinder, $1\frac{3}{4}$ inches high and $1\frac{5}{8}$ inches in diameter, and the lens employed is constructed to give the best results from these dimensions. To necessitate as little change as possible in the present plant, the new lamp is designed to furnish a light of these same dimensions.

Two disks of carbon, $1\frac{5}{8}$ inches in diameter, are placed $1\frac{3}{4}$ inches apart, and are connected at the circumference by twenty-four carbon filaments, one-fifth of an inch from each other. If each of these filaments give a light of 15 candle power, the inventor supposes that the total power will be 360 candles. If it were a simple question of multiplication, this undoubtedly would be the result, but there will probably be other elements entering into such a construction, which will modify the calculation, such as the difficulty of overcoming the resistance of such a length of carbon, and of maintaining the different filaments at the same degree of incandescence. If the system succeeds, it is proposed to include lights of the first order, by increasing the dimensions of the multiple arc.

Good Words from Old Friends.

We have so many of them that we do not often mention the fact in the SCIENTIFIC AMERICAN, although they are none the less pleasant to receive. The following comes from out in Wisconsin, in connection with a question to our "Note and Query" department:

"I have taken the SCIENTIFIC AMERICAN about eight years, and when I do not get it Saturday afternoon it seems as if the wheels of the week had somewhere lost a cog, and I go home from my place of business feeling that the morrow has nothing in store for me. In my estimation there are three good things in this life—the SCIENTIFIC AMERICAN, a happy home, and a clear conscience; the last two every man ought to have, the first every mechanic in the land ought to get."

ENGINEERING INVENTIONS.

A high and low water indicator has been patented by Mr. John C. Palmer, of Hamilton, Ont., Canada. It consists of a vessel having boiler connections, a float, guide rod, and levers, so arranged that when the water rises or falls beyond certain points the levers will be moved to sound the whistle, and thus promote the more safe management of steam boilers.

A car coupling has been patented by Mr. William E. Samuel, of Fairfield, Neb. This coupling has an automatically operating cock connecting with the steam and air brakes, so that when the cars are coupled, and the speed of the locomotive suddenly checked so that the bumpers come together, joints are made whereby the tubes of the several cars are connected for a sufficient length of time to apply the steam or air brakes.

AGRICULTURAL INVENTIONS.

A hand seed drill has been patented by Mr. Frank H. Chesebro, of South Haven, Mich. The seed box has a sliding plate with a discharge opening, and is connected by a bent lever and a rod with an elbow lever pivoted to a handle of the drill, in connection with a furrow opening spout, the device being designed to promote convenience and accuracy in the drilling of small seeds.

A potato digger has been patented by Mr. Frank M. Thorn, of Orchard Park, N. Y. It consists of a vertically adjustable double mould board plow between two broad tread wheels, the axis of each wheel so fixed to the plow frame that as the machine advances the contents of the potato hills will be conveyed by the mould boards into the broad rims of the wheels, by which they are elevated and deposited by gravity on a sifter or separator or upon the ground behind the plow.

MISCELLANEOUS INVENTIONS.

A watch charm has been patented by Mr. Cornelius H. Davis, of Philipsburg, Pa. It consists of a pendant and a spinning top removably secured thereto, so that the latter can be easily attached and detached, making an ornament and toy combined.

A surgical instrument has been patented by Mr. James Somers, of Moro, Oregon. It provides an instrument for certain kinds of amputations, so that the blood vessels and arteries will be twisted together before they are severed, and thus prevent hæmorrhage without cauterization or tying.

A saddle bar has been patented by Mr. Thomas J. Haslam, of Dublin, Ireland. It is for holding the runner to which the stirrup strap is secured, and is made to hold the runner firmly under ordinary use, but so that it will become detached automatically when the rider is thrown or falls from his horse.

A cotton packer has been patented by Mr. Alfred Hart, of San Marcos, Texas. This device is designed to receive the cotton from the condenser, after ginning, and pack it in a box preparatory to being pressed and tied into a bale, and embraces novel features whereby the work may be done automatically.

