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THE THOMSON-HOUSTON EXHIBIT AT THE INTERNATIONAL ELECTRICAL EXPOSITION, PHILADELPHIA.

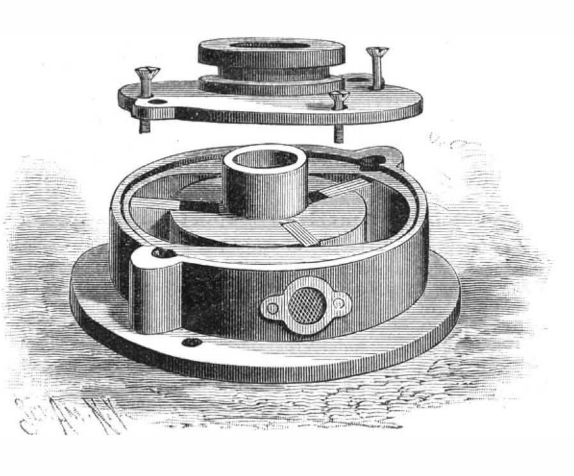
Visitors to the Exposition, upon entering the main gate and then turning to the right, had their attention attracted, before they had proceeded far, by a multitude of powerful arc lights suspended above a raised and richly carpeted flooring. Here were displayed a series of finely wrought mechanisms, from an exposed core of a dynamo to the perfected machine. This was the headquarters of the Thomson-Houston Electric Company, of Boston, Mass., which of late has become widely known for the efficiency of its apparatus and the business-like thoroughness of its system.

In the general exhibit this company had five dynamo machines in constant action, two having a capacity of 30 arc lamps, two more of 12 lights capacity, and still another of 6 lights. Besides these there were models of the unfinished Thomson-Houston dynamo, so arranged that the parts could be inspected, and other specimens of the latest improved type.

To those who had the time and inclination to attentively study this exhibit—and there were many such—conclusive evidence was presented of its possession of novel and striking features when compared to other systems of the same type. It was noticed that the hissing and sputtering, so common in some arc systems, were here reduced to a minimum, and the lights were powerful, constant, and steady.

A diminutive dynamo and plant designed by Prof. Thomson illustrated the system in all its workings far better than could have been done by a plant distributed to distant parts of the building. It showed clearly the relations between current, electromotive force, and work. A small dynamo generated a constant current, which kept aglow six arc lights, each of the intensity of sixty candles, and by switching the current it could be made to leave the arc lights and supply the requisite energy for an incandescent plant.

The peculiarity of the Thomson-Houston dynamo may be said to lie mainly in the armature, the construction of which is strikingly original. This armature is made of a cast iron hollow shell; and iron wires, forming an oblate



spheroid, surround this. Insulated copper wire in three series is wound on this core. Starting at that part of the shaft opposite the commutator, the wire of each of these series is led over the longitudinal circumference of the core, and, in order to avoid the shaft, changes its course and returns *via* the opposite circumference of the core. After making a sufficient number of convolutions, the terminal is carried out to a segment of the commutator, the beginning of the wire being attached to a coupler near that portion of the shaft which is opposite the commutator.

A like direction is taken by the second series of wires, which are kept at an angle of sixty degrees with the first, and the third series of wires follows at another angle of sixty degrees. The initial ends of these last two series are affixed to the coupler to which the first is attached. Hence all of them are electrically connected. To different plates of the commutator the three free ends are affixed. This method of winding has proved to be very efficient, two series being constantly maintained in the field of force.

By means of a combined motor and generator shown in the exhibit, the arc light or motor circuit can be made to feed incandescent lamps, an alternating current being used. The system employed is that of building on the same shaft the armatures for both the motor and the lighting apparatus, and any kind of current as to character or potential may be taken off.

What attracted not a little attention to this exhibit was the running of arc lights in multiple series. This is an invention of Professor Thomson, and a very important one, for, as seen at the Exposition, it permits the running of arc lights of altogether different intensities from a single circuit, some of them being in series, while others are in multiple arc or in multiple series, and renders practicable divisions and redivisions of lights as well as the rejoining of arc circuits.

For the benefit of scientific institutions and the lecture room generally, the Thomson-Houston Company make a hand dynamo. As exhibited, it showed that it is capable of generating a small arclight or several incandescent lights,

THE THOMSON-HOUSTON EXHIBIT AT THE INTERNATIONAL ELECTRICAL EXHIBITION, PHILADELPHIA.

or providing a strong and constant current for other purposes of illustration or experiment, at times showing nearly a one horse power energy.

The motors displayed by this company showed themselves particularly adapted for the transmission of power from a distance, which from present appearances would seem to be one of the great problems of the future.

Perhaps the most important feature of the Thomson-Houston exhibit was the little mechanism inclosed in a small box by which the electric current can be transferred from arc lights, and made to feed incandescent lights of from twelve to sixteen candle power. It is called the Thomson-Rice incandescent distributor. Heretofore little has been done in this direction; either arc or incandescent lights being exclusively distributed, because it was found that the cracking of one or more incandescent lamps usually led to the breaking of many more in the same group. By the device exhibited, however, an arc light can be turned out, and a group of eight incandescent lights be made to glow instead. Furthermore, all the lamps or any particular number of these in one circuit can be turned on or off with the same facility as gas jets can be operated, and without danger to other lights in the circuit. The little mechanism acts automatically and electrically, and is at no time subject to accident by reason of careless handling. As a whole, the Thomson-Houston system shows, as exhibited, that it is founded upon a correct interpretation of natural laws, and that its workings are directed by men who are conversant with the theory as well as the practice of electrical engineering.

The National Academy of Sciences.

A session of this society was held at Newport, R. I., Oct. 14 to 18. The National Academy was incorporated by Congress in 1863, to "consist of not more than fifty ordinary members," and the custom has been that these shall be selected specialists such as will best represent every department of knowledge. We believe there are now about one hundred members of the Academy, but it is nevertheless a very select organization as compared with that much larger body, the American Association for the Advancement of Science, and manypapers read at its meetings are such as would be of little interest to other than specialists in the subjects treated of.

Among the papers read was one by Prof. E. D. Cope to show the evolution of certain bones of the ear in *Pelicosauria*, involving a study in comparative anatomy as well as evolution.

Prof. Fairman Rogers, of the University of Pennsylvania, described experiments on the motion of animals, as depicted by instantaneous photography. In some experiments conducted last summer at Fairmount Park, Philadelphia, forty cameras were placed in a row, and so adjusted as to be successively opened by the motion of an animal passing in front of them. These experiments will throw light on the mechanism of animals, and, it is suggested, may give valuable application in machinery. For instance, marine engineers do not agree on the best form of steamer screws, and it is intimated that an exhaustive study of the fish's propeller would throw light on this. There will probably be no difficulty in arranging a glass tank through which fish can be made to swim, and be photographed in transit. The motion of dogs, horses—especially racers—deers, and other animals, in running, were described; and interesting and prolonged discussion ensued. Professor Rogers stated an interesting point to be the flexure of the long pastern. When a horse gallops, he moves in a horizontal line. His body keeps almost a uniform direction, notwithstanding that his feet rise and fall. He bends his pastern to keep level. In race horses it touches the track. He cited as an instance a celebrated race horse, which used to make eight marks on the ground, four for the pasterns as well as the four foot tracks.

Professor Tylor, of Oxford, England, the eminent anthropologist, considered at great length the "Civilization of the American Races," particularly the Zuni, Navajo, Mojave, and Wallopi tribes, among which he had traveled.

Among those present at this meeting of the Academy were President O. C. Marsh, Professor of Paleontology of Yale; Home Secretary Asaph Hall, Astronomer of the National Observatory; Treasurer J. H. C. Coffin, United States Navy; W. H. Brewer, Professor of Agriculture, Yale; G. J. Brush, Professor of Metallurgy, Yale; Josiah P. Cooke, Professor of Mineralogy, Harvard; Edward S. Dana, Professor of Physics at Yale; Walcott Gibbs, Professor of Chemistry at Harvard; Julius Hilgard, Superintendent of the Coast Survey; Samuel P. Langley, astronomer in charge of the Allegheny Observatory; J. S. Packard, Professor of Zoology at Brown University; Edward C. Pickering, director of the United States Geological Survey; Samuel H. Scudder, editor of *Science*, of Cambridge Mass.; William P. Trowbridge, Professor of Mechanics at Columbia College; and Francis A. Walker, President of the Massachusetts Institute of Technology.

A New Pavement in Berlin.

A new form of paving has been in use in Berlin since last year. Layers of bricks are put down impregnated with asphalt. After a time they absorb from 15 to 20 per cent of the bituminous matter, becoming remarkably elastic and capable of resisting pressure and damp. This new paving, it is said, lasts much longer than any of the other kinds, and it offers a sure foothold to horses. It is a very popular pavement in the capital of Prussia.

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A PRIZE FOR INVENTORS.—NEED OF PASSENGER AND FREIGHT CAR BRAKES.

Railroad officials seem to have arrived at the settled conviction that no essential improvements can be made in passenger car brakes; that the air or vacuum brakes, with all their faults and deficiencies, are as nearly perfect as can be, and that it is useless to seek further. And as practically all the roads have adopted these brakes for their passenger traffic, they naturally oppose the introduction of any improvements that would depreciate their costly investments.

For the present, then, the passenger car brake question may be considered settled, but it is not so with the freight car brake.

It may be asked why the air or vacuum brake is not as well adapted to freight traffic as to passenger traffic. In reply the roads say that the cost of the air or vacuum brake is greater than the freight service will bear; that the air or vacuum brake must, to be effective, be continuous, or connected for all the cars in a train; that this necessary continuity or connection of all the brakes in a train can, without much trouble, be assured in passenger traffic, wherein the interchange and mixing of cars rarely occurs, but that the conditions obtaining in freight traffic are such that each car must be equipped with a brake that will act independently of any other in the train.

On all the principal lines of railroads the majority of the freight trains are partly made up of "wild" cars (cars from other roads) and these cars are necessarily distributed throughout the train in the order of their arrival, so that one "wild" car without the air or vacuum brake in a train equipped with the air or vacuum brake might render all the brakes on the train ineffective.

Another objection which the roads make to the air or vacuum brakes for freight traffic is that the brake nose connections deteriorate from exposure, and that the couplings offer irresistible temptation to thieves.

If in spite of special care and watch in the yards the nose connections often give out and the brass couplings are almost daily stolen, what, they say, would become of the brake on freight cars which are run off and held on sidings all along the road for days and weeks, waiting to be loaded or unloaded?

There are other minor objections to the air or vacuum brake for freight traffic, but these mentioned appear to be inseparable from this class of brakes.

Not only, then, are the lists open to a suitable freight brake, but the roads are united in seeking for it.

This is one of the broadest fields for inventors, and will yield most abundant reward to the successful ones.

Great fortunes have been made from the air or vacuum passenger car brakes, and yet the whole number of passenger cars in this country are less than one-thirtieth of the number of freight and coal cars, which are all in want of their special brake.

Freight trains are still operated by the common hand brake, and though many other kinds have been proposed, the roads prefer to hold to their old friend until something in all respects superior shall be produced.

It is true that the hand brake requires a crew of two or three brakemen to a train, while a suitable brake would require no brakemen; it is true that it cannot quickly control a train running at high speed, and consequently that for safety the trains must be run slowly; and it is true that its persistent use daily brings death or injury to one or more poor railroad employes; but nothing yet devised for the purpose possesses all its virtues and fewer faults and is, at the same time, cheap enough.

For the benefit of inventors we have given this brake problem long and careful study, in which we have been aided by a number of prominent experts in railroad matters.

We can say, then, that a brake which shall fulfill all the requirements of freight train service must be cheap, simple, and durable, and require no special skill to repair or keep it in order, and it must possess the following functions and advantages:

1. It must be thoroughly automatic, and entirely under the control of the engineer.

2. It must adjust itself automatically, to suit either direction in which the car is pulled.

3. It must operate at any and all rates of speed.

4. It must be complete in itself on the car to which it is attached, and independent of the action of other brakes in the train, so that "wild" cars will not interfere with its action.

5. It must be capable of bringing a train to a "full stop," and, if on a descending grade, of "holding it."

6. It must admit of a train being moved a short distance at slow speed, and yet be operative to stop it again.

7. It must not interfere with the backing of a train, nor in any way with the handling of a train in yards.

8. It must provide for the stopping of the rear portion of a train when broken loose.

9. It must never cause sliding of the wheels.

10. It must never interfere with the use of the hand brake staff.

11. It must be easily rendered inoperative.

12. It must operate with slight motion of the drawbar, and not be injuriously affected by excessive motion thereof.

It should be applied in place without removing car truck or axle.

And finally, it should be so constructed that but one truck on a car need be equipped with it.

It is well understood that these functions and advantages can probably be combined only in a momentum brake; but no one has yet been able to construct a brake embracing them all.

But several so called automatic momentum brakes, however, have been invented, some of which are noteworthy for their ingenuity, though lacking in some one or more essential features.

None, we believe, are constructed and arranged to stop the rear portion of a train when the train breaks apart. When it is considered that about 40 per cent of the accidents to freight trains occur from the breaking apart of the trains and the subsequent collision of the two portions, it is not easy to overestimate the value of a brake that will prevent such accidents, and at the same time possess all other requisites.

Did the limits assigned to this article permit, we could easily advance many reasons why a brake such as we have described would also be superior for passenger traffic, but that ground is perhaps too well occupied for present advance upon it.

Here, then, is an opportunity for the exercise of inventive talent; upward of a million of cars in this country alone are lacking the equipment of a perfect automatic momentum brake, and the railroad companies are all demanding it.

Who will carry off the prize?

THE HEAVY GUN QUESTION.

Now that Congress has made something like an effort toward protecting the coast, those officers of both military arms who have made a specialty of heavy gun manufacture are doing their best, as might have been expected, to see that this effort is not misdirected. A committee of officers was, it is true, appointed, at the suggestion of the last Congress, to determine the very weighty questions as to national and private foundries and the quality of guns to be made therein. But, as is well known, only a few of the many experts to be found in the general service could be accommodated on the committee, and, precisely because the subjects to be considered are so weighty, suggestions by those who have been over the ground are at once timely and welcome.

Among those officers whose suggestions may fairly claim the serious attention of the committee, is Captain O. E. Michaelis, U.S.A. In a recent paper read before the American Society of Civil Engineers, Captain Michaelis goes into a careful and detailed consideration of the subject, contenting himself with presenting the recent experience in gun manufacture rather than attempting to determine the method or to formulate the policy from which the best results may be expected. Now that there is a disposition on the part of Congress to properly protect the coast, and new and costly foundries are to be established, we are confronted with what seems to be a very serious question, viz., who shall own or control these plants—the government or private parties, or both conjointly? The evidence as gathered by Captain Michaelis shows that each system has serious defects.

Up to the Franco-Prussian war the French foundries were owned and maintained by the government; a board of officers, having charge of the work of gun making, met only in secret session, and resisted the introduction of new processes or public criticism of the old ones. The German system of relying upon a single private company for arming the country has also little to commend it; the company in order to maintain itself must needs look for large foreign contracts, and when the decisive moment comes are either seriously hampered or in a position to take advantage of the state's necessities, and demand exorbitant prices. Nor has a partnership between the State and private parties proved altogether satisfactory.

One of the evils of this system is shown by Captain Michaelis by a recent experience of the British government, which, in addition to being charged exorbitant prices for war material, was forced to pay £65,000 to close an agreement, while the company, besides its profits on manufacture, came into possession of a complete working plant at a mere nominal valuation.

Curiously enough, Captain Michaelis, after setting up the dummy that a copartnership between the State and private parties leaves the latter free at times to take advantage of the State's necessities, as shown by the evidence adduced by him, he proceeds to knock it down by expressed approval of a similar project as contained in a letter of General Benet, of the Ordnance, to Commodore Simpson. In this Gen. Benet suggests that the government shall provide a private corporation "with some of the more costly plant, such as new furnaces, steam hammers, large lathes, cranes, etc., the foundry to reimburse the government by paying a certain percentage on all work performed with said plant until the whole cost is repaid."

There is an objection to such a plan, which is, perhaps, even more serious than the threatened danger of extortionate charges in the hour of extremity. Even the great gun manufactory of Herr Krupp, at Essen, has not enough gun making to keep all hands employed the year round, and must needs take large contracts for material in no way connected with armament or war. In this latter employment, Herr Krupp has many competitors in Germany, but if his plant had been supplied by the government at a nominal figure and upon easy payments, it is not unreasonable to suppose that no German firm could compete with Krupp, even in the manufacture of those mechanisms which are not allied to the art of war, and hence the imperial government would be but assisting Krupp to force other manufacturers out of the business.

In our own country, the spirit if not the letter of the Constitution is opposed to the State entering the market as a competitor with private parties, and such an arrangement as that suggested by Gen. Benet, and supported by Capt. Michaelis, smacks strongly of this. It would enable a private firm or company to come into the immediate possession of a costly plant, which, when not employed in gun manufacture, could be used in turning out other kinds of work in vast quantities, to the great disadvantage of all other private concerns engaged in a similar manufacture.

The system now in use in France has been accepted by the board of officers appointed at the instigation of Congress as the proper standard for imitation, and is commended by Capt. Michaelis in his paper. This system contains, perhaps, fewer objectionable features than any other that has been suggested during the long controversy now happily ended. In this system the government maintains the gun manufactories itself wherein the parts are machined and assembled. For foundry work, on the other hand, the private companies or corporations are depended upon. None of these are supplied with plant nor in any way assisted in preventing competition, this being the rather encouraged, and in France some of the foundries have been induced, on their own motion, to establish gun factories to supplement the government shops.

Concerning the quality and character of the guns that are to be, Capt. Michaelis brings together much and varied information.

Though the exact cost of solid cast-steel guns has not yet been ascertained, he believes that it will be found to be about one-third the cost of hammered steel guns. It has, he says, the range of tensile strength from 50 to 30 tons per square inch, and the corresponding elongation of 7 to 28 per cent, and is therefore destined to replace not only iron castings, but iron and steel forgings, which are very much more expensive and no stronger.

In regard to castings, a conviction has prevailed in some quarters that we had no open hearth plants equal to those at Terre-Noire, in France, where the manufacture of large castings is a specialty, and the best methods of annealing and tempering to be applied to the metal, in order to give it all the mechanical properties corresponding to its chemical action a study. Yet Captain Michaelis says that we have open hearth plants fully equal, if not superior, to those at Terre-Noire, and that the tensile strength of ordinary castings in this country, now sixty thousand pounds, may, with careful manipulation and special methods of casting, possibly under compression, be doubled. Indeed, Mr. S. T. Wellman, of the Otis Iron and Steel Company, whom he quotes, says he is very sure that we can produce a metal good enough for heavy guns without pressure; but with pressure we could do as well as Whitworth, who, so far, has beaten the world.

It is not so many years ago that our great guns, our machine guns, and breech-loading rifles had no equals in Europe, but now, on our own models, vast improvements have been made, and, says an author quoted by Capt. Michaelis: "If we don't soon begin to manufacture ourselves, everything American will be brought back to us with a foreign name. Our mammoth powder will become 'pebble,' and perforated cake be known as 'prismatic,' our pressure gauge as a 'crusher gauge,' and the Hotchkiss case shot be credited to Col. Boxer. Prof. Treadwell's system of gun construction of 1840 is known as Armstrong's of 1856, but no one has seen Armstrong's patent for it; Krupp has appropriated the Broadwell system bodily, and Eastman's slotted-screw breech plug is known as the French breech loading gun. Mr. S. B. Dean invented a method of mandreling bronze guns by which strength and hardness are greatly increased, and two years after his patents were taken in Austria, his gun was brought out there as the Uchatius gun, and a vast achievement. Their whole artillery is armed with it. The Russian government built a great foundry at Perm to carry out Rodman's design on a large scale, and took his powder and his experience along. Mr. Hotchkiss has established a large factory near Paris, where he has very extensive orders, and has become in his line the main reliance of the French government."

Surely, a nation like ours, which has through the genius of its sons furnished the bases for all great gun manufacture now in use abroad, should be able to at least equal in efficiency the improvements founded originally upon its own designs.

TWO REMARKABLE METEORS.

A correspondent in Lafayette, Alabama, gives an interesting account of two meteors observed by him on the night of the 14th of August.

The first meteor was unusually large and brilliant, exploding due west, and vanishing without leaving a trace behind. It was seen about midnight.

The second meteor was seen fifteen or twenty minutes later, was as large as its predecessor, and exploded in a south-southeast direction. After the explosion of the fire ball, a train of light remained visible for eight or ten minutes, at first motionless, and then slowly changing from a straight to a curvilinear form. The moon shone brightly at the time, the atmosphere was clear, and both meteors were sufficiently brilliant to make the shadows of the two observers and the shade trees in their vicinity almost as plain as in sunlight.

Our correspondent thinks that the first phenomenon could not have been a meteor, because it came to a sudden "standstill," and asks, "What was it?"