A bed and bedstead has been patented by Messrs. Andrew Smith and George H. Albers, of Sellwood, Oregon. There are transverse rollers at the head and foot carrying an endless belt for supporting the bedding, there being also a drawer in the foot end of the bedstead, with hinged leaf and sliding boards.

An eaves trough fastening has been patented by Mr. Olin Harley, of South Whitley, Ind. It is so made that a readily accessible single upper nut, in the form of a thumbscrew, serves to secure the hanger to a cross bar and to provide for adjustment of the trough free from all liability of detachment or loss of the nut.

A stand or casing for bottles has been patented by Messrs. Camille S. Bleton and Adolphe Malcville, of Paris, France. It has inwardly projecting tenons, and at the bottom a spring cushion, and is to be used in combination with a bottle having longitudinal grooves in opposite sides.

A horse collar has been patented by Mr. Henry Brooks, of Brooklyn, Ohio. Its main lining, or portion coming in contact with the animal, is of felt, and contains within a canvas or other wrapper a suitable filling, which is prevented by the soft nature of the felt lining from gathering into wads or lumps.

A washing machine has been patented by Mr. Morgan L. Grover, of Lavalle, Wis. This invention provides a rocking clothes box or tub, in which the clothes are placed with hot soapsuds and washed by being thrown from one end to the other by rocking the box, at the same time that they are beaten by a swinging beater.

A carpet stretcher and tacker has been patented by Mr. George M. Brandon, of Harveyville, Pa. Combined with a series of sharp points extended from a suitable handle is a projecting head and spring for holding a tack over a slot between the points, so the carpet may be stretched to the point desired and so held while the tack is driven.

A cartridge loader has been patented by Messrs. Jacob D. McKenney and Thomas W. Brown, of Chattanooga, Tenn. Combined with the body of the shell loader are powder and shot hoppers arranged to be brought alternately under a suitable aperture, with such an arrangement of slides as will allow of readily increasing or diminishing the charge.

A churn has been patented by Mr. Allin Cockrell, of Lamar, Mo. It has a shaft and a tubular shaft surrounding it, each operating blades in opposite directions in the cream box or tub, and the arrangement is such that the cream, buttermilk, etc., are drained off from the butter by a perforated bottom and a perforated tube.

A fabric measuring machine has been patented by Mr. John W. Kruger, of Litchfield, Minn. It is adapted for measuring goods of different widths, and will wind and unwind cloth accurately at the same time as measuring, the machine covering a special combination of rollers, fabric holding devices, and other parts and details.

A cravat fastener has been patented by Mr. John Adams, of Montrose, Col. It consists of a piece of rubber or other elastic material, having an opening with radial slits extending therefrom to the shield of the cravat, so that the collar button or stud may be pressed through the opening to attach the cravat in place.

A wash tub, sink, or other vessel made of cement has been patented by Mr. Carl Wesely, of West New York, N. J. This invention covers the making of such vessels with their angles and corners and upper edges faced with metal strips embedded in the cement or compound forming the vessel, to promote strength and durability.

A school desk has been patented by Mr. William P. Conner, of Bloomsburg, Pa. The desk has two leg frames on which the back of the seat and the box of the desk are held, the back of the seat also forming the back of the desk box, with numerous other special details, for strengthening such desks and simplifying their construction.

A vehicle shaft support has been patented by Mr. James F. Pace, of Simsborough, La. It consists essentially in a bar adapted to be pivoted at one end to the front of a wagon, and formed on its free end with a forward projecting hook, a spring for throwing the bar into a vertical position against the wagon front, and a catch plate to be applied to the front.

A needle for Jacquard looms has been patented by Mr. Andreas Mutter, of Paterson, N. J. The needle has a longitudinal slot, on the bottom of which rests a spiral spring, with a plate at its end adapted to slide vertically between the sides of the groove, so that if a needle is forced against a Jacquard card its end will not punch or perforate it.