Both phenomena are probably due to the same origin, the matter that circulates in inter-planetary space, and, according to size, isolation, or constituents, takes form as meteoric stones, fire balls, or shooting stars, all being classed under the head of aerolites, and being merely varieties of the same phenomenon. They vary in weight from the meteoric stone in Brazil estimated to weigh 14,000 pounds to the shooting star weighing a few grains. They vary in brilliancy from meteors shining brightly in the noonday presence of the sun to the tiny falling stars that only sharp sighted observers can discern as a vanishing point of light. They vary in continuance from the fire balls that burst and leave behind, in a few recorded instances, luminous trains shining for an hour after the body disappeared, to those that split into fragments, and leave scarcely a trace of their presence. They vary in the noise they produce from detonations like thunder or the firing of cannon to the slight sounds that only a vigilant ear can detect. They vary in number from the countless myriads that people the meteor zones to the solitary specimens that from time to time show themselves in our sky, and then vanish forever.

They are all due to the same cause. The earth as she moves in her orbit encounters these cosmical atoms in her course. Both bodies are moving with immense velocity, and in opposite directions. The meteors rush headlong against our atmosphere, are ignited by the concussion and fall to the earth as stones, or are crushed into impalpable dust.

The two meteors observed by our correspondent probably belonged to the class known as fire balls. It is not impossible, if the train of the second meteor was yellow in color, and it radiated from the constellation Perseus, that both meteors were members of the August meteor zone, through which the earth was passing about that time.

Meteors belonging to this group have been observed of great size and brilliancy, and with an estimated weight of seven pounds. The observer of the meteors also records a fine show of falling stars on the 10th. As the show often continues for several nights, we are somewhat inclined to this theory, for we have not infrequently seen members of the group as large as the planet Venus exploded with a sound distinctly audible, and leave behind a shining train.

The Prime Meridian Conference.

This body, which assembled in Washington, October 1, included forty members, representing twenty-four governments, as follows:

Austria-Hungary, Brazil, Colombus, Costa Rica, Denmark, France, Germany, Great Britain, Guatemala, Hawaii, Italy, Japan, Mexico, Netherlands, Paraguay, Russia, San Domingo, San Salvador, Spain, Sweden and Norway, Switzerland, Turkey, Venezuela, and the United States. The conference was not as prompt to adopt the general meridian of Greenwich as had been expected, but a resolution to that effect was finally passed, and that meridian recommended to all governments for adoption, the representatives of twenty-one governments voting in favor of it, San Domingo against it, and France and Brazil abstaining from voting.

The conference also resolved that longitude continue to be counted as at present in two directions, up to 180°, instead of in one direction up to 360°, as had been recommended by the Roman conference. Although the Greenwich meridian has long been the standard for four-fifths of the world's navigators and geographers, its adoption by all will be a common benefit. The ancient geographers drew the first meridian through Ferro, the westernmost of the Canary Islands, and this is yet followed to some extent. The French have also used the meridian of Paris, the Spaniards that of Madrid, while we have used both that of Greenwich and Washington. The French representatives appear to have made the principal objection to the adoption of the Greenwich meridian as seeming to be an English standard, but as it extends from north to south through the whole of Western France, they could remedy this by setting up an observatory on that line, and styling the reckoning accordingly.

Henry T. Anthony.

Mr. Anthony, who was one of the pioneers in taking up the famous invention of Daguerre, and afterward among the most prominent in developing and extending the business of photography, died at his residence in New York city Oct. 11, aged 71 years. The immediate cause of death was the result of injuries received from a fall in attempting to run out of the way of a cab car. Mr. Anthony was graduated from Columbia College in 1832, studied engineering and became a surveyor on the Erie Railroad, was employed on the Croton Aqueduct, and was also an engineer on the Hudson River Railroad. His name has for many years been most familiar, however, as that of a member of the firm of E. & H. T. Anthony & Co., manufacturers of and dealers in photographic materials. He had especial charge of the manufacturing department, and was the originator of many improvements in practical photography.

Raw Umber.

This is an ocher found on the island of Cyprus. It is known in the trade as Turkey umber, and the genuine article is a soft brown pigment, transparent in oil, and abounding in manganese, from the presence of which it derives its drying properties.

AN IMPROVED SCREW CUTTING LATHE.

The accompanying illustration shows a screw cutting foot lathe, manufactured by Sebastian, May & Co., of Cincinnati, O. It is specially designed to meet the wants of model makers, inventors, electricians, sewing machine agents, amateurs, and others having use for a small lathe to run by foot power.

With this lathe can be turned iron, steel, brass, wood, bone, or ivory; also screw cutting, polishing, drilling, milling, or any other kind of work that can be done on any large lathe proportionately.

It is strongly and durably built, and can be easily operated.

The bed of the lathe is $4\frac{1}{2}$ inches wide and is 34 inches long, is thoroughly braced, has four Vs, will swing 8 inches over bed, and take 20 inches between centers.

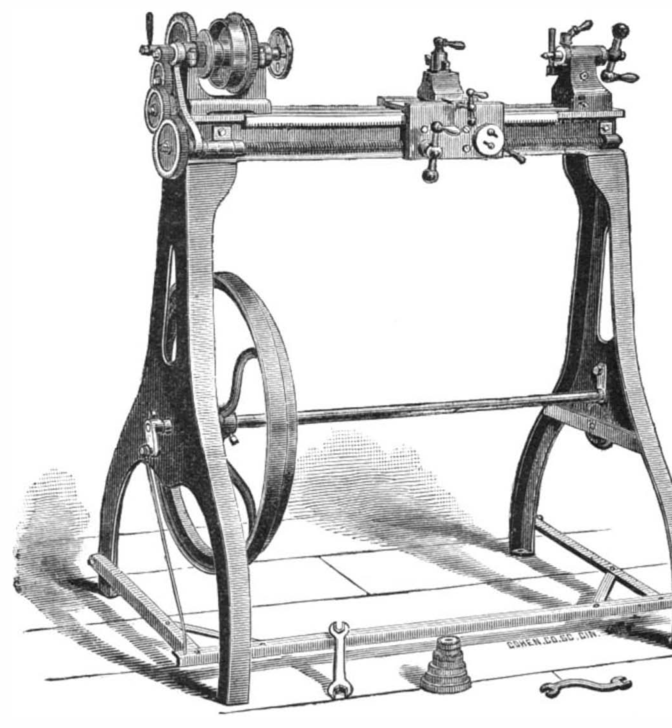
The head spindle is made of $1\frac{1}{4}$ inch solid steel, and tail spindle is $\frac{7}{8}$ inch steel. The back gear is thrown in and out by a cam. The tail stock sets over for tapers, and is fastened down by a cam. The head is detachable, so as to admit readjustment if spindle becomes untrue.

The treadle is of wrought angle iron. The rod supporting the driving wheel runs on friction wheels. The tops of the pitmans are of gun metal, and the bottoms of the pitmans slip through holes in the foot bar, so as to adjust the length of the stroke.

The carriage and rest are of the most approved and latest design. The carriage is detachable for hand work, and it can be thrown into feed instantly for turning or screw cutting. All threads for screws are bastard, that is, half square, half V.

With this lathe is furnished a face plate, two pointed centers, wrenches, and gears to cut from 3 to 40 threads.

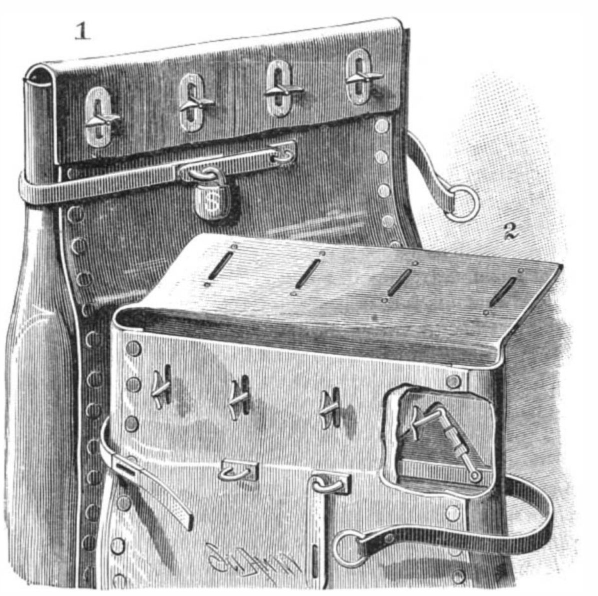
Any further information may be obtained by addressing the manufacturers.



SEBASTIAN, MAY & CO.'S IMPROVED SCREW CUTTING LATHE.

MAIL BAG.

Formed on the top edge of the back of the pouch is a flap which folds over on the front. Both the front and flap are provided with vertical slots which coincide with each other when the flap is folded. On the inner surface of the back of the pouch is riveted a leather strip, above which is



ARMSTRONG'S MAIL BAG.

secured to the outer surface a piece of leather having V-shaped recesses formed in its bottom edge. On these pieces is secured a piece of leather, between which and the back slides a strap. Pivots are held in the back of the pouch, and are so arranged as to pass through the slots, the outer ends being formed with a button. On the inner end of each pivot is an arm having a sliding section, the outer end of which is pivoted to the strap. At one end of the strap is a ring, and at the opposite end is a slot.

When the bag is filled the flap is swung down, so that the pivots pass through the slots when the strap is pulled; this swings the arms and turns the buttons in such a manner that they cross the slots. The slotted end of the strap is then swung over the front of the pouch, and the padlock applied as shown in Fig. 1. By disengaging the strap and pulling it in the opposite direction, the pouch may be opened. Fig. 2 shows the pouch opened, parts being broken away to show the arrangement of the pivots and arms.

This invention has been patented by Mr. B. F. Armstrong, of Engle, New Mexico.

A Machine for Producing Rain.

Among the last inventions reported from Australia is a machine for producing rain storms. It is intended to force a rain supply from the clouds during a period of drought. The apparatus is in the form of a balloon with a charge of dynamite attached underneath it. The balloon is to be sent into the clouds, and when there the dynamite is to be fired by a wire connecting it with the earth. A trial of this novel contrivance is to be given upon the dry districts of New South Wales, and the result is looked forward to with interest by some of the residents of that colony.

A Specific for Hiccough.

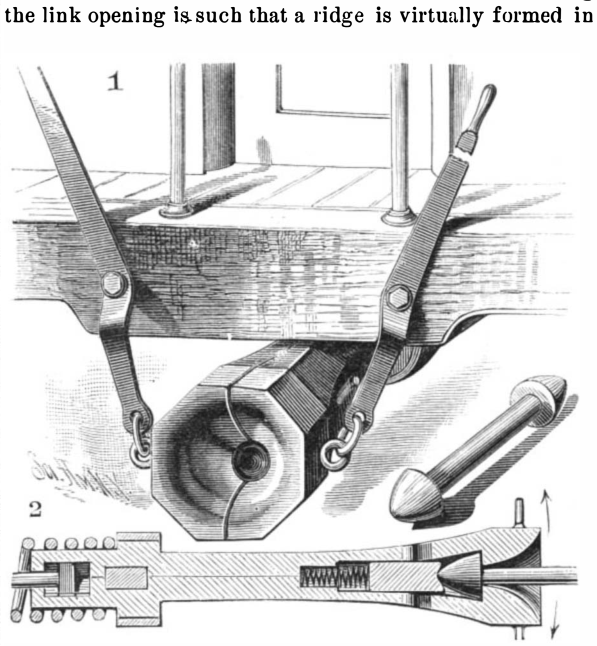
Dr. Henry Tucker recommends, in the *Southern Medical Record*, the use of the following very simple remedy in the treatment of hiccough, namely: Moisten granulated sugar with good vinegar. Of this give to an infant from a few grains to a teaspoonful. The effect, he says, is almost instantaneous, and the dose seldom needs to be repeated. He has used it for all ages—from infants of a few months old to those on the down-hill side of life, and has never known it to fail. The remedy is certainly a very simple one, and although no theory is advanced to account for its wonderful action, it merits trial.—*Therapeutic Gazette.*

CAR COUPLING.

The drawhead is formed of two like sections, in the outer end of each of which is a half funnel-shaped recess, behind which is a triangular recess forming, when the sections are united, a chamber in which slides a buffer block that is pressed outward by a spiral spring. Near the rear end of the drawhead is formed a fixed collar that is surrounded by a stirrup suspended from the bottom of the car, and that serves to hold the two sections together at that point. The extremity of the drawhead is surrounded by a powerful buffer spring. The sections are prevented from moving longitudinally on each other by a key. Near the rear of the drawhead is formed a recess to receive the head of a rod attached to the bottom of the car for limiting the longitudinal movement of the drawhead.

A pin entering a slot in each section retains the buffer block in place when the sections are spread. The sections of the drawhead are operated by means of two levers arranged as shown in the perspective view.

When one of the rounded heads of the link bar enters the funnel-shaped mouth of the drawhead, it forces the sections apart and passes into the front part of the inner chamber. The end of the head strikes the block, and the spring breaks the shock. When the head has passed the offsets, the sections spring together and hold the link rod in place. The link rod is released by moving the sections by means of levers. The inward convex curve of the recesses forming the link opening is such that a ridge is virtually formed in



McPHEETERS' CAR COUPLING.

the opening, against which the link will strike in case a car is derailed, thereby spreading the sections and allowing the head of the link to come out of the drawhead.

This invention has been patented by Dr. S. B. McPheeters, of Medoc, Mo.

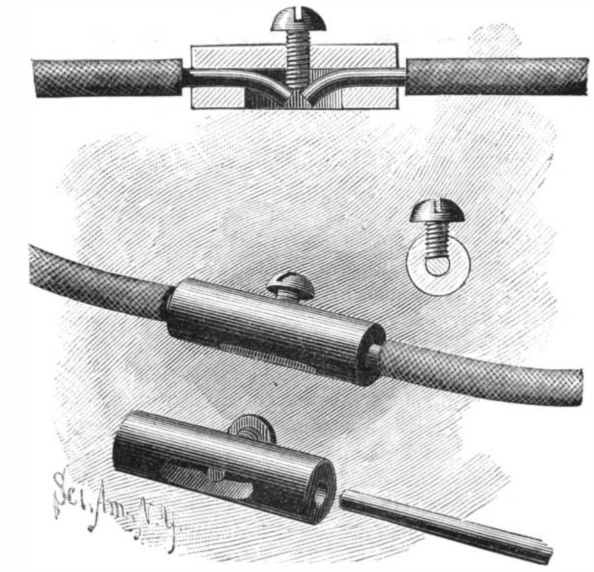
Machine Borers.

An interesting lecture was recently delivered at the Edinburgh Forestry Exhibition by Professor McIntosh, in which he called attention to the serious damage inflicted upon submarine woodwork by marine borers. Among the most destructive of this class are the crabs known as the *Cheluria terebrans* and the *Limnoria lignorum*, or Scotch gribble, of which the former is the most mischievous, as being able to make larger and more oblique excavations. The ravages made by the gribble in the fir beams that supported the beacon on the Bell Rock were described by Mr. Robert Stevenson a long time ago, the rate of destruction being an inch a year. It was thought that the gribble paid attention only to timber, but it is now known that it is equally unremitting in its attentions to the sheaths of gutta percha and other materials which protect submarine cables. The ravages of the gribble, great as they are, are surpassed by those of the *Xylophaga*, a very small bivalve occupying a position between the stone and rock boring *pholas* and the wood boring teredo. The tunnels which the latter made into timber were of astonishing length, varying from one to two feet in the common teredo to three feet in the case of the great teredo.

Up to the present time no wood has been found capable of resisting the attacks of these little creatures; and although various remedies have been tried in the shape of immersion of the wood in silicated lime, bitumen, and creosote, by forcing them under great pressure into the tissue, the latter material was the only one which had been found to be efficacious, while mechanically nothing short of metallic sheathing protects the timber. On the other hand, the Professor pointed out that the borers were frequently useful in their proper place, and particularly in the case of drifted timber and old wrecks, which would be very dangerous to navigation were they not rapidly disintegrated by the action of the teredo. The subject is one that is worthy of very close attention at the hands of those scientific men who would be connected with the marine laboratories now being established.

JOINT FOR ELECTRIC CONDUCTORS.

The annexed engraving shows a joint for electric wires recently patented by Mr. Richard W. Kear, of 206 South



KEAR'S JOINT FOR ELECTRIC CONDUCTORS.

Center Street, Pottsville, Pa. A short tubular socket is provided with a longitudinal slot, diametrically opposite which is a screw threaded aperture containing the binding screw. The ends of the wires are passed into opposite ends of the socket until they meet below the aperture, when the screw, being turned down, presses and bends the ends of the wires down into the slot, as shown in the upper view, thus holding the ends of the wire in such a way that they cannot be withdrawn. The screw and the tubular socket form a good electrical connection between the wires. The manner of using the socket with coated wires will be readily understood from the engraving.

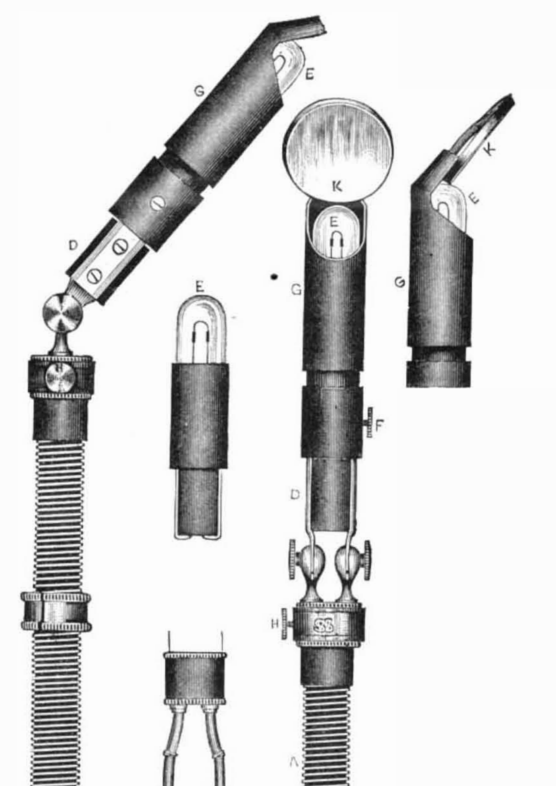
The World's Telegraphs.

The telegraph appears to have made more progress in the United States than in any other country. The number of American telegraph offices in 1882 was 12,917, and the number of telegrams forwarded during the year was 40,581,177. The number of telegraph offices in Great Britain and Ireland in 1882 was 5,747, the number of telegrams forwarded being 32,965,029. Germany had 10,803 offices, the number of telegrams forwarded being 18,362,173. France had 6,319 offices, the number of telegrams forwarded being 26,260,124. Russia had 2,819 offices, the number of telegrams fowarded being 9,800,201. Belgium had 835 offices, the number of telegrams forwarded being 4,066,843. Spain had 647 offices, the number of telegrams forwarded being 2,830,186. British India had 1,025 offices, the number of telegrams forwarded being 2,032,603. Switzerland had 1,160 offices, Italy 2,590, and Austria 2,696. The number of telegrams forwarded in these three last mentioned countries was 3,046,182, 7,026,287, and 6,626,203 respectively.

ELECTRIC MOUTH LAMP AND LARYNGOSCOPE.

In diagnosing lesions of the teeth and associated parts the small electric lamp shown in the accompanying engraving will be found an invaluable assistant to the dentist, and by its aid the exact location of the disease may be determined. By the use of the appliances heretofore in vogue this could not be accurately ascertained, and as a consequence many sound teeth have been sacrificed in the fruitless search for the seat of neuralgic pains for which, owing to the insufficiency of the means of diagnosis, no satisfactory cause could be established. This lamp illuminates the oral cavity so brilliantly that any departure from normality can be unerringly detected; and as it is placed within the arch, behind the object to be lighted, its rays fall upon the lingual surfaces of the teeth while the eye of the operator is directed to the labial surfaces, and thus every portion of the teeth and gums is thrown into strong relief—the sound teeth appearing translucent and showing no variations in texture, while the unsound teeth have an opaque or dark appearance.

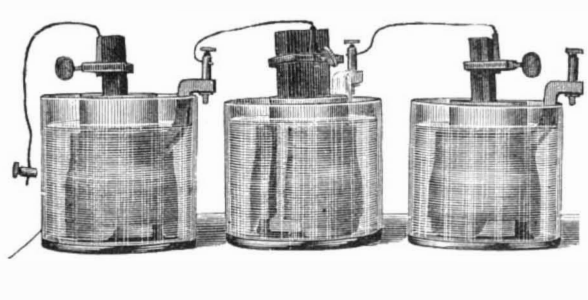
The lamp, E, is an incandescent electric light mounted permanently in a non-conducting case of hard rubber, and provided with metal conductors which pass outside of the smaller section of the case. The lamp is carried in another hard rubber cylinder, D, called the lamp holder, which is also supplied with metal conductors fitting those on the case, the two parts when adjusted being clamped together by the set screw, F, thereby holding the lamp firmly in its socket. The conductors of the lamp holder are connected to the handle, A, by hinged joints, so that almost any desired adjustment can be readily secured. This handle is called a resistance handle because it is wrapped with wire of a low conducting power, by which, through the agency of the ring, I, the flow of current is regulated. When the ring is placed at the end of the handle nearest to the battery cord, the resistance is reduced to the minimum, and the current from the battery flows freely to the lamp. Sliding the ring to the opposite end of the handle compels the current to travel through the wire with which the handle is wrapped to the ring and back again, thus forming a resistance. The connection to the battery cord, B, is made by the spring coup-



ELECTRIC MOUTH LAMP AND LARYNGOSCOPE.

ling, C. A non-conducting shield, G, is placed over the lamp globe for the double purpose of preventing the radiation of heat and of directing the light to any desired point. At H is a screw for breaking the circuit, which should be broken occasionally during a prolonged examination, and also, whenever the lamp is not in use to prevent its becoming so hot as to be unbearable in the mouth. In order to admit of the examination of posterior cavities a mirror, set at an angle of forty-five degrees, is attached to the end of the guard. With this attachment the lamp forms a perfect laryngoscope.

The battery to operate this lamp consists of three improved Bunsen cells having large carbons. The porous cups are filled with the bichromate solution (made in the following proportion: One-half gallon of boiling water, in which is dissolved half a pound of bichromate of potash; when cold, there are added ten fluid ounces of chemically pure sulphuric acid), and the glass jars with water to which two ounces of chemically pure sulphuric acid are added. This battery is



specially adapted for the work required of it, and produces a strong current of great constancy.

This useful device, which the surgeon and physician, as well as the dentist, will find of great value in the examination of the mouth and throat, is made by The S. S. White Dental Manufacturing Company, of Philadelphia, Pa.

Hardening Steel Mill Picks.

When it is desired to harden a piece of steel, it should be known to a certainty for what specific purpose the material is to be used; for instance, it is very reasonable to suppose that a tool that is made to do its work by blows, as a cold chisel, a knife that cuts by means of an even, constant pressure, a tool that must combine strength with cutting qualities, or one intended for soft, another for hard work, must not receive the same treatment in manufacture in order to be good tools for their respective uses.

Take for example the matter of mill picks; these are ordinarily made of cast steel hardened and tempered in an anthracite forge. Double refined cast steel is used, and should be manufactured for this express purpose. In drawing out the steel great need of caution is essential, inasmuch as, if the iron is not worked right, it seems really impossible to temper subsequently. The plan generally followed by the best makers is to draw out the pick with an anvil and hammer, both of which have very smooth faces, and the steel is heated not above a dark cherry red. When it comes to finishing, the best artisans claim the steel should be hammered only on the flat side, and the lighter and more rapid the blows the better the resulting tool, the blows, light and quick, being continued till the steel is quite dark. For tempering, a bath made of two gallons of soft water and two pounds of salt is used; this will last for tempering a dozen picks, but some care is needed not to have the bath too cold, as it tends to chill; hence the workman often dips a hot iron in his bath before he begins to temper his picks. When the pick is at a dark cherry heat, it is dipped just at the point, the rest being cooled in the ordinary way. We suggested mercury to a skilled workman as a good thing with which to temper, but the great trouble is to control this substance for this purpose; it makes the steel so hard that it is brittle, the entire edge often cracking off, so sudden is the reaction.

As to the comparative merits of American chrome and English steel for making picks, opinions vary; though American steel seems to have the most friends. When English steel is used, the tool is heated only moderately in forging—not sufficient to scale—and when the redness leaves it is not hammered; it is hardened by heating to a low red heat, dipping in warm salt water, and tempered to a brown; while with the American steel it is heated to a yellowish color for forging, to a low red for hardening, and at once quenched.

The best weight for a pick seems to be about four pounds, and to be perfect should be ground only with moderate pressure, with plenty of water, down to the edge, but not sharpened on a large stone.—*Midland and Industrial Gazette.*

Value of Hay for Stock.

Experiments have been made in England as to the comparative value of good hay for stock, with the result that it is estimated that 100 pounds of hay are equal to 275 pounds of green Indian corn, 400 pounds of green clover, 442 pounds of rye straw, 360 pounds of wheat straw, 160 pounds of oat straw, 180 pounds of barley straw, 153 pounds of pea straw, 200 pounds of buckwheat straw, 400 pounds of dried corn stalks, 175 pounds of raw potatoes, 504 pounds of turnips, 300 pounds of carrots, 54 pounds of rye, 46 pounds of wheat, 59 pounds of oats, 45 pounds of mixed peas and beans, 64 pounds of buckwheat, 57 pounds of Indian corn, 68 pounds of acorns, 105 pounds of wheat bran, 167 pounds of wheat, pea, and oat chaff, 179 pounds of mixed rye and barley, 59 pounds of linseed, and 330 pounds of mangel-wurzel.

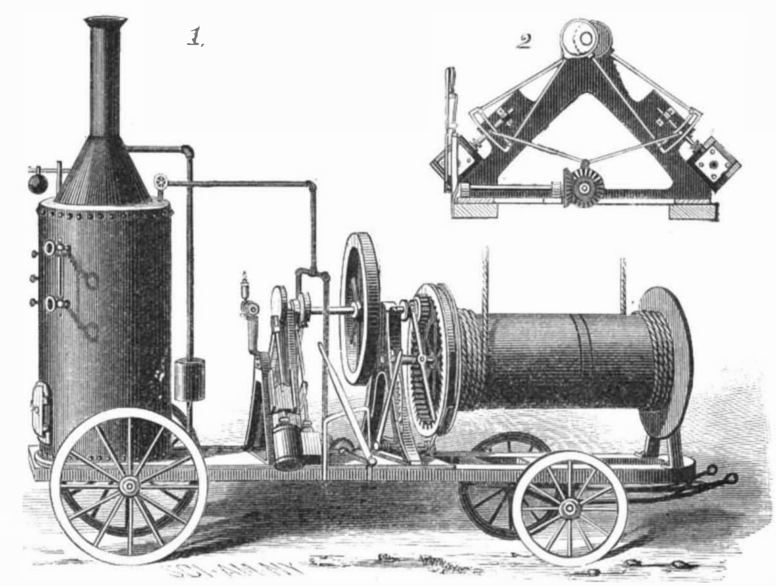
Acorn Bread.

The Indians scattered along the foot-hills of the Sierra are a quiet, inoffensive people. They do not appear to be governed by any tribal laws, yet adhere to many of their old traditions. One or two men of superior ability and industry form a nucleus around which others less ambitious gather. Hence they fence with brush and logs a tract sufficient for their requirements of hay-making, pasturage, etc. Although they often indulge in the food of civilized nations, the acorn is still a favorite article of diet in every well-regulated wigwam. The process of converting this bitter nut into bread is curious. Under the branches of a grand old pine I found them at work. They had shucked and ground in the usual manner a large mass of the acorn meats. A number of circular vats had been hollowed out of the black soil, much in the shape of a punch-bowl. Into these was put the acorn pulp. At hand stood several large clothes-baskets filled with water, and into these they dropped hot stones, thus heating the water to the required temperature. Upon the mass of crushed bitterness they carefully ladled the hot water, making it about the color and consistency of cream. Not a speck appeared to mix. A buxom *muhala* stood by each vat, and with a small fir bough stirred the mass, skillfully removing any speck that floated upon the surface. The soil gradually absorbed the bitter waters, leaving a firm white substance, of which they made bread. I asked to taste it, at which they said something in their language, and all laughed. I asked again, and after more laughter I was handed a small particle on a fig leaf, and found it sweet and palatable. They began to remove it, and so adroitly was this done that but a small portion adhered to the soil. They spread it upon the rocks, and in a short time it was fit for use. This, I am told, they mix with water, put it into thin cakes, and bake before the fire.—*San Francisco Chronicle.*

HOISTING MACHINE.

The boiler, engine cylinders, the hoisting drum, and all the other parts of the machine are supported upon a truck resting upon wheels. The bed plate carrying the boiler and engines is formed with rear stands on which the cylinders are attached at an inclination of forty-five degrees. The stands are made with guides for the crossheads, and the rods are connected to the same wrist pin on the crank disk of the shaft, so that the engines work at right angles and carry each other over the dead center. The driving shaft carries two eccentrics for operating the valve rods of both engines through the medium of links. (The construction and arrangement of these parts are shown in Fig. 2.) By the movement of a lever the links are simultaneously shifted to reverse the engines.

On the driving shaft is a pinion, attached by a feather, so that it can be moved on the shaft by means of a lever to engage with the internally toothed rim on the end of the drum. The rim is provided with flanges, between which is



VIERNOW'S HOISTING MACHINE.

a brake strap operated by a lever. The drum is in two parts, the larger portion fixed on the shaft and the smaller end portion fitted to slide on the shaft, the two parts being connected by pins in a middle head. A nut holds the sliding part up to place, so that when it is necessary to take up or let out the hoisting rope the nut is screwed back and the part moved on the shaft, and then rotated to wind or unwind the rope. The ropes pass off from opposite sides of the drums over pulleys, and to the platforms, so that in operation one platform is raised as the other is lowered. By this construction and arrangement the machine is rendered very compact, and can be conveniently operated, especially for supplying material to buildings in course of erection, and it can be easily moved from place to place.

Further particulars concerning this machine may be obtained by addressing the inventor, Mr. G. M. Viernow, Room 33, S. E. corner Olive and Fifth Streets, St. Louis, Mo.

GOVERNOR BEGOLE, of Michigan, in a late address asserted that he had found, from an accurate study of statistics, that 91 per cent of the crime and pauperism of the State came directly from the use of intoxicating drinks.

Stray Plants.

An interesting botanical lecture was lately delivered by Prof. Rothrock, in Horticultural Hall, Fairmount Park, Philadelphia, on Stray Plants. The lecturer stated that he did not intend confining himself to those larger plants which we can all see, but would embrace also a brief statement of those minuter forms which we never see by the unaided vision, and whose presence was only generally recognized by the evils which they wrought and by the enormous death rates which they induced.

Twenty years ago or more, Bentham and Hooker, the two most distinguished English botanists, began preparation of their great book, the Genera Plantarum. It was intended to bring together in the natural order of their structural affinity all the flowering genera of the existing flora on the globe. What are genera or, as used in the singular, what is a genus? All the species of pine constitute one genus, all the spruces another, all the firs a third, all the cedars a fourth, and all these are grouped in the order of cone-bearing trees. Modern science teaches that all these have descended from a few species of parent plants, and that time and physical surroundings have produced the variations we now see in the vast aggregate of plants representing the order. A study of the Genera Plantarum shows a marked *tendency* in the smaller orders to a localization in a portion of the globe. The larger orders are, as might be expected, more widely spread. The very increase in the number of their genera implies the greater diversity of physical condition which they have encountered in their descent through the ages. Genera are in the main more localized than the orders. This, too, is to be expected. Thus, for example, the genus Crassula, of 120 species, was mainly localized at the Cape of Good Hope. Just in the same way the asters and golden rods found their maximum development in our own region. Sometimes, however, plants would wander off from their birthplaces. Illustrating this, we had the hickory group, of which there are but ten known species. Nine of these grow in the United States and one in Mexico. It is strange that the Mexican species has a four-winged fruit, and stranger still that the Pecan hickory, which, on the whole, is its nearest geographical associate, should also show a marked tendency to the production of fruit of the same kind.

Just, too, as there were in the past vast migrations of men who invaded and took possession of other lands after extirpating the native population, so there had been such migrations among plants. The original forest on the island of Saint Helena had been superseded by European cone-bearing trees. Instances of the same thing on a much larger scale could be named. The strangest examples were where the same species of plant would be found here and in Japan, but nowhere else. Our blue cohosh was such an instance. Hardly less remarkable was it that of the two species of podophyllum (May apple), one grew here and the other in the far-off Himalaya region. We have no reason to doubt that they are blood relatives, but how is it that one or both have strayed from the original birthplace?

It is one of the unexpected things (which Professor Gray has so well shown) that we have more plants here of the Japanese flora than Europe has, and that even the Pacific coast of America has not so many of them as the Atlantic slope has. Europe may have received (by natural means) some few American plants; but, in the main, the line of plant migration has been from the Old World to us—from west to east.

The lecturer then introduced the invisible stray plants, which are only seen clearly by the best powers of the best microscopes, plants that are destitute of the green color which makes our larger and more familiar forms self-sustaining. They (more than the mistletoe) are parasitic. They are the habitual associates of decay, disease, and death; though as yet it would be premature to assert that they are the causes of disease, yet the facts appear to point to that conclusion. Thus we have one supposed to be the cause of diphtheria, another of splenic fever, another of pulmonary tuberculosis, and another of cholera. Take the one last named (comma-shaped), *i. e.*, that of cholera.

First. It is found in persons suffering from cholera.

Second. It is found only in the organs affected by cholera, and, therefore,

Third. It is not found in healthy persons.

Fourth. It diminishes in numbers as the patient convalesces. Hence it is proportionate in number to the gravity of the disease.

Fifth. It has marked powers of locomotion.

Sixth. It lives and multiplies rapidly in the clothing of cholera patients if this be kept damp for twenty-four hours.

Seventh. It will die if kept dry for twenty-four hours.

Eighth. It develops only in substances which have an alkaline reaction.

Ninth. It dies when brought in contact with solutions which contain only a little free acid.

These are substantially the conclusions reached by Koch, who has been the most careful investigator of the subject. Clearly they point to the following cautions in cholera seasons: Cleanliness of the person, of the clothing, and of the surroundings; isolation of cholera patients; destruction by fire of clothing and bedding used by the sufferers; absolute purification and frequent acidulation of drinking water, and the rejection of all water which can in the slightest degree be tainted with sewage from cholera infected districts. All of these conclusions are amply sustained by the experience which epidemics have but too largely furnished. One thing more the importance of this subject teaches. It is, that local, State, and national health boards should be absolutely free from political restraints or from any measure of party expediency; that they should be invested with power which is final; and that they should have the support and active co-operation of every good citizen.

These germs of disease then come fairly under head of Stray Plants. They float in the air we inhale and in the water we drink. And once started in their career of destruction, it is possible for them to incircle the globe with badges of mourning.

TREATMENT OF DEFORMITIES OF THE NOSE.

This is the season of the year when contests at foot ball, base ball, bicycle riding, fox hunting, and kindred outdoor sports are at their height, bringing in their train broken arms, dislocated shoulders, sprained ankles, and not infrequently broken noses. The surgeon's skill is called into requisition more at this time of year than at almost any other, and the cause of this results in casualties of a greater variety than occur to persons in their ordinary pursuits, and hence the doctor and surgeon is sometimes puzzled to determine the best means for treating the peculiar case before him. W. J. Walsham, Assistant Surgeon in charge of the Orthopædic Department at St. Bartholomew's Hospital, London, communicates through the *Lancet* his experience in treating deformities of the nose following injury, which is timely, and will no doubt be found useful to the surgical profession.

"During the last few years," says the distinguished writer, "I have had a considerable number of cases of deformities of

MASK FOR STRAIGHTENING THE NOSE.

the nose due to injury under my care; and as the treatment of such deformities is but lightly touched upon in works on surgery, it may be interesting to some to learn the result of my experience. . . . For convenience of treatment they may be divided into those affecting, first, the lateral cartilages and, second, the nasal bones.

"1. *The Cartilages.*–These may be variously bent or twisted to one or other side, or they may be depressed at the spot where they join the nasal bones, giving the nose in this instance a sunken appearance. In the former case the septum nasi (the central column of support) will as far as I know be always found deflected in a direction opposite to that of the bent lateral cartilage, blocking up more or less completely the corresponding nostril. In the latter case, *i. e.*, when the cartilages are depressed, the septum may not only be deflected, but also, as is unfortunately too often the case, fractured with lateral displacement of the fragments, or else dislocated from the maxillary crest. In addition to the deformity, therefore, there will exist the usual train of symptoms accompanying nasal stenosis from other causes, *i. e.*, a sensation of stuffiness in one or both nostrils, a nasal tone of voice, etc. In neither class of cases will either operative or mechanical treatment alone suffice. The septum must be straightened, and the lateral cartilages at the same time be forced into position, and there retained by mechanical apparatus till the septum has had time to consolidate.

For retaining the septum in position, in my earlier cases, I used Adams' retentive apparatus, modified so as not to injure the columnella. More recently I have had an instrument made of vulcanite, which, however, is open to the objection that the vulcanite is apt to become softened by the heat of the nose, and lose its shape and retaining powers. The advantages of the softer vulcanite may be obtained by having the blades of a steel instrument coated with this material. For solid ivory plugs I have now substituted hollow plugs of vulcanite, which can be worn with greater comfort, as they allow the patient to breathe through them. Many forms of retentive apparatus for holding the lateral cartilages in position were in use before I found one which fulfilled all the indications. At first the ordinary nose truss, which is fastened to the forehead by a band round the head, was tried. This, however, proved of little service, inasmuch as it is liable to shift, and thus give no fixed point to work from. The same objection holds to the spectacle method of fixing the truss. At length this difficulty was overcome by having a mask accurately moulded to the face, as shown in the accompanying wood cut. A plaster of Paris cast is first taken of the face, and in this the leather for the mask is moulded, apertures being left for the mouth, eyes, and nose itself. The mask when thoroughly dry is lined with soft chamois leather, and fits accurately to the irregularities of the face, so that no movement can take place. It is secured by suitably arranged straps around the head. Having thus obtained a fixed point to work from in the mask, it is easy to bring pressure to bear upon the nose in any direction required by means of suitable screws, springs, etc., attached to the mask."

A Telegraphic Contest.

A prize contest for fast telegraphic transmission took place, on August 17, in the Western Union Telegraph Company's building. The prizes were three in number—the first a gold medal, the second a silver medal, and the third a decorated telegraph key. They were given by J. H. Bunnell & Co., of New York, and the only conditions were that the Morse steel lever key should be the one used. The prizes were for "clearness of character and speed combined." The judges of the contest were J. H. Dwight, night force manager; W. B. Waycott, cable manager; and E. F. Howell, chief operator, all of Western Union. The affair was in charge of Mr. F. Catlin, chief operator.

At eleven o'clock, when the contest began, over one hundred leading operators and telegraph managers were present. On a printed slip was the work to be done. This consisted of 500 words, 15 periods, and 4 commas, in all 2,368 characters, as published in the *Operator* of August 15. The messages were sent on a local circuit. There were ten contestants, all of whom did remarkable work, and at one o'clock the contest was finished. Shortly afterward the judges announced their decision, which was as follows: First prize—W. L. Waugh, "superior" work, each letter and character perfect; time, 11 m 27 s. Second prize—W. M. Gibson, "good" work; time, 11 m. 3 s. Third prize—F. J. Kihm, "fair" work; time, 10 m. 32 s. It is notable that not one of the winners is a Western Union man, Waugh belonging to the Commercial Telegram Company Stock Exchange, Gibson to the Bankers and Merchants' Stock Exchange, and Kihm to the United Press Association.

The names of the other contestants, with their time, are as follows: J. W. Roloson, 10 m. 10 s.; L. E. Liddy, 11 m. 58 s.; M. J. Doran, 11 m. 32 s.; W. A. Hennessy, 11 m. 51 s.; E. Delaney, 11 m. 52 s.; Harry Ziegler, 12 m. 29 s.; P. J. Byrne, 13 m. 50 s.

Roloson's time of 10 m. 10 s. is the most remarkable on record, but his work was too indistinct and unreadable to obtain a prize. He is an operator of the Bankers' and Merchants' Company, and with coaching will be a most formidable opponent. The prizes are quite handsome. The gold one is a bar from which hangs a shield-shaped pendant, on which are the name and date of the contest, and in the center the design of a hand holding the lightning. The silver one is a bar to which hangs a round medal, the top of which is cut out, and in its place stands out the same design as the gold one contains.—*Electrical World.*

Great Rafts.

The Cleveland *Press* tells the following: Two of the largest rafts of pine logs ever brought to this port, and the only rafts ever brought from Lake Superior, lie just outside the breakwater. One covers about five and the other eight acres of territory. The largest raft contained about 3,000,000 feet of lumber, and the smallest a little over 2,000,000 feet. There are in both rafts about 16,000 logs, ranging from 12 to 16 feet in length. The rafts left a point on the south shore of Lake Superior, between Grand Marias and Grand Island, about 100 miles west of the Sault, a little more than two weeks ago. They were made up in two sections each, pear-shaped, and inclosed in booms. Through the rivers the sections were towed separately, and they also went through the rapids in the same shape, without loss or damage. The run is about one mile in length, and the fall in the neighborhood of 20 feet. The entire distance from start to destination is about 600 miles. The run from Detour was made in 14 days, the average speed being about 1½ miles an hour.