A turpentine hacker has been patented by Mr. Walter Watson, of Fayetteville, N. C. The hacking blade has a shank of flat form for a portion of its length, and its end rounded, bent, and screw-threaded, combined with a handle having apertures, to receive and firmly hold the shank of the hacker throughout its length.

A pencil case and sharpener has been patented by Mr. Greenleaf A. Wilbur, of Skowhegan, Me. The pencil case is open at both ends, a rubber or eraser to be placed in one end, and so the pencil may be passed point first into the other end, the case having a side slot in which a sharpener may be held, the device thus affording protection to the point of the pencil and the means of readily sharpening it.

A gate spring has been patented by Messrs. Miles Kious and William A. Morton, of Le Roy, Kan. The action of the spring is such as to close the gate until the latter is opened so wide that the staple passes the hinge center, when the strain of the spring is on the opposite side of the hinge pin, and the gate is held open, while in the other cases it is automatically closed.

A ball and socket hinge has been patented by Mr. Albert G. Rockfellow, of Ashland, Oregon. With the use of a screw shank the construction is intended to protect the hinge completely from the weather, and from the lodgment of grit and dirt, thus prolonging the life of the hinge and at the same time giving a gate on which it is used the inclination that makes it self-closing.

A carpet stretcher has been patented by Mr. Joseph S. Ingham, of Academy Corners, Pa. A bar having a sliding cross bar carrying teeth is so combined with a pulley, rope, winding post, lever, and clamp, that the carpet can be stretched to the desired position and so held until tacked, the invention being an improvement on a former patented invention of the same inventor.

A compound for treating tobacco has been patented by Mr. Adolph Gloeser, of West St. Paul, Minn. It is for cigars and smoking and chewing tobacco, to destroy or neutralize its injurious properties and render it more agreeable, and consists of tincture of coca, fluid extract of tolu, fluid extract of hops, essence of lemon, and apple cider, in certain designated proportions.

A running gear for vehicles has been patented by Messrs. Alexander K. Wilson and Benjamin F. Holder, of Valdosta, Ga. By this construction the head block is located vertically over the front axle, and the weight of the body is borne directly on such axle, the use of the kingbolt being avoided, and the reach, guide, or keeper, and curved bar of the head block forming a fifth wheel.

A fruit drier has been patented by Mr. John G. McNaughton, of Marion, N. C. Combined with a series of pans, each having two bottoms forming a steam compartment between them, are steam spreaders forming an arched passage closed at the bottom and finely perforated at the top, so controlling the entrance and exit of the steam that the full heat is exhausted before its escape.

A mail crane has been patented by Mr. Fred W. Sensiba, of Talbot, Mich. This invention covers a special construction whereby cranes for holding mail pouches at the sides of railway tracks, to be taken therefrom by a passing train, are made to automatically swing into a position parallel with the track when the pouch is pulled out, so the crane will then be out of the way of the cars.

An underskirt has been patented by Mr. Jacob Mayer, of New York city. By this invention the yoke and body of the skirt are made of one piece of material, with folded darts in front and curved side and back seams and curved placket, to make a corset-fitting skirt without waste, slightly padding the figure in front, and preventing the outlines of the front points of the corset from showing through the dress.

An implement used in the manufacture of cans, etc., has been patented by Mr. Hiram G. Filson, of New Cumberland, W. Va. It consists of an adjustable cylindrical holder to be employed in soldering the edges and bottoms, and adapted to hold articles of different diameters, with self-adjusting bearings and a handle on the interior of the holder to withdraw it from the soldered article.

A water regulator for windmills has been patented by Mr. Anson M. Otis, of York, Neb. A tank is suitably suspended from one end of a lever, which carries a weight on the other end, the weight greater than the empty tank but less than a full one, making a device for automatically stopping the flow of water into a tank or throwing a windmill out of gear when the tank is full.

A split pulley has been patented by Messrs. Harrison Underwood and Charles Schweizer, of New York city. Combined with two half pulley sections is a split rim or band secured to and surrounding them, with bolts for clamping them on the shaft and for holding the ends of the band together, making a pulley which can be easily placed and firmly locked on the shaft.

A washing machine has been patented by Mr. Robert Lynn, Sr., of Pleasant Plain, Iowa. Combined with a rotary cylinder having longitudinal slits in its periphery are buckets secured within the cylinder adjacent to and in front of the slits, with backward curved rear sides, the device being adapted to be placed in a common tub for washing clothes, and continually dipping up water and pouring it upon the clothes.

A feed regulator for hemp drawing and spinning machines has been patented by Mr. George Davis, of Elizabeth, N. J. The condenser standard has an arm, and the brake strap has an arm with a suspended weight and a projecting pin, whereby the parts are connected and the movements of the condenser standard are made to control the drive pulley of the machine, and thus regulate the delivery of the sliver to the condenser.

A self-acting solar reflector has been patented by Mr. Heinrich A. W. Braune, of Valparaiso, Ind. The invention consists in a guide and a fixed piece for changing the inclination of the mirror as it revolves, with devices for adjusting the inclination of the longitudinal horizontal axis of the mirror to the longitudinal horizontal axis of the revolving frame, and keep a beam of light continually in the same position in relation to the lens of the solar camera.

A water elevator has been patented by Mr. Justus W. Thorp, of Dayton, Washington Ter. A lifting screw is hung from its upper end and supported on anti-friction rollers, dispensing with a lower end bearing, and there are universally jointed shaft connections from the driving gearing of the screw to a water wheel in the stream from which the water is lifted by the screw, the invention being calculated to facilitate hydraulic mining.

A machine for boring gun barrels has been patented by Messrs. Herman H. Hackman and Theophiel P. Walter, of Vincennes, Ind. It is made with an expansible and hollow boring tool, and a guide bar clamped to the working carriage and passing through the boring tool, its bar, and the gun barrel, to govern the diameter and shape of the bore, with other special features, so that the work may be done by unskilled labor and the barrels will have great precision.

A water elevator has been patented by Mr. Benjamin J. Hewitt, of Manton, Mich. Over a well curb is placed a shaft having a loosely mounted shifting pulley, around which is coiled a rope with buckets at its ends, one bucket enough heavier than the other to overbalance the latter and its contents, in connection with which is a weight so arranged that the full bucket may always be lifted by moving the pulley one way or the other on its shaft with a lever.

A tension regulator for the let-off motions of looms has been patented by Mr. Arthur Middleton, Jr., of Pelzer, S. C. The construction is such that the pressure of the tension producing spring is regulated automatically and continuously in exact proportion to the reduction of the size of the roll of warp on the beam, thus giving the warp the same tension from the beginning to the finish of the roll without the help of an attendant.

An apparatus for and method of making and raising salt brine from deep salt veins forms the subject of two patents issued to Mr. John Peters, of Haverstraw, N. Y. The invention covers an arrangement of outside pumping machinery to force water into deep wells in salt deposits, where it will dissolve salt by contact and become brine, and to expel the latter from the well by pressure, thus doing away with inside pumping machinery, and allowing of the use of a natural or artificial head or pressure of water near the mouth of the well to dispense with the force pump.

A wind motor has been patented by Mr. Frank S. McKibben, of Tacoma, Washington Ter. Combined with an upright structure carrying a revolving platform a shaft is journaled with two cranks at right angles to each other, with a wind wheel on the shaft, connecting rods connecting the two cranks, with various other novel features, whereby the motion will always be transmitted vertically, and the top platform may revolve without affecting the devices for transmitting motion.

A money drawer and recorder has been patented by Mr. Alphonso S. Keating, of Corry, Pa. This invention affords means for automatically giving a signal when the drawer is opened, with certain devices for automatically feeding a strip or sheet of paper over the top of a box in front of the drawer, on which to note expenditures, etc. The same inventor has also patented a cash recorder, with devices for showing when the register has been opened, and various novel features for facilitating the correct keeping of the cash drawer.