A Perilous Pathway.

The travels of the native East Indian explorers, their stratagems and their disguises, their hazards and sufferings, their frequent hair-breadth escapes, are teeming with excitement. One of them describes a portion of his track at the back of Mount Everest, as carried for a third of a mile along the face of a precipice at a height of 1,500 feet above the Bhotia-kosi River, upon iron pegs let into the face of the rock, the path being formed by bars of iron and slabs of stone stretching from peg to peg, in no place more than 18 inches, and often not more than 9 inches wide. Nevertheless this path is constantly used by men carrying burdens.

One of the finest feats of mountaineering on record was performed last year by Mr. W. W. Graham, who reached an elevation of 23,500 feet in the Himalayas, about 2,900 feet above the summit of Chimborazo. Mr. Graham was accompanied by an officer of the Swiss army, an experienced mountaineer, and by a professional Swiss guide. They ascended Kabru, a mountain visible from Darjeeling, lying to the west of Kanchinjunga, whose summit still defies the strength of man.

Burnt Umber.

To produce this most important pigment the crude umber is put in iron retorts and subjected to a heat more or less intense. The result is the changing of the tone of the color to a very much deeper and more red brown. The drying property is also increased by burning. Burnt umber, with white and orange chrome yellow, will give a variety of shades of clear warm drabs. Burnt umber, with white and lemon chrome yellow and scarlet lake, will give a rich shade of tan color.

The International Electrical Exposition, Philadelphia.

(SIXTH PAPER.)

More than usual interest and an increased attendance has marked the closing days of the Exposition. The recent experience has shown the managers that three weeks, at least, is required to get a great collection of electrical apparatus into smooth running order. Aside from the usual dilatoriness of exhibitors in general, many of whom do not make up their minds about coming until they learn of the intentions of their rivals, there is the delay attendant upon setting up and experimenting with complicated machinery. Taken as a whole, the Exposition may be said to have been fairly successful, if not from a financial, at least from a scientific standpoint, which is the more gratifying.

It was, of course, a disappointment to discover, when all the exhibits were in, that the Exposition was international in little else but the name. This was not the fault of the Institute under the auspices of which the Exposition was given. It was within its power to invite, but not to enforce attendance. But it was within the power of the managing committee to arrange for the official testing of apparatus at an early day. This they neglected to do, or at least they were dilatory, so dilatory that a week will have passed after the closing of the doors ere the testing of a large and very important class of apparatus can even be begun. This department is under the direction of Prof. M. B. Snyder, a competent man, and it is not his fault that the work of testing is so far behindhand. He could not begin until he had been furnished with the means of testing and the apparatus to be tested, and the amiable but somewhat slow moving theorists who compose the management, forgetting that art is long and time fleeting, when asked to bestir themselves would seem to have adopted the stereotyped reply of the Mexican: *Si, mañana* (Yes, to-morrow).

The plan of doing away with the custom of awarding prizes, and the adoption of the system in vogue at the Vienna Electrical Exposition of giving certificates of official tests made by uninterested persons, promised so well that it was commended even by the exhibitors themselves. Notwithstanding this, the somewhat extraordinary spectacle is presented in the gallery of a company interested in a secondary battery in the act of officially testing their own apparatus. There is no reason to doubt that a reputable company, as this is, may be relied upon to fairly test their own apparatus, but such a proceeding must be regarded as irregular and objectionable, even if nominally supervised by a member of the committee of the Exposition; and if the committee really propose to attach their official signatures to the record of these tests when completed, the act may not unreasonably be looked upon as wholly inconsistent with the theory advanced and promulgated by themselves, to the effect that no person in any way pecuniarily interested in an apparatus should have a hand in testing it. If these people get an official certificate of their own results while testing their secondary battery, surely no other exhibitor should be compelled to submit to the hardship of accepting tests made by strange even if uninterested hands. And should such a course be adopted, the official certificates which each exhibitor would carefully tuck into his innermost pocket upon leaving would, in reality, be as valueless as any other description of tests made out by an interested person, except so far as it might possess the power to deceive the ignorant or impose on the unwary.

Such tests as are made by uninterested persons—and the public cares little for the others—will not be given to either the scientific or the popular press; it having been decided to keep them for a monthly publication of a certain institute. This will, of course, still further retard their appearance, if it does not succeed in keeping them wholly out of the view of the public for which they are intended. It is an unusual course to pursue regarding the results of a great public exposition, and furnishes still further proof, if proof were wanting, that such enterprises in behalf of the inventor and the manufacturer should never be tied to the apron-strings of any particular society or corporation.

There is a general feeling of regret that the Exposition must needs close on the appointed day, as the interest which it has awakened afar and anear is largely in excess of what was expected, and the attendance, instead of showing a gradual falling off, is on the increase. A canvass of the principal exhibitors, however, shows that they are not prepared to remain longer than was at first proposed. The benefits which come from comparison have perhaps rarely found better illustration than within the halls and galleries of this Exposition. Here we have the various dynamos side by side, the gas-motor working by the steam-motor, gas burning alongside of electric lamps. What makes a fair comparison here possible is the fact that everything is in almost perfect running order. The incandescence lamp need not be compared with an ancient and clogged gas jet, nor a great regenerative gas burner of the improved type to an electric lamp purposely designed to show only a faint glow. A comparison of the incandescence lamps while at their best shows that they differ from each other not as one star differs from another, in magnitude only, but in their color, their shape, and the size of their filaments, and above all, in the life of the lamp itself, or rather of the glow within it. These incandescence lamps, shown as they now are with all their latest improvements as to filament, vacuum, shape, and current-conductors, merit some little attention. The Swan lamp, used by the Brush Company in this country, has a filament consisting of carbonized cotton and parchment. In shape it is a spiral, and its resistance cold is about 40 ohms. A no small advantage possessed by this lamp, besides efficiency, is the small cost at which it can be constructed. The latest filament of the Edison lamp is made of fibers of bamboo cane, cut longitudinally, the fibrillæ left undisturbed and carbonized by heat. It is shown principally with intensities of ten, sixteen, and twenty candle-power. The lamp in electrical resistance varies from seventy-eight to ninety ohms pole, and calls for a current of high tension or E. M. F. in order to bring it to the point of incandescence.

The ten candle power lamp is principally interesting because it was designed to represent the real and not the ideal gas jet in intensity, and succeeds admirably in accomplishing this purpose. It was a cunning mind that thus clearly comprehended what was before everybody and yet nobody saw. There is no deception about it, nor is that said in its favor which may not be realized. When the idea of making the incandescence lamp marketable was first entertained, the current was so divided that each lamp should be of the intensity of the gas jet. Now the ordinary five-foot burner when new and clear is of the power of sixteen candles. It does not, as we know, remain very long in this condition; the aperture becomes more and more clogged, and the flame emitted suffers greater or less diminution, according to the nature of the gas burned in it. Hence few burners give the maximum intensity, and, as a result, the general public is accustomed to a light of less than sixteen candle power. Now the theory of charges made by the projectors of incandescence lighting, is to give the public the same amount of light, similarly diffused, as they have been in the habit of receiving from the gas companies, and at the same price. So far as intensity is concerned, it would matter little whether the incandescence lights represented gas jets in good order, when they were at their best, or when they were burning with greatly diminished flame. The electric meter now in use would readily indicate by its transference of copper electrolytically from one electrode to another just how much light had been used. But it was found that the consumer did not appreciate the difference between an electric light with a constant intensity of sixteen candles and a gas jet intended to give a sixteen candle power light, but, by reason of incomplete combustion and other causes, giving out only about ten on the average. He wanted the same number of burners with the same amount of light, and was willing to pay for electricity what before he had been paying for gas. This being the case, a computation was made of the intensity of the average gas jet, and an incandescence lamp was constructed which should have a similar intensity. Hence the ten candle power incandescence lamp.

The Maxim lamp shown in the Exposition is in some respects altogether dissimilar from its original forms. In the earlier incandescence lamps of the present type, the life was so short, or rather the lamps varied so much in duration of life, that they were fit for little else but laboratory experiments. Nature hates a vacuum, and enough oxygen usually remained, when the lamps were removed from the mercury pump, to insure so much combustion of the carbon loop as to constantly threaten the life of the lamp. By some ingenious experiments, Mr. Maxim discovered that the vapor of gasoline, when made to take the place of the extracted air, would keep the carbon loop in repair by making a deposit upon those parts of the loop which had become disintegrated by combustion. Soon, however, it was discovered that the vapor of gasoline had also its defects, for that, besides making a deposit of carbon upon the loop where it was needed, it made still another in the sides of the glass globe, where it was not. As the Maxim lamp is now constructed, the filament is of carbonized cardboard, which previous to being sealed in the lamp is raised to incandescence in a carbonaceous vapor, such, for instance as a hydrocarbon gas, the result being that a fine layer of carbon is deposited upon the filament. The present type of the Maxim lamp is the result of the labors of Mr. Weston, the electrician. Its electrical resistance when cold is from 40 to 60 ohms.

In the Stanley lamp carbonized hair is used as a filament. It is of twenty candles power, and has a resistance of about 80 ohms cold.

The big electrical clock shown near the main entrance to the hall has played a by no means unimportant part in this Exposition. It controls eighty similar secondary clocks, placed in different parts of the buildings, and has been used generally in most delicate experiments; in all cases—so it is said—having given satisfaction. Being purely electric it has neither springs nor weights, and may fairly be compared with the best astronomical clocks. Among the multitude of secondary clocks which are connected to it by wire, some move once a minute, others once in two seconds, and still others every second. The big clock is connected by wire with a telegraph company outside the building, and, at noon, is put in circuit with the National Observatory at Washington, whence the exact time is transmitted.

The storage batteries at the Exposition have proved of great interest, and very naturally, it might be said, for though most people are familiar with the theory upon which they are constructed, only few there be among the general public in this country who have seen them. In the Old Country it is otherwise. Electrical tricycles are sometimes seen in the highways, and electrical launches occasionally appear in the rivers. Such contrivances have, therefore, ceased to be a novelty.

Two batteries of the Planté type are exhibited by a manufacturing company. One consists of 20 cells, the other of 320. Near by is a rheostat of the Plante pattern connected with the larger of the batteries. By this connection the difference may readily be distinguished between the currents of high and low intensity.

The battery is joined in multiple arc, and requires two cells of low intensity to charge it. Being joined in series, it shows the possession of an E. M. F. of 640 volts, notwithstanding the fact that the original current had a force of only 4 volts If now the condenser be charged by this secondary current in a similar manner, and the poles of the condenser be joined in series, an E. M F. will be formed of sufficient electrical energy to generate a spark of one inch through the air. As may very readily be understood, this increase of intensity may not be had for nothing; it represents a proportionate loss of current.

The little pocket batteries, from which jewels for the stage or *salon* are lighted up by electricity, have often been described and sometimes illustrated in these columns for the readers of the SCIENTIFIC AMERICAN. At the Exposition they are shown, and their workings explained by an employe of the manufacturing company among the exhibits of which they are numbered. The little battery for the pocket is only 3 inches square, and before being used is charged from a galvanic cell of the common type. A very fine wire of silicious bronze comes up out of the pocket, and reaches to the jewels on the head. The turning of a little switch, which closes the circuit, is all that is required to light up the jewels.

A London manufacturer exhibits a number of the well known type of Faure-Sellon, formerly called the Faure-Sellon-Volckmar, secondary batteries. What makes these batteries particularly interesting is the alleged fact that some of them have been in practical use for nearly a year, and do not, it is said, show any diminution of their former power when properly charged.

They are connected up with several small motors and a number of lights of the incandescence type, and it may be said that they do what is required of them at least efficiently, if not economically, although it should be said on the part of their proprietor or agent, that he claims for them an efficiency of ninety-five per cent. They are said to be shown here particularly in the interest of a company which proposes to light up railway cars and steamboats, the current being furnished the lamps through the agency of these secondary batteries.

The Brush storage battery makes a very excellent showing in the halls of the Exposition, there being one of twenty-one cells in the gallery and another of similar power in the main hall used to run a loom. The form of this battery, though supposed to be a secret, is well understood to be a series of lead plates in a bath of sulphuric acid, having before this immersion been chemically prepared. The current used has an E. M. F. of forty volts, and is of about fifty-two amperes. Forty incandescence lamps, each of an intensity of sixteen candles, can be kept aglow in either series. Only one dynamo is required to charge the two series, and by means of an automatic current manipulator, the current is turned on or shut off from the dynamo, according to the necessities of the batteries.

A very ingenious and altogether new contrivance is the electrically operated propeller attachment for small boats. It is so arranged that any one who has a boat may attach one of these little machines to its stern, place the battery under the seats, and move about a river as though impelled by an invisible power. Curiously enough, the boat when fitted with one of these little propellers does not require any rudder; the propeller doing the steering as well as the propelling. One of these boat attachments has a battery of 12 cells, the plates being 4 in. x 4 in., a double induction motor and apparatus for propeller.

With such a battery, an ordinary boat would probably not make more than four miles per hour in still water, and possibly would not do as well as that, but with a horse-power battery—according to Molesworth's engineering formula, a horse-power is equal to the power displayed at the oar by about eight men—a much higher speed could be obtained. Of course, until electrical charging stations shall have been established along our river banks, whoever owns an electrical launch must need also possess a dynamo to charge its battery, and a steam engine to work the dynamo.

A particularly interesting mechanism is the semi-incandescence lamp invented by a Philadelphian and exhibited here. Unlike all other incandescence lamps, this one has no vacuum, but glows steadily in the open air. It cannot, of course, be said to be altogether original, save in the simplicity of its parts and its perfected movement. Reynier invented and Wiedemann improved a somewhat similar lamp, as will be remembered, though neither of these contrivances was of a practical nature, as is the one now shown in the Exposition. It is of about forty, perhaps forty-five, candle power in intensity, and can readily be fed by a small battery, say of ten cells; giving off a current of about twelve volts. The negative pole is of graphite of conical form, and bearing upon its inclined surface another piece of graphite, which represents the positive pole. This latter is free to move about, and as its tendency is to fall outward in the direction of the cone's base, an almost perfect contact is at all times had. To the metallic sleeve which contains the positive pencil is attached the positive wire from the generator, and upon the advent of the current the small positive pencil becomes incandescent by reason of its resistance to the current. Worn away by the current, this pencil recedes gradually by its own weight upon the negative disk, which latter disappears much slower.

MAKING GAS FROM CRUDE PETROLEUM.

Petroleum has long been looked upon by the scientific and industrial world as one of the best materials from which to obtain light and heat, and, as time passes, the assertion that in the future it will do all that coal now does is received with a steadily increasing confidence.

This belief is strengthened by the many peculiarities which characterize both the product and its surroundings; when properly treated it is one of the best known illuminants and possesses great heating power, and it can be brought at a minimum expense from those vast reservoirs in which Dame Nature has kindly placed it in inexhaustible quantities. But the proper purification of the crude material, the elimination of all those constituents which decrease the effects following combustion, has proved to be an obstacle of no mean importance, since, heretofore, the accomplishment of this object could only be attained at a cost that was practically prohibitory.

Although we have for many years been dependent upon mineral oil for a large portion of our light, yet gas made from this source has not, until recently, been introduced upon an extensive scale, mainly because of the difficulties attending its manufacture and its poor quality. It is a simple matter to place oil in a retort, and by the aid of a little fire obtain a gas; but to so purify that gas that it will contain no element except those which promote combustion is a part of the problem which has been long studied unsuccessfully.

The North American Petroleum Gas Company, of 145 Broadway, this city, has produced an apparatus by which a gas having superior heating and lighting qualities is generated at a small cost comparatively from crude petroleum. The apparatus is simple in all its parts, requires but little attention, being almost automatic in operation, and from it arise none of those odors which are so conducive toward rendering the ordinary gas works a nuisance in any neighborhood. Our engraving shows a petroleum gas works built by this company at Brighton Beach, Coney Island.

The oil, in the same condition as when it left the well, is raised by means of a small hand pump from a barrel placed outside of the building to a small tank located in a room adjoining the retort room. This tank is placed at such an elevation that the oil will flow to the retort, which it enters through the dome, spreading and falling to the bottom of the upper compartment, the floor of which, though at a cherry red heat, is covered with a substance which prevents "spluttering," and at the same time removes the heavier impurities. The gas here generated then passes through other chambers, arranged vertically, in which any remaining impurities are detained, and finally issues from the retort through a pipe which conducts it to a partitioned water box placed alongside of the retort. Here the gas is separated to insure each particle coming in contact with the water. The gas is then led to the condenser, consisting of a series of vertically arranged pipes, coupled in pairs and placed so that their lower ends enter the water contained in a closed box. This gas is so rich that before it can be used for ordinary purposes it must be mixed with about 40 per cent of air. This is accomplished by the mixer shown in the foreground of the engraving.

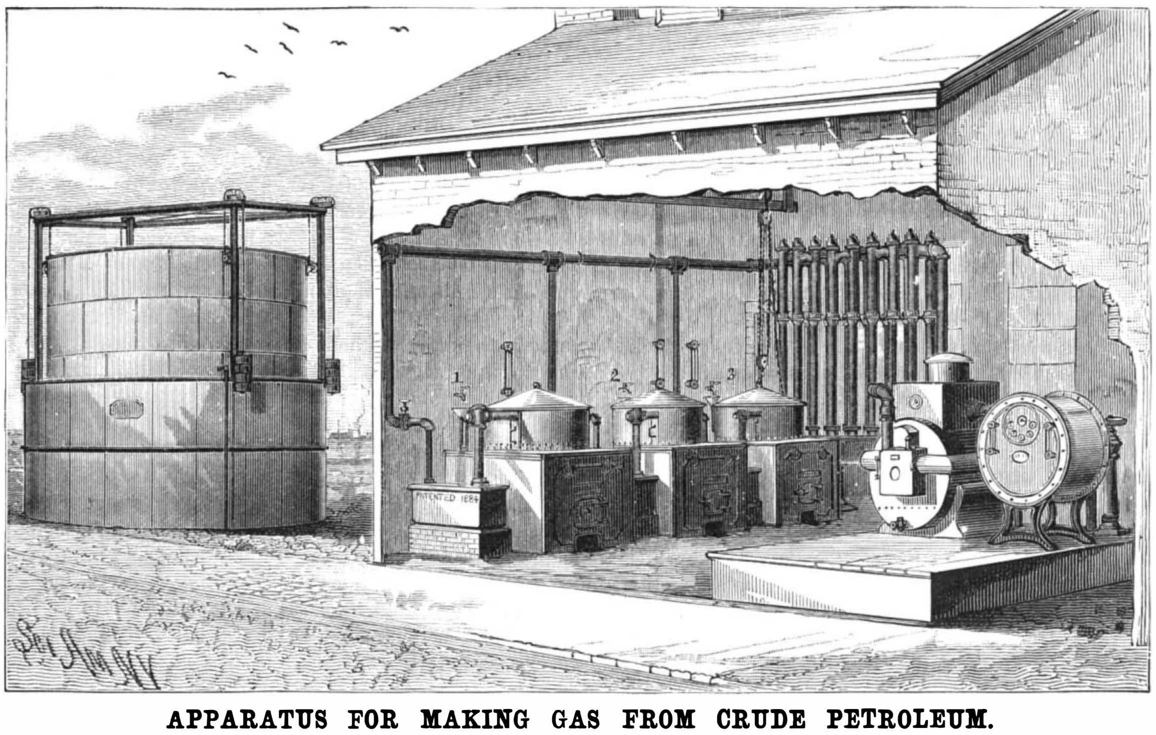
The furnace is placed in the center of the retort, immediately beneath the chambers, and the grate dumps into a long water trough. The heat is so distributed and utilized in its passage through the retort that all parts are subjected to just the right degree, while the consumption of coal is reduced to the lowest point. By means of flues and dampers the heat in any particular section can be controlled at will. The dome of any retort can be readily raised by the aid of a traveling block and tackle, thereby exposing the interior, which can then be cleaned, and the substance collecting the impurities renewed. So slight is the attention required that a man and boy can easily take care of ten retorts.

This apparatus generates from 80 to 100 feet of gas from one gallon of crude petroleum, which costs four cents; and each retort yields from 150 to 250 feet per hour. The gas is a fixed gas, being unaffected by either cold or great pressure.

Since it mixes readily with coal gas, an inferior quality of the latter can be raised to any desired standard of illuminating power by the addition of a small amount of petroleum gas. It can be mixed with coal gas either by passing both together through the purifiers, or by passing the petroleum gas directly into the holder, this forming a thorough mixture; the latter is the preferable method. The company claims that one barrel of crude petroleum will produce gas greater in amount of illuminating value than the coal gas produced from two tons of the best Pennsylvania gas coal; less fuel being required, no lime, and the handling of material being greatly reduced. A comparison—made by the chemist A. T. Schuessler—of this gas with ordinary coal gas shows that the former is 4·90 times superior in illuminating power, and therefore one cubic foot of the former will give almost as much light as five cubic feet of the latter.