A process of and apparatus for making wax and paraffine paper forms the subject of three patents issued to Mr. Edward G. Sparks, of New York city. These several inventions all cover different apparatus for passing paper through melted wax or paraffine in such way that both surfaces shall be thoroughly coated therewith, all superfluous wax scraped off, and the surfaces, if desired, be afterward brushed with a polishing roll, the body of the paper not being filled with the wax, thus making a saving in the cost of the manufacture of such paper, while either side of the paper may be applied for the ordinary uses indifferently.

Business and Personal.

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Notes & Queries

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References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
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Minerals sent for examination should be distinctly marked or labeled.

(1) J. R. B. asks: 1. What effect has kerosene oil on metals? A. No effect. 2. Does it soften steel? A. No.

(2) H. M. L. writes: I have made an induction coil; it is 3 inches long, and 1½ inches in diameter; it is wound with 4 layers of heavy and 13 layers of fine wire, and each layer is insulated by a layer of tissue paper; the current is interrupted by an electro-magnet. A child could bear the current at full strength. I would like to know how to make it stronger, and be able to regulate the current. When I put the bundle of wires in, the current increases; and if I put a steel rod in, it is still stronger; the spark it gives is hardly perceptible. I use a Grenet battery. A. It is probable that the resistance of your electro-magnetic interrupter, together with the primary wire of your coil, is too great. Either add another cell of battery or use some other form of interrupter. It is possible that your insulation may not be perfect enough; if so, you can improve it by soaking the coil for some time in hot paraffin.

(3) W. A. S. writes: 1. Wishing to try an experiment, I should like to know through your valuable paper, the SCIENTIFIC AMERICAN: 1. What is the nature of a loadstone? A. Loadstone is a variety of magnetic iron ore. 2. Where can I obtain such a stone? A. From any dealer in mineral specimens. 3. What is a sympathetic magnetic needle? A. There is no such thing. 4. When the needle on a dial is attracted to a certain point by a loadstone, would a sympathetic needle on another dial placed at a considerable distance from the first move to a corresponding position on its own dial? A. No.

(4) J. C. N. asks: 1. For electro gold plating how long should an article remain in the bath to receive a good heavy coating of gold? For example, take a silver dollar; how long should it remain in the bath to receive one dollar's worth of gold, with a single cell Smee battery, size of zinc plates 3½x7 inches, heat of bath 160° Fah.? A. This depends on the strength of the gilding solution, the size of the anode, and the condition of the battery. The usual method of determining the amount of gold deposited in a given time is to weigh the cathode before gilding, and from time to time during the process. 2. Also, how often should it be taken out and brushed over with pumicestone or sand? A. It should be taken out and scratch-brushed soon after the first immersion, and a short time before the finish. 3. Can you give me the formula for making mercuric nitrate? A. You can make it by dissolving mercury in strong nitric acid. Another method is to saturate strong nitric acid, diluted with an equal measure of water, with oxide of mercury.

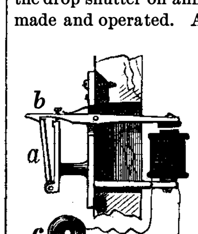
(5) H. M. N. asks (1) the reason why astronomers think the sun is not stationary? A. By observing a great number of stars, it has been ascertained that the solar system is moving toward the constellation Hercules. 2. Where can I find the sun's motions treated at length, with the supposed reasons assigned for the same? A. Newcomb's Popular Astronomy will give you information on this subject.

(6) C. E. A. asks. will it be practical to light my plating room by electricity. My dynamo has capacity to run 200 gallons solution. A. It is probable that your machine generates a current of low electromotive force, and is therefore not adapted to electric lighting.

(7) J. J. W. writes: There is considerable discussion in this shop as to what is known as India rubber, or pure rubber. I claim it is a popular name for caoutchouc, while others claim that it means gutta percha. As we all bank on the SCIENTIFIC AMERICAN, we have agreed to lay the matter before you, and accept your decision as final. A. You are right. Gutta percha is a different gum.