Through the courtesy of the president of the company, Mr. Isaac D. Guyer, we recently had an opportunity of comparing the illuminating power of petroleum gas with water gas, issuing from burners of the same size. The petroleum gas was under a pressure of one inch, while the other was two and a half inches. The petroleum gas flame was much larger, more brilliant, and of a purer color than the other.

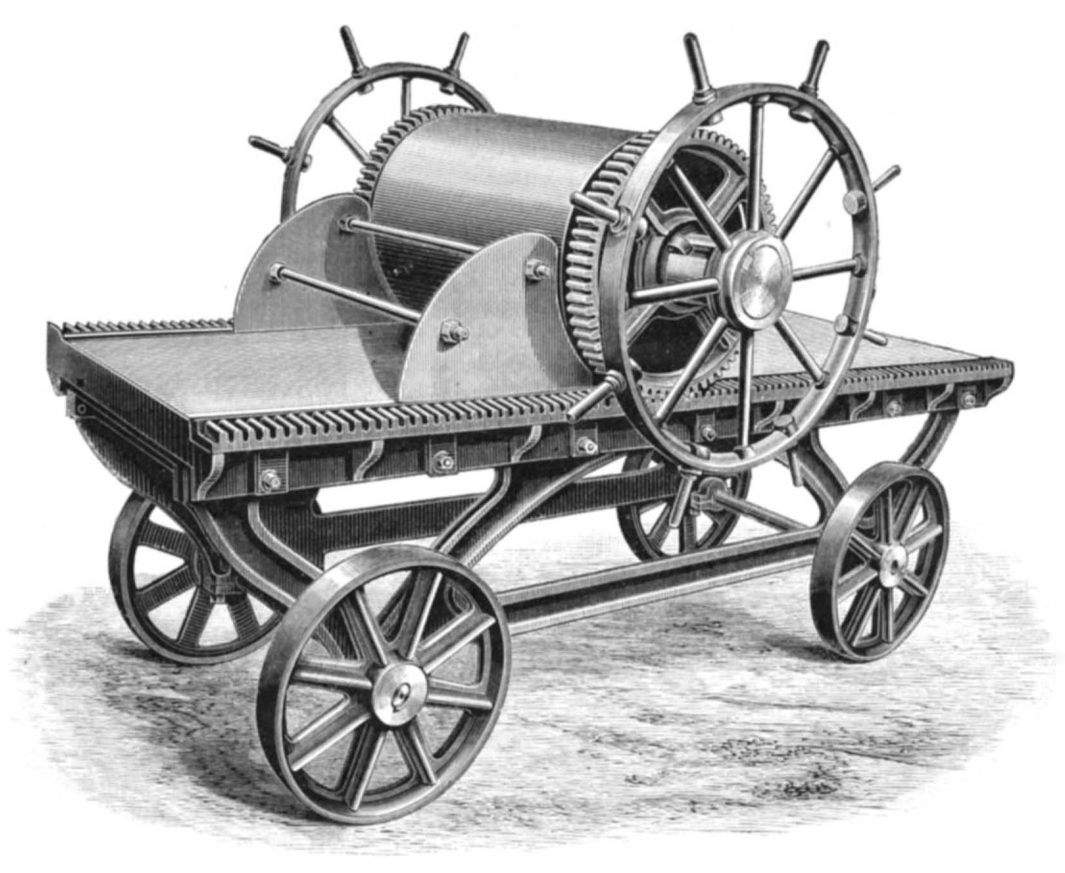
An important advantage possessed by this gas arises from the fact that the plant necessary for its manufacture upon a large scale can be erected at a cost much less than that required by the ordinary gas works; and in addition, the space occupied is small in comparison.



APPARATUS FOR MAKING GAS FROM CRUDE PETROLEUM.

GLASS ROLLING TABLE.

We give an illustration of a machine constructed by Messrs. Robert Daglish & Co., St. Helens' Engine Works and Foundry, for rolling out cut glass into sheets. Our engraving is from *Engineering*. The table is portable, being mounted on four wheels, so that it can be moved with ease to any part of the glass works. The moulding tables are of cast iron, and of widths varying from 2 feet 9 inches to 4 feet 2 inches The surface is either plain, ribbed, checkered, or formed with any device which it is desired to impress on the glass. On each side of the table a rack is mounted on the frame of the carriage, and gearing into each rack is a toothed wheel mounted on a shaft, which also carries a plain iron drum the width of the table. The melted glass is poured on the table in front of the roller, which is then passed to and fro by means of the handwheels shown, and the glass is thus spread out into a sheet. An adjustable guide is placed at the back of the roller to regulate its travel, and means are provided of varying the thickness of the sheet rolled.



IMPROVED GLASS ROLLING TABLE.

Trade Mark Rights in Words.

Until this year the Registrar of Trade Marks in England has steadily refused to admit to registration any mere words, however fanciful, as trade marks. An exception was always made in favor of words used as trade marks before August, 1875. This exclusion of the right to use fancy words as trade marks seemed, however, an unnecessary restriction on business. What manufacturers wanted was protection for a fancy title which should come to designate their particular products. The inventor of a scent or a sauce wants protection for his "Paradisina" perfume or his "Tiberius" relish. This is much more useful to him than mere protection of a certain design which he may print on his labels. The public buy the perfume or the relish, and do not trouble themselves about the presence or absence of an anchor, a crown, or a cross-keys on the labels.

So the government granted this power of registering fancy words as trade marks, and the result is now beginning to appear. Last month we published, says the *Chemist and Druggist* (London), some correspondence which had passed between Mr. Haydon, of Birmingham, and the Registrar of Trade Marks. Mr. Haydon seems to have directed attention to the registration of the terms "Domestic Tea" and "Mitre Tea," and to have asked on what principle such titles are admitted to registration. The answer of the Registrar showed that the subject had been considered, and it can easily be seen that to draw the line fairly is a task of extreme delicacy. The act says he may register as a trade mark any distinctive impression of the name of the firm, or the signature of a firm, or "a distinctive device, mark, brand, heading, label, ticket, or fancy word or words not in common use."

The Registrar decided—fairly enough, the editor thinks—that he ought to regard as a fancy word, not necessarily an absolutely new word or meaningless combination of letters, but any word used outside of its ordinary significance. The term "Mitre," as applied to tea, seems to be, on that interpretation, quite a fancy word, but the adjective "Domestic" almost approaches description. The Registrar, however points out that the combination of words "Domestic Tea" is not a combination of "words in common use," like "Souchong Tea" or "Green Tea," which, as such, would clearly be excluded.

The Salvation Army's Trade Mark.

The *Official Trade Mark Journal*, London, in its issue of August 20, publishes an application from "William Booth, General of the Salvation Army and Minister of the Gospel," to be registered, as the proprietor of a trade mark, in which the design of a cross and crown and the words "blood and fire" form the principal part.

ANCIENT HYDRAULIC CLOCKS.*

The clocks of the ancients were based upon a uniformity in the velocity with which a liquid of constant level flows through an orifice. Heron, of Alexandria, composed a treatise (now lost) upon hydraulic clocks, and Philo, of Byzantium, in a recently discovered fragment of his Pneumatics, indicates several of the apparatus that were in use for obtaining a constancy in the level of the liquid motor in cases where there was not at one's disposal a continuous feed which permitted of employing the very simple waste pipe arrangement.

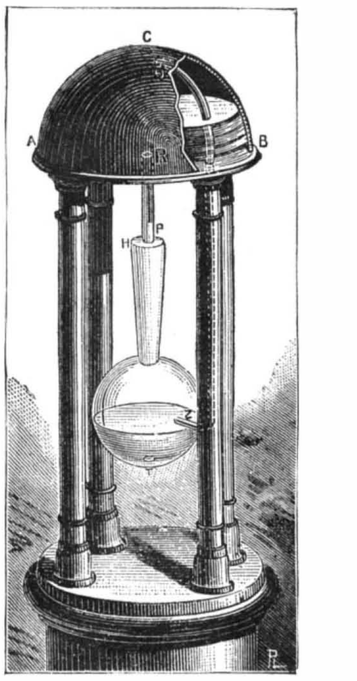


Fig. 1.—CONSTANT LEVEL APPARATUS.

Fig. 1 shows one of these apparatus. Let H T be the vessel, in which a constant level is to be obtained at the height, Z, despite the outflow that occurs at T. This vessel is surmounted with a reservoir, A C B, containing three apertures—one at C, for the introduction of the liquid; one at R, for the reception of a tube, R P, that serves to feed the vessel, H T; and one at B, for allowing of the passage of the tube, Q Z, which puts the upper part of the vessel in communication with the lower one at the level, Z.

The upper vessel is filled through the aperture, C, while the orifice, P, is closed, and then the former is closed and the latter opened. The liquid then flows into the vessel, H T, and the air enters through Z Q. If the discharge from R P is greater than that from the orifice, T, the liquid will then gradually rise in H T, until it reaches the level, Z. The apparatus will then be charged; since, as soon as the level of the water will have risen above Z, the air will no longer enter through R Q, and the flow from the upper vessel will stop, and will not begin again until the level, upon lowering, uncovers Z. This level will oscillate, then, between two very approximate limits until the upper reservoir is emptied.

I have selected the preceding arrangement from among the four given by the Greek author, because it is adapted to the production of one of those little prodigies that the ancients delighted in. It will be seen, in fact, that if the lower vessel be replaced by an urn with a wide mouth, and the bottom, A B, by a sieve, we might thus have a fanciful explanation of the action of Providence sending rain at periodical intervals to supply the sources of rivers.

Before the Greeks had thought of establishing constant levels, the Egyptians had devised clepsydras based upon the properties of the siphon. A Greek grammarian, named Horapollo, who taught belles-lettres at Alexandria in the fourth century of our era, has left a few details upon this subject which I can only quote in Latin:

"Rursus æquinoctia significantes idem animal Cynocephalum sedentem pingunt; duobus enim anni æquinoctiis, duodecies in die, per singulas nimirum horas urinam reddit; idemque noctie facit. Quare non immerito suis horologiis Ægyptii cynocephalum sedentem insculpunt, a cujus membro aqua difluat idque propterea quod duobus quas jam dixi, in quas æquinoctii tempore dies et noctes ex æquo dividentur, horas significet. Cœterum ne foramen illud acue artificioseque constructum, per quod in horologium aqua profluit et excernitur, aut latius fit, aut rursum auctius, remedium hoc excogitarunt, est quo quiquid pilorum est, ad caudam usque abradentes, pro hujus crassitudine ferream quondam fistulam in usum jam dictum fabricentur."

Fig. 2 gives the restoration proposed by F. Kircher, for the Egyptian clepsydra of Horapollo.

The cynocephalus, M, contains a brass vessel which serves as a reservoir for the water whose flow is to measure the hours. C D is a glass cylinder whose bottom contains an aperture for the passage of a tube, K, that forms a siphon with the bell, E F. It will be seen that the water that flows from the cynocephalus' body into the cylinder, C D, will rise in the latter until its level reaches the upper orifice of the tube, I K. At this moment the siphon will become primed, and the water will flow into the vessel, G H. If the discharge from K is sufficiently great with respect to that from the cynocephalus, the vessel, C D, will empty entirely at the end of a certain time. Between the contents and discharges of the cynocephalus and the vessel, C D, ratios may be so established that the cynocephalus shall supply the clock for 24 hours, and that the cylinder shall fill up in 12 hours and likewise empty in 12 hours. It will then only be necessary to mark upon the cylinders, C D, and E F, divisions that shall correspond to these hours. The ascending divisions on the cylinder, C D, will represent, for example, the 12 hours of the day, and the descending ones on E F, those of the night. These divisions will not all be exactly at the same distance, since the velocity of the flow varies

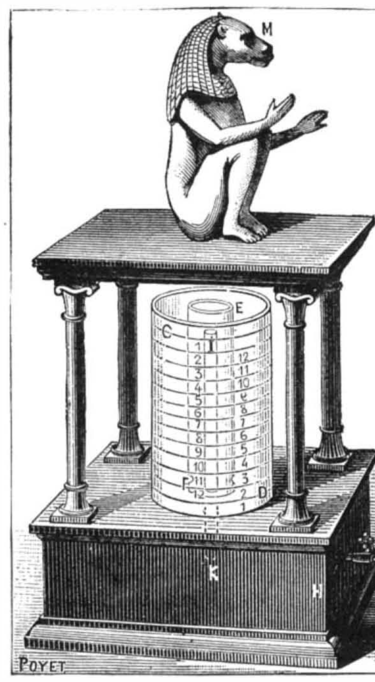


Fig. 2.—EGYPTIAN HYDRAULIC CLOCK.

with the height of the liquid above the orifice through which it runs.

One might, by daily modifying the discharge from the cynocephalus, by means of cocks, succeed in having the cylinder, C D, fill during the time that elapses between sunrise and sun set, and in having it empty between sunset and sunrise; but the operation would be a very delicate one, and the ancients solved the problem in another way—by the aid of curves analogous to those that serve for the equation of time in sun dials.

In the clock that I have just described, the cynocephalus is supposed to be filled with water every twelve hours. In order to surmount such an inconvenience, it is only necessary to cause water to flow from a fountain, A, into a basin provided at its upper part, for the overflow, with a cock for keeping the level constant, and at its lower with a siphon for leading the water into the large cylindrical vessel.

Kircher asserts that he has read in Heron's treatise upon hydraulic clocks that the Egyptians had apparatus of this kind that began to work automatically at sunrise. For this purpose there was employed as upper reservoir a very thin glass or metal globe, which was provided internally with a siphon, D E, rising to a little above the center. Through an orifice, A, water was poured into the globe nearly up to the siphon's curve, and then the aperture was hermetically closed. It will be seen that the first rays of the sun

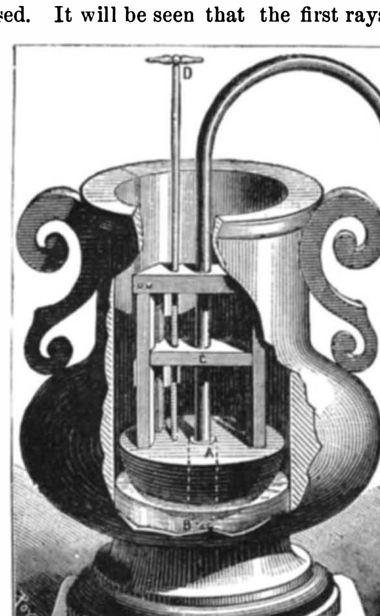


Fig. 4.—HERON'S CONSTANT DISCHARGE SIPHON.

that struck the globe expanded the air, and, causing the water to rise in the siphon, primed the latter. The discharge then continued until the globe was empty. With two clocks of this kind running alternately it was unnecessary to rise at daybreak unless the sky was cloudy—an occurrence that seldom happens in Egypt.

In the apparatus shown in Fig. 2, as well as in that in Fig. 1, the discharge from the upper vessel diminishes in measure as the level of the contained liquid lowers. Heron in his Pneumatics describes an arrangement which permits of rendering the discharge from a siphon constant, and even of causing the velocity with which this constant discharge flows to vary at will. In order to render the discharge constant, it is only necessary to affix the shorter leg of the siphon to a float (Fig. 4), when it will always preserve the same length over the surface of the water. The velocity of the outflow is made to vary by increasing or diminishing such length by means of a screw, D, that actuates a crosspiece, *c*, movable between the two uprights of a frame affixed to the float. The shorter leg of the siphon is fixed to this crosspiece, and its ex-

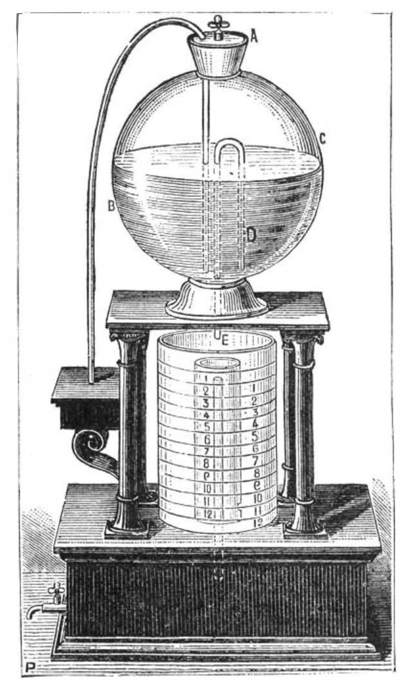


Fig. 3.—EGYPTIAN HYDRAULIC CLOCK SET IN ACTION BY THE SUN.

tremity slides with slight friction through a tube, A B, set into the float.

It will be seen that 200 B. C., the screw was already practically utilized; but the nut was not as yet manufactured, and it will be seen from the Alexandrian engineer's description that this device was replaced by a simple pin which was fixed to the crosspiece, and which engaged with the thread of the screw.

* A. De Rochas, in *La Nature.*

Fig Cultivation in Sicily.

There are several varieties of the fig tree in Sicily, some yielding a large, others a small fruit, and this fruit varies in its degree of sweetness, also in color from white to black. The fruit of some varieties ripens sooner than that of others. The trees grow equally well in poor and rich soil, and bear abundantly when planted on the mountain side and in the valleys. Consul Woodcock, on Catania, says that the favorite varieties of Sicilian figs are the *Sangiovannaro*, the *Sottuno*, the *Melinciano*, and *Ottalo*. The *Ottalo* has smooth leaves, the peduncle of the flower and fruit is longer, and the fruit is sweeter than that of the other varieties. The *Ottalo* fig is considered to be the best for drying. The fig is propagated from the suckers that spring up from the roots, cuttings from the tree being also used, and these are set in the months of February and March. In orchards the distance maintained between the trees is about twenty-six feet. The fig is long lived, as it is constantly being renewed by shoots that spring up from the roots taking the place of the main trunk when it becomes old and decayed. The soil is worked in the spring, and also in November following. The best varieties in Sicily are grafted, and also budded upon the stock of the wild fig, this operation being performed also upon healthy trees of the best varieties, and the time chosen for it in March, or when the trees are in blossom in June. Great care is exercised in the cultivation of the tree to remove all dead and diseased branches, and to avoid too much cutting and pruning. The fruit is dried in the following manner: It is gathered when partially ripe, that is, when the fruit is more green than ripe, and immediately plunged into boiling water, and allowed to remain only a very few minutes. It is then placed in a spot sheltered from the sun, and the next morning, at sunrise, spread upon a platform in order that it may be flooded with sunlight, care be taken not to place it upon the ground on account of its dampness. While drying, shallow willowwork baskets are used for holding the fruit, and these are never placed upon the ground, but kept in an erect position. At sundown the fruit is covered to protect it from the night dews or unexpected showers of rain, and this operation is continued for several days until the fruit becomes thoroughly dry. When dry it is placed in layers in small boxes or baskets, these layers being arranged very neatly and artistically, the fruit being pressed down firmly by hand until the box or basket is full, when they are securely covered and kept in a dry place ready for shipment.

A Poor Inventor Who Became Rich.

An inventory of the estate of the late Cyrus McCormick, the inventor of the harvester, has been filed in the Probate Court of Cook County, Ill. The total is not far from twenty million dollars. The executors of this colossal trust furnished a bond for thirty millions.

Correspondence.

A Letter from the Garden of Eden.

To the Editor of the Scientific American:

Referring to the paragraph on the Seychelles Islands, printed in your monthly edition for May, I beg to correct the statement that there is a grove of palms here which grow in pairs, and which, if one is cut down, the other dies also. This is an error. A quintuple headed cocoanut tree, which has been sketched by that indefatigable *peintre et voyageuse* Miss Marianne North, is the nearest approach to the Siamese twin palms which the Seychelles can boast.

As regards the other assertion, viz., that General Charles G. Gordon had discovered here the site of the original Garden of Eden, I can affirm that I have heard from that brave and devoted soldier's own lips his theory and argument that the Garden was located at or near Seychelles, that the bread fruit represented the tree of life, and the coco-de-mer, which grows in no other part of the known world, was the undoubted tree of good and evil.

EVELYN P. MUSSEY.

United States Consulate, Port Victoria, Mahe, Seychelles Islands, September 6, 1884.

[The Seychelles Islands, from which our correspondent writes, consist of a group of small islands in the Indian Ocean, situated 300 miles south of the equator and about 1,200 miles easterly from Zanzibar, east coast of Africa. Mahe, the principal of the islands, is from 3 to 5 miles wide and 16 miles long, very luxuriant in vegetation, tropical but delightful climate. Port Victoria, from which our correspondent writes, has a population of about eight thousand. It is a calling place for whaling vessels.—EDS.]

Underground Telephone Wires.—A Correction.

To the Editor of the Scientific American:

In the fifth paper upon "The International Electrical Exposition," published in your issue of October 11, 1884, certain statements are made which are at variance with the facts of the case. I am so accustomed to expect correctness in the columns of the SCIENTIFIC AMERICAN, that I am constrained to believe that your correspondent is for once not writing from his own knowledge, but has received a garbled report from interested parties, and I have therefore no hesitation in requesting the publication of this letter. The statements referred to are on page 332, and relate to a paper read by myself which was criticised by Mr. W. H. Preece.

The statement is made by your correspondent "that Prof. Preece believes that wires may be efficiently and economically buried.

That at a recent meeting of the telephone managers a paper was read by an employe of the American Bell Telephone Co., whose duty it is to keep the lines in running order.

That the object of the paper was to show that telephone lines could not be efficiently operated underground. "

That at the conclusion of the reading Prof. Preece took the writer severely to task for the incorrectness of his conclusions, remarking that "if that was the result of his investigations, he must sadly have neglected his business." "

And that results with underground telephone wires are more than encouraging, etc. "

In the first place, Mr. Preece lays no claim to a professorship—he is chief engineer of the British telegraphs, and a Fellow of the Royal Society.

Second. The paper was not read at any meeting of the telephone managers, but at the afternoon session of the fourth day of the National Conference of Electricians.

Third. The duty of the employe of the American Bell Telephone Co. who read the paper (myself) is not to keep the lines in order.

Fourth. Not being actively engaged in the business of telephonic communication, the A. B. T. Co. has no lines.

Fifth. The object of the paper was not "to show that telephone lines at least could not be efficiently operated underground." The subject then under consideration by the conference was:

"Induction in telephone lines, long line telephony, and underground wires," and the paper related to the subject as a whole, was prepared by request of the U. S. Electrical Commission, and only incidentally touched on underground telephony.

Sixth. Prof. (?) Preece did not take the writer severely to task for the incorrectness of his conclusions, although he freely criticised his premises.

Seventh. Although Mr. Preece did make the remark cited, it was by no means with reference to underground wires, but merely referred to the omission from the paper of several methods for preventing induction which had gone into use in England.

Eighth. The inference that Mr. Preece held the opinion that telephones could be worked for considerable distances underground is not warranted by the facts. The paper stated that telephone wires could not be successfully and commercially operated underground for a greater distance than twelve miles, and Mr. Preece fully concurred in that statement both at the Montreal meeting and at the Philadelphia conference; while the remark that "even telegraph wires are constructed underground at four times the expense of overhead wires, while they are but one-fourth as efficient," was made by himself not over a year since in a lecture before the Society of Arts in England.

Ninth. It is not true that the results so far obtained with underground telephone wires have so far been encouraging. On the contrary, they have been discouraging.

The articulation invariably becomes sluggish when the underground conductor exceeds two miles in length, and this effect is greatly accentuated when an overhead line of several miles in length is connected with the underground line. Increasing the sectional area of the conductor aids materially in overcoming the sluggishness.

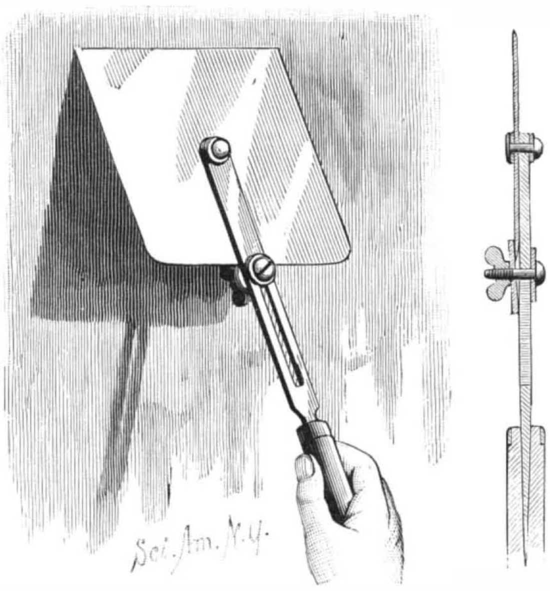
It is not necessary here, however, to enter into the question of the relative efficiency and economy of underground and overhead lines, as my only object in forwarding this communication is to give a correct statement of facts, which can readily, if necessary, be attested from the records of the conference.

THOS. D. LOCKWOOD.

Boston, October 11, 1884.

REVERSIBLE WALL SCRAPER

The end of the shank is pivoted to the center of the steel blade of the scraper. One edge of the blade may be firmly



COLEMAN'S REVERSIBLE WALL SCRAPER.

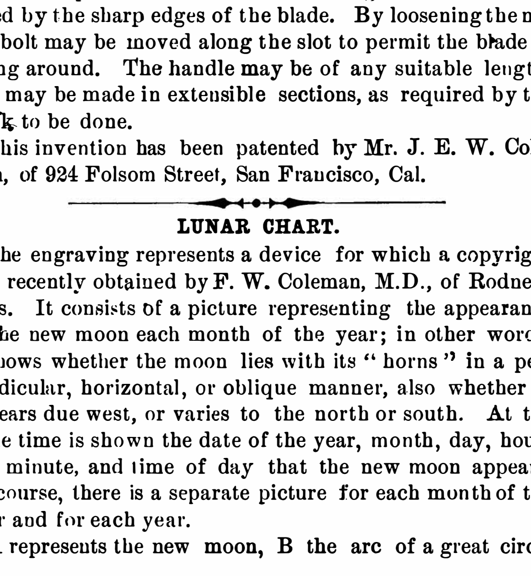
clamped to the shank by means of a thumbscrew that passes through a slot in the shank, as indicated in the sectional view, the nut bearing directly against the blade or against a plate interposed between the blade and nut. The blade is made about square in shape, with two corners rounded, with two opposite edges sharpened, and with the other edges finished square across the thickness of the blade. The sharp edges are specially intended to be used in removing accumulations of paper or calcimine from sound walls in preparing the surfaces to receive new work, and the square edges for like work upon unsound walls which might be further injured by the sharp edges of the blade. By loosening the nut the bolt may be moved along the slot to permit the blade to swing around. The handle may be of any suitable length, and may be made in extensible sections, as required by the work to be done.

This invention has been patented by Mr. J. E. W. Coleman, of 924 Folsom Street, San Francisco, Cal.

LUNAR CHART.

The engraving represents a device for which a copyright was recently obtained by F. W. Coleman, M.D., of Rodney, Miss. It consists of a picture representing the appearance of the new moon each month of the year; in other words, it shows whether the moon lies with its "horns" in a perpendicular, horizontal, or oblique manner, also whether it appears due west, or varies to the north or south. At the same time is shown the date of the year, month, day, hour, and minute, and time of day that the new moon appears. Of course, there is a separate picture for each month of the year and for each year.

A represents the new moon, B the arc of a great circle



COLEMAN'S LUNAR CHART.

with points upon which the degrees are marked, C is a base line whose ends are marked with the points of the compass—north and south. Within the arc is the date of the year, month, day, and time at which the new moon appears.

Such a series of pictures will be appreciated by that large class of people who firmly believe that the position of the horns of the moon indicates whether the weather during the ensuing month will be wet or dry.

Dr. Raymond on the Divining Rod.

An interesting feature of the Philadelphia Electrical Exhibition was a lecture given by Professor Rossiter W. Raymond, before a large audience of attentive hearers. The following extracts are from the *Progressive Age:* After an introductory allusion to the prevalence, even at the present day and in this country, of a belief in the divining rod as a means of discovering springs, mineral veins, hidden treasures, and oil deposits, the lecturer described its various forms, the commonest of which resembles a letter Y, and consists of a forked brance of witch-hazel having this form. The ordinary forked rod is held in the two hands, each grasping the extremity of a prong, with the fingers closed, and the palms upward, the shank or stem being horizontal, or vertical, or variously inclined, according to the preference of the operator. Carried in this manner over the surface, the rod is said to turn or dip over or near treasure, veins, springs, etc., and even to give more complicated information by means of its movements, which have been at different times elaborately codified.

The lecturer proceeded to trace the mythical origin of the divining rod and its use in ancient times—principally, if not wholly, for moral purposes, that is, for the discovery of guilty or the decision of important questions or the indication of future events. Its physical application for the discovery of hidden springs, metals, etc., seems to have been a later origin, and to have become general throughout Europe in the sixteenth century. During this period its action was either attributed to a mysterious natural affinity between the material of the rod and the material affecting it, or else to the agency of evil spirits, or to a divine gift bestowed on the operator.

In the seventeenth century numerous treatises were written, both as to the facts and as to the theory of the rod—the latter being referred, in accordance with the dominant Cartesian philosophy, to "corpuscular effluvia." According to the school, there were "corpuscles" of springs, minerals, thieves, assassins, lost landmarks, etc.—each kind exerting a different influence upon the sensitive expert, and possessed of extraordinary levity and permanence, so that they could be traced, suspended in the air, after the lapse of days or years. Many years later an electrical theory was popular. It, however, was thoroughly refuted in 1782, in the case of Blaton, by the simple expedient of making and destroying the insulation of the operator without his knowledge, and thus proving that such knowledge was an essential part of the so-called electrical action.

The lecturer adopted, with some modification, the theory of Chevreul, suggesting that, in the case of springs (and of mineral veins which are the conduits of springs), there are differences of temperature, heat conductivity, etc., which might affect sensitive persons so that the unconscious volition and minute muscular movements of Chevreul might be thus occasioned. In the main, however, he regarded the present theory and practice of divining with the rod as the small, lingering remnant of a once powerful superstition, and entitled to the same respect as "planchette"—the object of curiosity, or of study from the standpoint of psychology, but not worthy of the attention of geologists or prospectors.

A Destroyer in the Spruce Forests of Maine.

According to accounts of observations published in the third *Bulletin* of the Entomological Division of the Department of Agriculture, the ravages of the spruce bud worm (*Tortrix fumiferana*) have been extensive and destructive in the coast forests of Maine west of the Penobscot River. The damage appears to have reached only a few miles inland from the coast, but the belt in which it has prevailed is marked by extensive masses of dead woods. The trees are attacked in the terminal buds, which are eaten away, and when that is done, the case is hopeless. The fatal character of the attack is owing to the fact that the spruce puts forth but few buds, and those mostly at the end of the twigs, and, when these are destroyed, it has nothing on which to sustain the season's life. The attack is made in June, when the growth is most lively, and just at the time when the check upon it can produce the most serious results. The larches are also attacked by a saw fly, but with results that are not as necessarily fatal as in the case of the spruce. They are more liberally provided with buds, some of which may escape and afford a living provision of foliage. The larch, moreover, sheds its leaves in the fall, and is in full foliage before its enemies attack it. Hence, while the spruce and fir succumb to the first season's assaults, the larch can endure two years of them.—*Science Monthly.*

Artificial Sea Air.

Many, indeed, are the luxuries that the magician's wand of invention now brings into the midst of our homes. As an instance, to produce a sea atmosphere for the sick room, a foreign contemporary suggests the use of a solution of peroxide of hydrogen (10 volumes strength) containing 1 per cent of ozonic ether, iodine to saturation, and 2·50 per cent of sea salt. The solution placed in a steam or hand spray diffuser can be distributed in the finest spray in the sick room at the rate of 2 fluid ounces in a quarter of an hour. It communicates a pleasant sea odor, and is probably the best purifier of the air of the sick room ever used. It is a powerful disinfectant, the same author writes, as well as deodorizer, acting briskly on ozonized test solutions and papers. It might be well to test the subject in some ward of one of our hospitals.

The Opening of the Arlberg Tunnel and Railway.

In view of the recent opening of the Arlberg Railway for its entire length, a brief history of the origin of the railway will be read with interest. Although the building of the line itself has by no means been an easy task, the construction of the tunnel and its approaches has presented the chief difficulties to the engineer. The tunnel pierces the high watershed extending from the Silvretta (the point where the frontiers of the Tyrol, Vorarlberg, and Switzerland meet) to the north as far as the Arlberg (forming the frontier between the Tyrol and Vorarlberg), and the eastern slope of which sends its waters to the Black Sea, the western to the German Ocean. The lowest point of this watershed is the Arlberg (5,800 feet), which has given its name to the most western province of the Austrian Empire, the Vorarlberg. The latter may justly be described as a jewel among the territories belonging to the crown of Austria, for it is not surpassed by any of the other provinces in beauty, wealth, trade, and industry. But the inhabitants of Vorarlberg were almost completely separated from the mother country as regards trade, being dependent upon the neighboring States, for the postal road leading from Bludenz over the Arlberg to Landeck and Innsbruck was not at all sufficient for the requirements of the traffic. Thus it happened that Vorarlberg became gradually more estranged from the mother country, and that far-seeing men have been endeavoring to establish closer connection by means of a railway. A look at the map shows that the most direct route of communication between the greater portion of the Austrian monarchy and Switzerland and the South of France leads over the Arlberg, and a line of railway such as that now on the point of being opened is the most important link for the trade of Austria with the west of Europe.

When, in 1859, Austria lost Lombardy, she was anxious to permanently secure the possession of Venice by the construction of a direct road—the Brenner Railway. But before it was commenced (the Brenner Railway was opened in 1867, when Venice had been ceded to Italy), the idea was suggested of connecting it by additional lines from Innsbruck with Switzerland, Southwest Germany, and France. Since 1864, then, the principal engineers and political economists of Austria began to take active interest in the question of a railway by way of the Arlberg. For a number of years petitions poured into the Reichsrath and upon the government from the communities and chambers of commerce of the Tyrol and Vorarlberg, asking for the railway; but a deaf ear was turned to these appeals, until, in the spring of 1880, parliament resolved to construct it at the expense of the State. From 1864 to 1880 a number of pamphlets, written both from a commercial and engineering point of view, made their appearance; but there is no need to enter upon them here. All writers were unanimous in their opinion, however, that the climatic influences and the geological conditions of the Arlberg rendered a railway over the mountain impossible. The Arlberg Pass is one of the most inhospitable and exposed passages of the Alps. The winter lasts from seven to eight months, the temperature falls as low as 25° Reaumur under zero, and not unfrequently snow falls at one time to a depth of from 8 feet to 10 feet. Constant storms between the Rhine and Inn valleys lift up the snow in large masses, causing enormous drifts and destructive avalanches. Large landslips and dangerous freshets are also of frequent occurrence. There are several projects with a much shorter tunnel, involving less expense; but it was found that a railway with a short tunnel, situate higher up, was very risky for the working of the railway traffic, and the present long tunnel was finally decided upon.

The Arlberg Railway runs from Innsbruck to Landeck through the Inn valley, from Landeck to St. Anton through the Rosanna valley (a branch valley of the Inn valley), from St. Anton to Langen through the Arlberg, and from Langen to Bludenz through the Kloster valley. From Innsbruck to Landeck-Plettneu the railway runs south of the Inn, and rises nowhere more than 66 feet above high water of the river. With the exception of a short portion the railway runs from Plettneu to St. Anton along the northern bank of the Inn, and rises from 132 feet to 264 feet above the bottom of the valley. From Langen to Bludenz the northern side was chosen, and for about nine miles the railway is 120 feet above the bottom of the Alfenz valley, the highest elevation being 492 feet. The Oetz valley is crossed at Roppen by a bridge of 250 feet span, the Putz valley at Imst by another of 132 feet span, the Inn valley at Landeck by a bridge of 198 feet span, and the Putznau valley at Weitzberg by one of 394 feet span. There are besides a number of bridges of various spans, all being executed in the best manner. The Arlberg Railway consists of two sections—the valley railway from Innsbruck to Landeck (45 miles long) and the mountain railway from Landeck to Bludenz (39 miles long), in the middle of the latter being the great tunnel, 10,250 meters (6·13 miles) long. The first section of the railway was commenced in November, 1881, and opened for traffic on July 1, 1883. The mountain section was begun in September, 1882, and will be opened for passenger traffic on September 15 next, as has been stated. The tunnel has been constructing since July 25, 1880, and was finished in the middle of last July.

The boring of the great Arlberg tunnel proceeded very rapidly, far more rapidly than that of any other tunnel previously constructed. Instead of the estimated daily progress of 6·60 meters (21½ feet), the heading was driven at the average rate of 9·50 meters (over 31 feet), so that the perforation of the tunnel, which took place on November 19, 1883, a little over three years after its commencement, is a performance which has never been equaled. The excellent dispositions made, and the engineering skill displayed, are the main causes of the rapidity of the work. But it must not be forgotten that the experience gained in the construction of the Mount Cenis and St. Gothard tunnels was of the utmost value, and served as a guide. On the eastern side of the Arlberg tunnel Ferroux boring machines, driven by compressed air, on the west Brandt machines, worked by water under a pressure of from 80 to 100 atmospheres, were employed. The tunnel has two lines of rails, and is walled up along its whole length. In places where great pressure showed itself, the walling has been made very thick, and headings for carrying off the water have been driven at intervals for nearly 60 feet into the sides of the tunnel. From St. Anton, where the tunnel entrance is 4,272 feet above the sea level, the great tunnel rises 2 per 1,000 for 2½ miles, and falls from this point toward Langen (entrance 3,991 feet above the sea) 15 per 1,000 for a length of nearly 4 miles. The cost of the finished tunnel is 4,200 fr. per meter run (slightly over £50 per foot run). Besides the great tunnel, the Arlberg railway has nine small tunnels, varying in length from 214 feet to 696 feet. Their aggregate length is nearly one mile. All these tunnels are also completely walled up, the average cost being only 850 fr. per meter run. For securing the railway against freshets, stone and snow avalanches and landslips, a large number of supporting walls, aqueducts, and roofings for protection against avalanches had to be constructed at great expense. The total cost of the Arlberg Railway and tunnel is, in round numbers, £3,480,000.—*London Morning Post.*

Dynamite Shells.

The San Francisco *Chronicle* gives an account of the recent experiments with dynamite shells at Port Lobos. It quotes Gen. Kelton as saying of them:

"The experiments were made under my charge, and with the authority of the Chief of Ordnance," said Gen. Kelton. "The piece of ordnance used was a condemned 3 inch rifle gun, made of wrought iron; the gun was a sound one, save that it had become honeycombed by use and exposure to weather; it was a good gun for the experiments. I was ably assisted by Mr. Quinan, till recently a distinguished officer of the 4th U. S. Art., who resigned to undertake the hazardous business of improving the methods of manufacture of high explosives, for which task his scientific attainments eminently fitted him. Experiments of the kind in question need the supervision of an expert in high explosives, and Mr. Quinan's knowledge of dynamite came into great service—in fact, any one outside of a dynamite maker would be unfitted for the work of loading the shells, etc., as he would be so appalled by what he had heard of the wholesale destruction wrought by dynamite that he would be almost certain to blunder at the critical point of the work. Mr. Quinan in person loaded the shells, each shell, an elongated 3 inch rifle projectile, being charged with seven ounces of dynamite. The selected place of experiment was Lobos Beach, with the ocean on one side and a precipitous cliff on the other, the place being selected that no possible danger could occur to any one. When the gun was fired, our party was over 100 yards from the piece and under protection. The gun was placed in position 150 yards in front of a huge rock. The first projecting charge was a quarter pound of cannon powder. The rock was struck by the shell, the dynamite ignited by percussion, and the shell broken into innumerable fragments, whereas by ordinary powder it would only have broken into a few large fragments. The second charge was half a pound of cannon powder, and the experiment was attended with equally good results. It did just what was expected; the shell was expelled, and did not ignite until it struck the rock. The third charge was a pound of powder service charge. When the gun was fired the explosion of the charge, the bursting of the shell, and the shattering of the gun appeared to be simultaneous. The gun was torn into fragments. One fragment, including the breech, and weighing about 200 pounds, was hurled to the rear fully 20 feet; the muzzle part hung to the carriage by a trunnion, the carriage being only slightly injured; the third fragment of the gun, weighing several hundred pounds, flew high in the air, in a nearly vertical course and over the cliff; the immense piece of iron went up a distance of fully 90 feet. Then, as a matter of course, our experiments for the day ceased."

The results of the experiments were, in the opinion of Gen. Kelton, "exceedingly satisfactory, for they conclusively showed that shell loaded with dynamite can be used in warfare. Seven ounces of dynamite rent the gun as a charge of 100 pounds of powder could not have done. Powder would have opened a fissure in the iron, thus permitting the gas generated by its combustion to escape; but while the combustion of powder, while rapid, is progressive, the combustion of dynamite is so instantaneous that the enormous volume of gas thereby generated seems to want to escape at once; this fact was shown by the sudden rending of the gun into fragments.

"If the dynamite shell should strike the side of the vessel and explode without penetrating the armor, the destructive effect would be greatly in excess of the damage worked by the ordinary shell made of gunpowder. But the dynamite shell must penetrate to some extent to produce its full effect. I am satisfied that experiments will show that it can easily be managed to give the shell the power to thus penetrate before it explodes. The necessary penetration—about one-half the length of the shell—would be effected in the thousandth part of a second after it had reached the ship. Then the exploding dynamite would instantaneously rend asunder the entire side of an ironclad. In defending a fort against a land attack, these dynamite shells would be very effective. One of these shells exploding in the midst of a body of attacking troops would produce as much consternation as a thunderbolt; its explosion would be like unto the explosion of a powder magazine in their very midst. No troops in the world, however brave, could stand more than a few of such shells. So destructive, in fact, would be these shells that their introduction in active warfare would vastly diminish the duration of wars, if it did not make wars an impossibility."