(8) R. T. M. writes: A gentleman not long ago asked whether a yacht would sail in a calm if a bellows sufficiently large to fill her sails were operated by steam, on board. The person to whom the question was addressed answered, "Not an inch." I differed with him, and held that the yacht would move backward. We cannot convince each other. Will you have the kindness to answer in your correspondence column? A. The yacht would not be moved by the action of the wind from the bellows on the sails. The reactionary effect of the wind might move the boat backward as you suggest, and this effect would be greater without the sails.

(9) E. J. C. writes: Please describe how the drop shutter on annunciators and burglar alarms is made and operated. A. The drop, *a*, is pivoted to a plate attached to or formed upon the main frame, the plate having on its face the name or number. The drop is held in a slightly inclined position by the catch on the end of the lever, *b*, this end of the lever being held down by a spring. The opposite end of the lever carries an armature, below which is located the magnet, which is in circuit with the battery and the push button, *c*. By pushing the button, *c*, the magnet is rendered active, and the armature is pulled down, raising the opposite end of the lever, *b*, releasing the drop, *a*, which thus falls of its own gravity. The action of the annunciator is rendered more or less sensitive by a screw which passes through the lever, *b*, and striking on the upper edge of the annunciator plate limits the downward movement of the catch.



(10) L. B. asks: How are the moulds obtained for making hollow rubber balls? If made in sections, how united? At what temperature are they vulcanized, and in dry heat or steam? A. The mould is a simple metallic mould made in halves. The rubber is placed in it so that it will join at the edges when the mould is closed, but before closing the mould a small quantity of water is placed in the rubber. This makes steam when the mould is heated, and forces the rubber into every part of the mould. Steam heat is used, and the temperature depends upon the time in which the work is to be done; 300° to 310° Fah. is about the right temperature for quick work. Consult SUPPLEMENT, Nos. 249, 251, and 252 for information on rubber manufacture.

(11) J. W. S. asks: What ingredients are used with corundum in making wheels and other forms for grinding and reducing metals, and the manipulative process? A. There are various cements employed in making emery and corundum wheels. Corundum wheels to be used with water are generally made of corundum and shellac. Dry corundum wheels are often made with glue only as a cement. Rubber (vulcanized), water glass, and oxychloride of zinc are also used.

(12) J. E. H. writes: 1. Given: two 4 inch achromatic objectives, properly corrected, one of five, the other six feet focal distance, which will make the better telescope? A. For comet seeking and similar uses, the short focus; for other work, the long focus. We think the long focus would be preferable for general use. 2. By what method is the focal distance of compound eyepieces determined? A. Consult SUPPLEMENT, No. 399. 3. Can the eyepieces of a microscope be used for a telescope? A. Yes. 4. What is the meaning of the term "ampere" as used in electrical technology? A. The unit of the current. It is found by dividing the electromotive force in volts by the resistance of the circuit in ohms:

$$C=\frac{E}{R}$$

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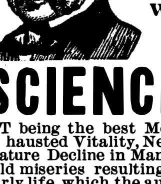

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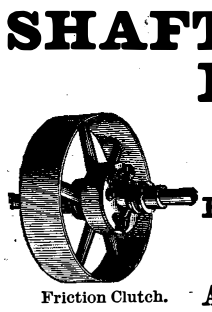

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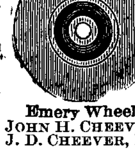

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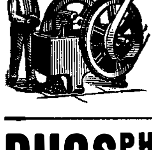

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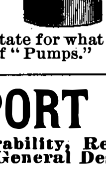

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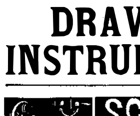

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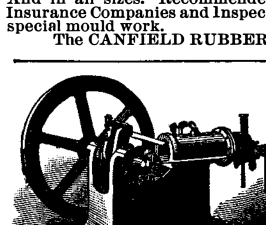

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