In conclusion, Gen. Kelton expressed satisfaction that the experiments had been so successful. While experiments had been made by others, he did not think that any had gone so far or succeeded so well; these experiments with dynamite can only be conducted on the most favorable conditions, and by men who understand the dangers of dynamite and can take every possible precaution against premature explosion.

Captain Daniel M. Taylor, of the Ordnance Department, and an aide-de-camp on General Pope's staff, said: "The experiments conducted so successfully by Gen. Kelton show that a compound many times more destructive than gunpowder will add to the havoc of the battlefield in future wars. One peculiar property of dynamite may somewhat interfere with its usefulness as a destroying and rending agent, and that is the fact, authenticated by experiments, that its destroying power operates vertically and with its main effect in a downward direction; in other words, a dynamite-charged shell would not scatter death and destruction in every direction, as a gunpowder-charged shell so frequently does.

"Captain James Chester, of the 3d Artillery, has paid great attention to the subject of dynamite in its connection with the art of war. He maintains that dynamite can be used with great success in active warfare if rockets are employed to throw the death-bearing material into the ranks of the enemy. He holds that dynamite shells can be thrown by means of the rocket with fair accuracy and to very long ranges. He calls these rocket-propelled shells aerial torpedoes, in contradistinction to submarine torpedoes, and holds that with the submarine torpedo defense in the hands of the navy and the aerial defense in the hands of the army, the country would be safe against any attack."

Haulage by Rods.

Rziha, the well known tunnel engineer, has recently described a system of haulage on the east end of the Arlberg Tunnel, designed by Ceconi, that is peculiar, and has been remarkably successful in meeting the special circumstances of the case. From the portal at Langen, 1,214 meters above sea level, the tunnel has an up grade of 15 per 1,000 for a length of 6,170 meters to a height of 1,310 meters above sea level, or a total rise of 92·55 meters; while from the St. Anton portal, 1,302 meters above sea level, it has an up grade of 2 per 1,000 for a length of 4,100 meters. The highest point in the tunnel, therefore, is located more than 2,000 meters nearer the east end than the west end, and even if both tunnel headings had been driven at the same rate of advance, it would be necessary to hoist from the face of the east end over a section of 1,200 meters with an adverse grade of 15 per 1,000. This section, however, became much longer, owing to the fact that the western heading progressed much more slowly than the eastern. This rendered hoisting over the section in question a difficult matter, because the use of men and horses was out of the question, 200 of the latter being ultimately required.

As the advance heading was driven only single-track width, chain or rope haulage would have been difficult, particularly because the space in the heading would be much contracted by guide rollers and rope or chain. These considerations led Ceconi to use a wooden rod united in sections, on wheels running on the track, and hauled over the section in question by three Krauss locomotives in the following manner: The train, consisting of from 70 to 74 cars, was made up in the heading, and then the rod train was pushed into the heading until its end came into contact with the end of the train, and both were coupled together. Then the engines drew out rod and train on a side track in the level part of the tunnel. Then they were uncoupled, and the train of cars was switched on to the train track and hauled out of the tunnel by two locomotives, the wooden rod train being left standing on the side track. After dumping, the car train was pushed back into the tunnel until the steep section was reached, and then was divided into single cars, which were run to the face of the heading singly, with a man at the brake. The hauling, therefore, required from 70 to 74 brakemen, and from 10 to 12 men on the rod train. The rod train consisted of 21 by 12 centimeter timbers 7·6 meters long, mounted on two four-wheeled trucks. In October, 1883, the rod train was 1,070 meters long, and it will reach a length of 1,200 meters. It weighs 52 kilogrammes per running meter, or 55 tons in all. A full train of 75 cars weighs about 230 tons, and an empty train, 262·5 meters long, 129 tons. There are ten trains in twenty-four hours, moving a gross weight of 3,591 tons, an exceptional duty under the circumstances. An entire train with rod train has over 400 axles, and is 1,400 meters long. The trains are run on regular schedule time.

ENGINEERING INVENTIONS.

A stuffing box has been patented by Messrs. William Dingle and William Jenkins, of Lake Mahopac, N. Y. It is made in two parts, with a smooth inner surface, its bolt-receiving lugs being perforated to receive the perforated heads of the gland fastening bolts, and having a gland made in two parts with smooth outer surface, and overlapping lugs perforated to receive the fastening bolts, so the gland can be secured in the stuffing box by exterior bolts and nuts, and can be readily applied and removed.

MECHANICAL INVENTIONS.

A bench stop has been patented by Mr. John Adams, of Hancock, N. Y. The casing has a post with a lateral stop or arm capable of rotary movement and carrying a clamp, with its jaw adapted with said stop or arm to effect the clamping operation, making a bench stop adapted for universal use.

A screw driver has been patented by Mr. Willis B. Gilmore, of Minneapolis, Minn. The bit has an annular recess to contain a loose spring, with one end entering an aperture or connected with a surrounding sleeve fitted upon the bit of the driver, making an improved device for holding the screw on the end of the bit, with other novel features.

An apparatus for striking moulds for hand rails has been patented by Mr. Frederick R. Bodley, of Denver, Colo. This is a mould striker of novel construction to produce moulds for rails of any required pitch, size, and shape, without requiring special skill for its operation, and so the most difficult mould can be struck out on the mould board as easily as simple forms.

A power transmitting pulley has been patented by Mr. John T. La Turno, of Armstrong, Mo. It is made in two sections placed loosely on a driving shaft, with interior lugs and springs between them, one of the pulley sections carrying the pulley rim or face, and the other section a clutch device, in combination with a clutch splined to the driving shaft, giving a gradual strain between driving and transmitting power gears in starting.

AGRICULTURAL INVENTIONS.

A sorghum and corn cutter has been patented by Mr. Charles E. Coe, of Leesburg, Kansas. It consists of a shearing mechanism, with means for advancing it upon the ground to cut the stalks, laying them to form a bunch, holding the bunch till it is large enough, and dropping it at the will of the operator.

A baling box has been patented by Mr. Oliver Bulkeley, of Dexter, Texas. Fixed standards reach above the end board, and there are hinged side boards, so the bale cords can be placed in the box with their ends reaching over the upper edges, when the bale cloth can be put in, and the cotton or other material to be baled packed therein, and the whole tied by the cords. It is particularly intended for the cotton field, as it only weighs 100 pounds, or it may be of use to small farmers in baling hay.

MISCELLANEOUS INVENTIONS.

An axle skein has been patented by Mr. Edmund N. Hatcher, of Columbus, O. Combined with an axle and its skein, the hood, band, and bolts are all formed in one piece, thus strengthening the parts at the points usually the weakest.

A spool holder has been patented by Mr. Amos W. Judd, of Chattanooga, Tenn. It consists of a spiral spring of small diameter for holding the spool, and in a fastener fixed to the ends of the spring and capable of being attached to the clothing of the user.

A pump has been patented by Mr. James E. Sinclair, of Waverly, Md. The water cylinder is combined with a hood arranged on the outside of the casing for collecting escaping gases, whereby they may be destroyed to prevent the spreading of noxious vapors.

A beehive has been patented by Mr. Martin Van Ensley, of McMinnville, O. The bottom is made double, with passage and ventilating openings, and there are other novel features, covering improvements on a former patented invention of the same inventor.

An elevator has been patented by Mr. Chas. W. Hays, of Orange, N. J. It is constructed with an arm attached to the well door to engage with the carriage when the door is open, and prevent the carriage from moving up or down before the door is closed, thus locking the carriage in place when the door is open.

A draught equalizer has been patented by Mr. Oliver C. Beck, of Rickreal, Oregon. The invention covers a combination of single trees, a double tree, and a treble tree, so as to equalize the draught of one horse drawing at one end of a tree or cross bar by two horses drawing at the other end of the same tree.

A hydraulic dredge has been patented by Mr. John H. Anderson, of Shelby, Neb. It is a sectional dredging vessel comprising a main boat and supplementary boats, with dredge tubes for cutting either a narrow or wide channel, the invention being an improvement on a former patented invention of the same inventor.

An apparatus for working electric bells has been patented by Mr. Wilbur F. Horn, of Carlisle, Pa. The bell is rung or other electrical effects produced by the immersion of one of the battery plates into the exciting fluid, by a novel device, one plate being permanently immersed and the other normally out of contact with the exciting fluid.

A scraper and elevator has been patented by Mr. Titus H. Apple, of Meadville, Pa. It is for loading snow, earth, sand, sawdust, stones, or such materials into carts, wagons, or other vehicles, for which the parts are novel in detail of combination, and the apparatus can be thrown into and out of operation very easily and rapidly.

An electric lock has been patented by Mr. Hilborne L. Roosevelt, of New York city. The armature of the magnet is combined with a swinging plate, spring, and bolt, and a trip plate is interposed between the armature and swinging plate, with other novel features, the invention being an improvement on a former patented invention of the same patentee.

A machine for making horseshoes has been patented by Messrs. Joseph Rigby and John W. Gorsuch, of Ottawa, Kansas. A former is fixed on an iron casting fastened on a block, and around it the shoe blank is bent by hand levers, the invention affording an improved device for bending straight blanks into the form of horseshoes by hand.

A saw jointer and set has been patented by Mr. James K. Bridges, of Woodstock, Ill. This invention covers a simple device to joint the teeth of crowning saws or straight ones, to joint the raking teeth and set the teeth of thick or thin saws, and to gauge the set of the teeth to ascertain any irregularities of the set and enable them to be corrected.

A windmill has been patented by Mr. Joshua G. Benster, of Duncan, Neb. This invention covers improvements in the construction and arrangement of the supporting apparatus for the wheel supporting frame, the frame itself, the wheel, and transmitting apparatus, and the apparatus for mounting and operating the tail vane, all intended to provide a simple, substantial, and durable mill.

A machine for spinning and winding yarn, thread, etc., has been patented by Messrs. Oscar Hanna and Hiram W. T. Earnshaw, of Dover, Ky. This is a device which may be attached direct to the condenser card, to the jack frame, or to the twister frame, when used as a doubler and twister, and is particularly adapted to the spinning of roving as it comes from the condenser.

A wagon end gate has been patented by Mr. Charles P. Krenson, of Munster, Ill. The end gate is fastened in place in the wagon box by hinged rods and levers, the rods being hinged to one side of the box and adapted to be engaged with levers pivoted to the other side of the box, the levers being held and locked by suitable devices, and the lock bars engaging with the hinged rods to hold the gate from working up.

A copy case has been patented by Mr. Myron A. Sherman, of Grant Fork, Ill. It is made with a sheet metal body with the upper parts of its sides bent outward, upward, and inward, forming grooves, and having a cover with a glass plate in a sheet metal frame to slide in said grooves, the cover sliding on and off at either end of the case, and so the edges will not tear or scratch the copy.

A device for holding photographic plates in developing trays has been patented by Mr. Samuel B. Pratt, of Boston, Mass. In combination with a developing tray is a sliding plate arranged to hold one end of a photographic plate, and adapted to be raised for lifting one end thereof out of the liquid, so the photographic plates may be easily held in and removed from the liquid without immersing the fingers.

A hay press has been patented by Mr. Herman L. Whitehead, of Island City, Oregon. There are improved contrivances for working two followers from opposite directions toward each other in a horizontal case by means of a single or double lever arrangement with power applied by a windlass by horse power, making a simple device for applying great force in a low down case, while the pressed bales may also be lifted out by one of the levers.

NEW BOOKS AND PUBLICATIONS.

Magneto-Electric and Dynamo-Electric Machines. By Dr. H. Schellen. Translated and enlarged by Nathaniel S. Keith. Vol. I. D. Van Nostrand, New York.

The work of Dr. Schellen, who had previously been a publicist of considerable mark in several departments of physics, was deservedly popular in Germany, and had reached its third edition before the close of last year. Taking this book as a foundation, Mr. Keith proceeds to add descriptions of dynamos and allied apparatus made and used in this country, the plan of the work being designed to cover everything of practical value or special interest experimentally which has been done in this field up to the present time. Mr. Keith has heretofore written much, and made many valuable original investigations on applications of electricity to practical ends, so that he comes to this task amply equipped with all the qualifications necessary to present the public with a work of standard value in the two volumes of which the first is just issued.

Illustrazioni della Ferrovia Metropolitana e Campi Flegrei, Naples, Italy.

This is a book of illustrations showing an elaborate scheme for the improvement of the city of Naples, to which Mr. Lamont Young has devoted the last ten years. He has also had the assistance, in this task, of Mr. A. Caprani, founder of the Royal Hotel in that city. This wonderfully beautiful city of southern Italy seems now fairly in the way of having our modern street railways, spacious boulevards, etc.

Steam Boiler Incrustation. By Charles T. Davis. Industrial Publishing Company, Washington, D. C.

This treatise is largely devoted to methods for preventing corrosion and the forming of scale, determining the constituents of water and their effects on boilers, compounds and apparatus for purifying it, apparatus for feeding chemicals with the water, etc.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) Reader desires to know which of the following contains the most nutriment—rice, beans, peas, or oats? A. Peas contain 93 per cent of nutriment; rice, 88 per cent; beans, 87 per cent; oatmeal, 74 per cent.

(2) C. E. B. asks: What amount of salicylic acid per gallon will prevent the fermentation of cider, or other liquid of similar nature? A. Add one oz. salicylic acid to each forty gallons immediately after the cider has left the press, and no fermentation will take place.

(3) C. B. S. asks how to make a glue suitable for gluing sea shells together, one that will set quick, and be stiff after set, and yet not crackle or break easily. A. Use the following:

Starch	2 drachms.
White sugar	1 ounce.
Gum arabic	2 drachms.
Water	q. s.

Dissolve the gum, add the sugar, and boil until the starch is cooked.

(4) C. S. R. asks: What material will mix with anthracite coal ashes, to make a walk that will be firm and smooth both in wet and dry weather? A. Mix with Portland cement one part, ashes two parts; make into a mortar quickly, spread on path and smooth with shovel or trowel.

(5) B. T. S. writes: It is said that about one-twentieth of water is air; now if I convert the water into steam and then condense it back to water, and take that water direct out of a vacuum back into the boiler, and use it over and over without its coming in contact with the air, what proportion of air will there be, if any, still left in that water? A. Practically no air; but any fresh water that may be pumped into the boiler contains air, which will mix with the steam and enter the condenser.

(6) E. P. M. asks: 1. Is it practicable, by any known plan, to manufacture, in glass, frusta of hollow cones about four inches high, whose shells shall be about a quarter of an inch thick, tapering in interior diameters from $4\frac{5}{16}$ inches to $3\frac{11}{16}$ inches; the interior section to be circular to within $\frac{1}{64}$ of an inch, it being allowable to strengthen or stiffen the shell by exterior flanges as desired? A. Yes, make a model of your cone in wood or any other material. Send it to a glass house and have cones blown, or if they are to be exact have them pressed in a mould, which the glass blower can have made to suit your pattern. 2. In the conversion of rectilinear reciprocal to rotary motion, what per cent of power is lost by the imperfections of the ordinary crank in the varying force exerted at different points in the circle described by the pin? A. The crank value is 0·63 of the direct pressure.

(7) Upsilon desires to know recipe for acid compound that will restore worn or blunt files to utility. A. Clean the files by brushing them clean of dirt and grease as well as any foreign metal sticking in the teeth; then dip in a strong alkali for a few minutes to remove all traces of grease from the bottom of the teeth; rinse in clean water, then dip a solution of 1 part nitric acid, 3 parts sulphuric acid, to 7 parts water. Time 5 seconds to 5 minutes, according to cut and wear. Rinse in warm lime water, dry, and oil slightly. Finally brush with powdered charcoal to take off excess of oil and give them the peculiar look of new files.

(8) H. B. asks the process for making counter dies for the ordinary seal press and metal used, to give the best result. A. Cast the counter die upon the face of the die in type metal, and solder it to the brass backing piece while in the press in order to get a good register. 2. Formula for making ink to print on tin with a rubber stamp? A. Use a little varnish rubbed up with the ordinary printing inks.

(9) Brazoria asks if there is any device for measuring distance, close or far, without the use of rods or chains. How is distance measured? A. You cannot measure a distance without a measure of some kind to begin with. Long distances are obtained by triangulation, for which an accurately measured base is necessary. See any book on trigonometry.

(10) G. R. H. writes: Can you explain how it is that although water expands in freezing, a piece of wet board when frozen is smaller than at any other time? That it is so I have proved repeatedly, although I have heard the fact disputed. A. The expansion of water ceases at the moment of congelation. Ice contracts by cold more than wood.

(11) J. N. asks the most extensive place in the manufacture of cutlery—Sheffield, England, or Turner's Falls, Mass.? A. Sheffield, England.

(12) G. A. D. writes: Will you please inform me what kind of shoe blacking that is which some private valets use for blacking their masters' shoes and where it can be bought? It is said to keep the leather soft and give a good polish. A. All blacking which gives a good polish on shoes is in its nature non-beneficial to the leather, and many of the best polishes contain acids which are injurious. The leather, however, may be kept in fairly good condition by using the blacking sparingly and occasionally sponging off, when a slight application of neatsfoot oil and tallow will help restore the life to the leather. There are too many good blackings in the market for us to particularize here, but more depends upon their use and the care taken of the leather than in the differences in their quality.

(13) J. F. M., of Ohio.—The signing of the patents by the Acting Secretary is lawful, and such patents are perfectly valid. This has been so held by decision of the United States Court.

(14) E. L. I. asks: What substance loosens printer's ink so that newspaper pictures can be transferred to other paper? A. The liquid to be used is made by dissolving 1½ drachms common yellow soap in 1 pint hot water, adding when nearly cold 3¼ fl. oz. spirit of turpentine, and shaking thoroughly together. This fluid is applied liberally to the surface of the printed matter with a soft brush or sponge (being careful not to smear the ink, which soon becomes softened), and allow it to soak for a few minutes; then well damp the plain paper on which the transfer is to be made, place it upon the engraving, and subject the whole to moderate pressure for about one minute. On separating them a reversed transfer will be found on the paper. This transfer will not be equal to the

original, as only a part of the printer's ink is removed. If the printing be very old, a longer soaking and more pressure may be necessary.

(15) C. H. K.—Starr died in 1847, when about 25 years old. He was interested in the first patent mentioning incandescent carbons. He employed, in 1845, carbons heated to a white heat by the passage of the electric current, recommending platinum as the best metal for the purpose, and the best carbon that of gas retorts. He made an electric candelabrum with twenty-six lights symbolizing the twenty-six States of the Union, which Faraday is said to have greatly admired.

(16) A. B. asks: Which nation stands, statistically, as the first in the matter of inventions? A. England stands first in respect to the early development and grant of patents for inventions. The United States ranks first in the number of patented inventions.

(17) H. B. V. asks the earliest date of the round piston valve engine. A. The earliest rotary valves for steam engines were those of Marquis of Worcester, Savery, and Newcomen, about 150 years ago.

(18) E. A. S. asks the best way to remove from cloth, paper, or ivory the stains from the purple aniline pencils now so often used, and from the aniline ink, which has driven out of the market almost every other variety. I find that hypochlorous acid will take out the greater part of the stain from an ivory paper cutter, but traces of the spots still remain. A. We would recommend you to try hydrogen peroxide. Its use for bleaching ivory is unexcelled. Follow it up by treatment with alcohol. A description of its application to ivory is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 339.

(19) F. A. W. asks: How can I make water dissolve the largest amount of bicarbonate of soda? That is, can I dissolve more to a gallon of water, and have it stay in solution, than by simply adding the soda to cold water? A. The bicarbonate of soda is soluble in 13 parts of cold water, and is decomposed by boiling water. Therefore it is most soluble at just about 158° Fah. (70° C.), where 14·64 parts of the theoretical anhydrous salt becomes soluble in 100 parts of water, and 16·69 parts of the crystalline salt are soluble in the same amount of water.

(20) J. C. H. writes: I saw in one of your numbers a recipe for a hektograph or copying pad consisting of 100 parts good or common glue, 25 parts baric sulphate or kaolin, and 375 parts water. I took of the glue 4 ounces, kaolin 1 ounce, and 15 ounces water. When first made it stuck to the paper and peeled up with it; after it got harder it did not take up enough ink to make a good copy. The ink used was a concentrated solution of Paris violet aniline, as called for by the recipe. A. The formula originally given you is the one used by the French government, and is for several reasons considered superior to any other. The following may prove more satisfactory, and we suggest its trial: Take good carpenter's glue 4 ounces, soften it in very cold water by soaking an hour or two, remove when entirely soft, then heat four ounces by weight of glycerine till vapor arises from it, then add the glue to the hot glycerine, and stir till dissolved; then keep the vessel in a water bath for several hours till the excess of water is evaporated.

(21) L. M. J. writes: In the process of pasting the photograph on the glass, in doing electograph, artograph, and photo painting, is there anything combined with the starch paste to prevent blisters and peeling off the glass when dry? A. We presume you use the starch too thick; thin it by adding more hot water. It is also essential that the glass should be thoroughly cleaned. The paste consists of nothing but starch.

(22) L. R. G. writes: Will you be good enough to give sufficient directions for the preparation and subsequent treatment of the photographic copying papers giving the following results: White lines on blue ground, blue lines on white ground, and black lines on white ground, on first impression? A. The blue process, giving white lines on blue paper, is described on page 52 of the SCIENTIFIC AMERICAN for July 28, 1883. The reversed blue process is as follows: Well sized paper is painted over with a brush with the following solution, freshly prepared: 30 volumes of gum arabic solution (1 to 5), 8 volumes solution of citrate of iron and ammonia (1 to 2), and 5 volumes of iron perchloride (1 to 2). The mixture appears limpid at first, but soon grows thicker. The paper is dried in the dark, then exposed for a few minutes under a negative or drawing, and developed with a solution of 1 part potassium ferrocyanide in 5 parts of water applied with a brush. It is fixed with dilute hydrochloric acid 1 to 10, washed thoroughly, and dried. For black lines on white ground the paper is immersed in the following solution: 25 ounces gum, 3 ounces sodium chloride, 10 ounces iron perchloride, 45° B., 5 ounces iron sulphate, 4 ounces tartaric acid, and 47 ounces water. The developing bath is a solution of potassium ferricyanide or potassium ferrocyanide, neutral, alkaline, or acid. After being exposed, the positive is dipped in this bath, and the parts which did not receive the light take a dark green color; the other parts do not change. It is then washed with water in order to remove the excess of the cyanide, and dipped into a bath containing acetic, hydrochloric, or sulphuric acid, when all the substances which could affect the whiteness of the paper are removed. The lines have now an indigo black color. Wash in water and dry.

(23) J. B. asks for a preparation for nickel plating without a battery. A. The process is described in answer to query No. 28 in SCIENTIFIC AMERICAN for May 24, 1884. 2. Also a receipt for making scarlet ink? A. Half a drachm of powdered lake and 18 grains of powdered gum arabic dissolved in 3 ounces ammonia water makes one of the finest red or carmine inks. 3. A receipt for making ink for stylographic pens? A. 20 grains of brown shellac are dissolved in a warm solution of 30 grains of borax in 300 to 400 grains of water and filtered hot; to the filtrate is added a solution containing 7·5 to 10 grains of water. Soluble nigrosine, 0·3 grain tannin, 0·1 grain picric, 15 grains ammonia water, and 7 grains water. 4. How to make printing ink dry quickly, if there is a mixture, and what? A. Printing ink is composed essentially of lampblack and varnish. A quick drying varnish can be used in the preparation of the ink. Borate of manganese and lead salts, such as litharge and lead acetate, can be added to the varnish to increase its drying qualities. But all good inks require time to dry.

(24) M. B. P. writes: I am troubled a great deal with red ants. Can you inform me of any receipt for destroying them? A. If powdered cloves are scattered around where the ants are, it will be found very effectual in driving them away. The better quality of Persian insect powder is excellent.

(25) W. S. P.—Hammered brass work is a very old art revived. It consists of making the surface of ornamental articles in brass or other metals appear as if indented in concave facets, which is done with polished hammers or sets driven with a hammer. The thickness of brass to be used depends on size of the article and fineness of the work.

(26) M. H. writes: 1. I have a field glass about 2½ feet long, and have tried to look at the sun with it by putting a piece of smoked glass outside over the large glass, but could not see the sun at all. How shall I proceed? A. Place a piece of paper or white card 6 to 8 inches from the eye end of the telescope, and properly focusing the image of the sun upon it you will have the most acceptable view of the sun. If you pass the object end through a dark curtain in an open window that commands a view of the sun, and darken the room, you may make a very satisfactory view to a number of persons at the same time, without in any way injuring the eyes. You may make a wire frame that will hold the paper screen attached to the telescope, so that, in moving the telescope to follow the sun, the screen will move with it. 2. Is there any other kind of faucets that can be used for cider besides the wooden ones? A. There is nothing better than maple faucets for cider.

(27) W. A asks a formula for a liquid shoe polish that will not injure and crack the leather, but is a leather preservative; people complain of the polishes as sold as spoiling and cracking the leather. A. Put a half pound gum shellac, broken up in small pieces, into a quart bottle or jug, cover it with alcohol, cork it tight, and put it on a shelf in a warm place; shake it well several times a day, then add a piece of camphor as large as a hen's egg, shake it well, and in a few hours shake it again and add 1 ounce lampblack. If the alcohol is good, it will all be dissolved in two days; then shake and use. If the materials are all good, it will dry in about five minutes, giving a gloss equal to patent leather, and will be removed only by wearing it off. This will make perhaps one of the least harmful of liquid shoe polishes, which are in general no way leather preservatives, except as they afford a coating preventing wear. 2. What composes the liquid glue that is advertised to mend or cement wood, glass, china, and leather, etc? A. Take a wide mouth bottle and dissolve in it 8 ounces best glue in half a pint water by setting it in a vessel of water and heating until dissolved. Then add slowly 2½ ounces nitric acid 36° Baume, stirring all the while. Effervescence takes place under generation of nitrous gas. When all the acid has been added, the liquid is allowed to cool. Keep it well corked, and it will be ready for use at any moment. 3. What is the best exterminator for moths, especially carpet moths? I have tried black pepper, camphor, etc., but it does not kill. Can you give me a good recipe of one that will kill them? A. The genuine Persian powder is considered the best preventive for moths, but once they have taken possession, their removal is best effected by beating, etc.

(28) A. V. R.—A very satisfactory method of producing an insoluble glue is effected by adding a little potassium bichromate to the glue when it is dissolved for use, and then to expose the glued part to the light. The proportion of bichromate will vary with circumstances; but for most purposes about one-fiftieth of the amount of glue will suffice. By this means even hot water has no effect upon the glue.

(29) J. W. A. writes: Please state the cause of small warts appearing through the hair on the scalp, also cure for same. A. The warts are probably due to some irritation of the scalp produced by causes we cannot determine. Dichloracetic acid or anhydrous chromic acid will remove these; in using the first mentioned compound, it is best to grease the portion of the scalp adjacent to the wart, thereby preventing any pernicious effect on the skin.

(30) H. E. K. wishes a good recipe for removing pimples, freckles, and small running sores, and also a greasy look from the skin; something that will not harm the skin, but will make it soft and white. A. Pimples and running sores may be caused by so many different things and are of such variety that it would be best to consult a physician in regard to them. Freckles can be removed by washing with borax, and the greasy look of the skin will disappear on washing with soap.

(31) J. H. M. asks: What composition is used for tinning knives, and how is it put on to make it look smooth, also how to prepare the knives previous to tinning? A. Pure block tin is used for tinning knives and iron spoons. The articles are thoroughly cleaned from oil or grease in a hot alkali bath; then if free from scale dip in a solution of muriate of zinc to which has been added a small piece of sal ammoniac, dry quickly over a hot plate of iron, or furnace, and immerse in a bath of melted tin for a few seconds. Have the surface of the melted tin kept clean by skimming and sprinkling with a little powdered resin.

(32) J. G. O. writes: I get the water for an engine from a pond about 12 feet below the boiler, and distant 290 feet, with four elbows. I put an inspirator up connected to the feed, and the discharge pipes are 1¼ inch diameter each, steam pipe ¾ inch, but it would not work more than 2 or 3 minutes at first. Three engineers gave different opinions as to the failure. What shall I do about it? A. There is great difficulty in making an injector work reliably on as long a suction pipe as you describe. We do not think that your connection pipes are at fault, nor the water at 80° Fah. too warm. Put a leather seated suction or foot valve below the water on end of pipe at pond. Have the pipe pitch all the way upward toward the injector, so that the air will rise naturally when the pipe is filled; place the injector as low as possible, even to digging a pit for it. Place a vertical pipe from the highest part of the main near the injector, projecting above the level of the injector, with a cap that can be made perfectly tight. Start the injector, and get all of the air out of the pipe if possible. If the injector continues to work, all right. If not, there is probably air in the pipe or a leak, in which case take off the cap of the stand pipe and fill with water, closing the valve at the injector. If there is a leak in the pipe, it should show by the water falling in the stand pipe. You will know what to do in this case.

(33) P. F. asks (1) a receipt for a good fireproof paint for boilers and smoke stack to portable engines. A. For paint for boiler and smoke stack use coal tar and asbestos or a good asbestos paint. 2. A preparation for taking the grease off an engine so it can be painted again? A. Use strong solution of caustic soda to remove old paint and grease. 3. A preparation to clean brasses and steel work on an engine? A. For cleaning brasses use pulverized pumice stone and kerosene oil, and polish with dry rotten stone on leather. For removing rusty spots on the finished iron work use fine emery paper or emery cloth.

(34) H. B. B.—Carp culture has met with such success, and assumed such importance that the American Association, Philadelphia, proposes publishing a monthly in its interest. We consider the fish, however, coarse and tasteless and not worthy of culture in waters that can be used for a better class of fish.

(35) L. K.—We do not know the composition of the special oils you mention. Paint your shade for green with a mixture of chrome yellow and indigo blue in oil. We have had one in use several years so painted.

(36) R. S. D. asks: 1. Does the microphone, Fig. 4, SUPPLEMENT, No. 163, require an induction coil same as the Blake transmitter? A. It may be used either with or without an induction coil. 2. Please give directions, that is, size and amount of wire necessary to make such an induction coil. Will the ordinary annealed Bessemer steel wire answer to make the core of? I mean such as is used as binding wire. A. Make the spool about three inches long, to contain a core of fine, very soft iron wires, the core being about five-sixteenths of an inch in diameter; wind upon the spool three layers of No. 18 wire; cover this with one thickness of ordinary writing paper, and wind upon this about ten layers of No. 36 copper wire. Bessemer steel will not answer well for the core of an induction coil. 3. Is the call in the telephones in use through the country electric or magnetic? If electric, is the same induction coil used as the transmitter uses? A. The calls generally used are magneto-electric machines; induction coils are seldom or never used for calling purposes.

(37) A. D. S. asks: Is there any known thing that will be a conductor of electricity only when light strikes it? A. We think selenium will meet our wants.

(38) H. L. C. writes: In SCIENTIFIC AMERICAN, No. 5, vol. xlviii., are directions for an electrical machine. 1. Should the plates be varnished on both sides? A. They may be varnished on both sides. 2. Should the scales be cemented before or after the varnish is applied, and what cement is the best? A. Afterward. The varnish itself will form a very good cement. 3. Will white shellac do to varnish with, and how many coats? A. One coat of white shellac varnish will answer.

(39) G. A. H. writes: 1. I am making an electric induction machine, of the Von Holtz type, and I would like to know if these are good dimensions for same, and what size spark can we expect of same, if carefully made? The plates are of thinnest French plate glass, 14 and 16 inches in diameter. The tinfoil disks are two inches in diameter. I am using lead button on same, fastened with shellac varnish; will that do? For Leyden jars, I am using two battery jars 5x7 inches. Are these too large? What should be the distance of revolving plate from stationary plate? Is three-sixteenths inch a good distance for this size plate? A. Lead buttons will not answer as well as buttons of brass, because the lead will wear rapidly, and the particles of it may become scattered over the glass plates. The proportions of your plates are about correct. If your machine is properly made, you may expect to get a spark from six to seven inches long. Your jars are too large; jars two inches in diameter would be large enough. The distance between the stationary and movable plate may vary from three-sixteenths to three-eighths of an inch. 2. I am also making a Whinhurst induction machine, with a pair of 12 inch plates. What is the proper size of the tinfoil pieces for 12 inch plate? By making the pieces larger, and less numerous, would that increase size of spark, or would narrow and more pieces of tinfoil increase spark? Also will I get a larger spark by using Leyden jars? A. Divide your plates into 24 equal spaces, and make your tinfoil pieces to fill the alternate spaces, leaving an inch and a half at each end of each piece. We do not think it would be advantageous to make the pieces larger. Leyden jars will increase the size of the spark.

(40) C. C. C. writes: I have made a Daniell's battery, using a bladder instead of a porous cell, and tinned copper, as I could get no other kind; but the battery is exceedingly weak. Please tell me wherein the trouble lies. Where can I can get a porous cell for a Daniell's battery? A. The tinned copper will answer as well as any for battery, provided you put the copper side in. We think your battery would work better with a porous cell; but a single cell of Daniell's battery is not very strong in any case. You can procure porous cells for Daniell's battery from any of our dealers in electrical supplies.

(41) J. M. writes: In filling a barometer tube without heat, or without vacuum produced on cistern, I held the tube perpendicular (open end up), put on my cistern, and filled the cistern full; the end of the tube was even with the surface of the mercury. Then I put on my leather and cover and turned the tube to its proper position, but the tube still remained full to the extreme upper end. How can I lower the mercury in the tube to correspond to the inches on the dial of the barometer? A. You can produce a barometer in the manner described by you, but it will not be absolutely perfect, for there is always a film of air adhering to the inner surface of glass tubes which must be expelled by boiling the mercury. Your best way to graduate your dial would be to compare your barometer with a standard instrument. 2. How much mercury is required in the cistern to make the barometer work well? A. The cistern of the barometer must contain sufficient mercury to supply the tube when the mercury is at its greatest height, and cover the lower end of the tube sufficiently to prevent the entrance of air. 3. What is the reason all barometer tubes are 33 inches long? A. Because that is about the length of a column of mercury sustained by ordinary air pressure. 4. Why will not any length do, say from 24 inches up to 32 inches? A. See answer to No. 3. 5. How many degrees Fah. represent the boiling point of water? A. 212° under ordinary circumstances. 6. How many the boiling point of mercury? A. 644°. 7. Where can I get barometer tubes, and what is the cost of them? A. Address any dealer in glass tubes or chemical apparatus in this city. 8. Tell me simple formula used to find the cubic feet in a round spar 24 inches diameter in the big end and 18 inches in the small end, 90 feet long. A. Find the square root of the product of the areas of the two ends; to this add the two areas, and multiply this sum by one-third the length. 9. Tell me the philosophy of the working of an inspirator. A. Consult article on Giffard injector in SUPPLEMENT, No. 212; see also articles on injectors in SUPPLEMENT, Nos. 42, 153, 112, 57, and 356.

(42) H. F. C. asks whether chickens hatched in incubators differ in any way whatever from those hatched by the natural process. A. There is no difference between chickens hatched in incubators and those hatched in the natural way.

(43) C. M. L. asks how the smallest possible electrical battery can be made, or where purchased, as there is said to be a battery used in surgical operations, which can be fastened to the lapel of the operator's coat. A. By using plates of carbon and zinc, and employing bichromate solution as the exciting fluid, you can make a very small battery which will deliver a large current for a short time.

(44) B. F. P. asks: If a stamp on a steel tool has been obliterated by hammering, can it be renewed so as to render it legible? A. If the stamp has not been absolutely as well as apparently obliterated, it may be made plain enough for identification by grinding the place and heating over an open fire sufficient to color the steel. The stamped portions of the steel will show a different shade from the other portions.

(45) R. asks: Can I learn or be able to analyze or assay, for my own pleasure, ores and minerals, through the instruction of some work on the subject? Theoretically, I have a fair knowledge of the science, but have only a limited idea of the working example and apparatus. A. It is possible for one to acquire such a knowledge as you desire. Of course, a few lessons from one familiar with the subject are very desirable, but a satisfactory knowledge can be acquired from books. In blowpiping, besides the work you mention, Professor H. B. Cornwall's Manual of Blowpipe Analysis ($2.50) and Plattner's Manual of Qualitative and Quantitive Analysis of the Blowpipe ($5.00), and Elderhurst's Blowpipe Analysis and Determinative Mineralogy ($2.50) are excellent guides. For assaying, Rickett's Notes on Assaying is probably the best book to get.

(46) F. S. asks an easy test for glucose in honey—a qualitative test rather than a quantitative. A. The readiest means of detection is as follows: A solution of 20 parts of honey in 60 parts of water, when mixed with alcohol, gives a heavy white precipitate of dextrine if glucose has been added, while natural honey only becomes milky under the same circumstances. Glucose gives a red precipitate with Fehling's solution. The United States Dispensatory will give you the information necessary for the proper manipulation of this test. It can also be applied quantitatively as well.

(47) F. B. B. writes: With a solution of perchloride of iron and gallic acid, I get a purple ink. How can I wash the writing in to make it jet black? A. There is nothing that you can use that will improve the color of the ink when once it has been written with. We think, however, that as the writing ages it will darken.

(48) S. T. G. asks a recipe for mending lamp tops. A. Use a cement prepared by boiling 3 parts of resin and 1 of caustic soda in 5 of water. This composition forms a soap, which when mixed with half its weight of plaster of Paris sets firmly in about three-quarters of an hour. It is said to be of great adhesive power, not permeable by kerosene, a low conductor of heat, and but superficially attacked by hot water.

(49) W. G. F. asks how calcium sulphide is used to remove surplus hair from the face without injuring the complexion. A. Apply a light coating of the calcium sulphide made into a paste with warm water and starch. Sometimes soap lye is used instead of water. The paste is spread on paper and applied like a plaster.

(50) H. E. W. asks: 1. If ground connections for telephones are attached to lead water pipes, will any galvanic action take place, to injure the solder on brass connections, etc.? A. We think not. 2 What can be used to remove the grease, etc., from waste pipes from sinks and wash basins, that will not injure lead pipes? A. Use a strong solution of caustic potash.

(51) F. S. B. asks: What will clean zinc and make it look bright? A. Whiting or refined chalk in water; finish dry.

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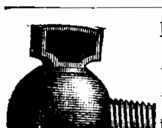

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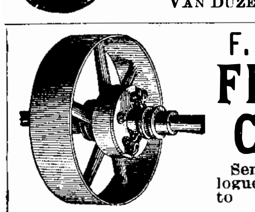

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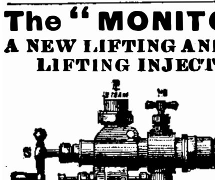

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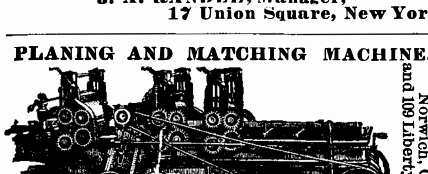

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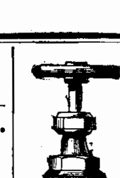

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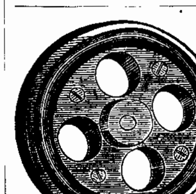

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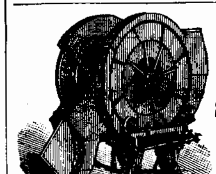

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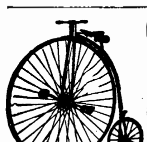

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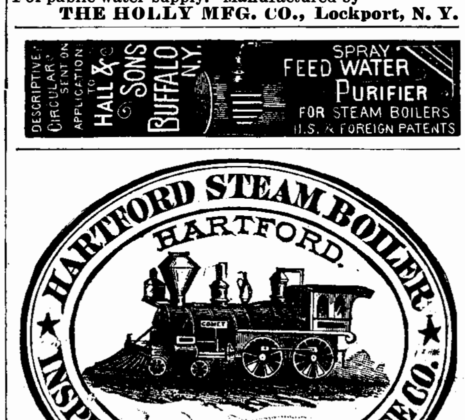

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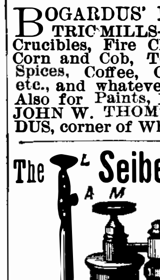

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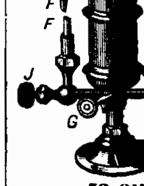

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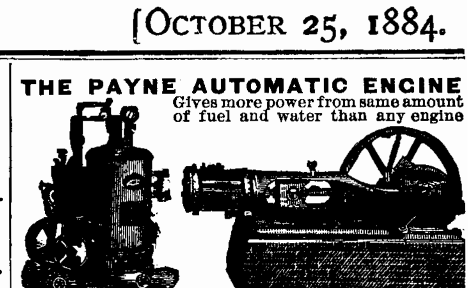

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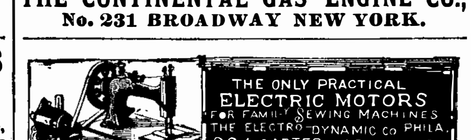

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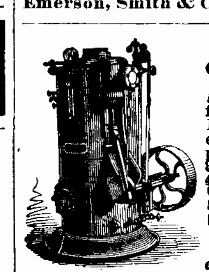

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