

the hand and keeping its position relative to the body the same. In drawing curved lines, it is well to make a few dots in the path the curve has to traverse; not more than four or six for any curve, but enough to guide the eye and give confidence to the hand. Passing the chalk point over the place where the intended curve is to be, without marking, is also useful, as it accustoms the hand and arm to the motion and change of joint required by the curve. Rapid drawing will not be acquired at once; speed will increase with practice. Left curves should be drawn first; and when drawing the balancing forms on the right hand, the eye should take in not only the curve in process of formation, but that already made, and to which it is symmetrical. The delineator will find it is better to draw with the whole arm extended from the shoulder joint than from the elbow or wrist, the face not being nearer the board than a distance of two feet in a perpendicular line to its surface. Supposing the shoulder joint to be a center and the extended arm a radial one, circles can be drawn rapidly and with astonishing accuracy.

The diagram should not extend much above the delineator's head, for above the head the hand will lose its power; nor below the elbow when the arm hangs at the side, for to draw then brings the head close to the board, and prevents a clear view. If it be necessary that lines be made both above and below these points, the position of the body and head must be raised or lowered, so as to avoid stooping or straining, which prevents good work.

Drawing on the blackboard without the aid of compasses or rule may be considered as the most perfect illustration of the expression "free-hand drawing;" and to acquire the art, the hand and arm should be quite free and supple in their motion, otherwise graceful curves and fine lines cannot be made.

Students should commence delineation on the blackboard by first drawing vertical, horizontal, and oblique lines, following this up with the shading of cylindrical, conical, and cubical forms, by means of lines of different widths at different distances. Colored chalks may be used when experience has been gained; and by the use of these, pleasing effects are obtained, delineations are made intelligible, and the subject more easily remembered. The relative position of the body to the blackboard and the manner of using arm and hand, as given above, should receive special attention and practice at the outset.

#### COAL DUST FUEL.

We are in receipt of several queries as to the best method of using coal dust as fuel under steam boilers. To these inquirers the following data, kindly sent us by Mr. C. J. Sanborn, of Quincy, Mass., will doubtless prove of interest. Mr. Sanborn states that he avoids dust by slightly dampening the screenings, and he regards plenty of boiler room as a prime necessity. His boiler is 4 feet in diameter by 14 feet in length, with 50 three inch tubes, 20 square feet of grate surface, and artificial draft produced by a blower. The engine is 14 by 36, cutting off at  $\frac{1}{2}$  stroke, piston speed 280 feet per minute. Power is supplied to six granite polishing machines, two large polishing lathes, large grindstone, pump and blower. Consumption of coal dust 1,000 pounds per day of 10 hours, with, say, 300 pounds of Cumberland coal. Cost of dust \$2.50 per ton. The grate surface is composed of flat plates running the length of the furnace, with about 80 one half inch holes to the square foot. It should be added that in this case the feed water is delivered to the boiler nearly cold on account of the small size of the heater, and it is also charged with salts and lime, rendering frequent blowing-off necessary.

#### GOVERNMENT SCIENTIFIC WORK.

THE geological and geographical work conducted under the auspices of the United States Government during last year is divided by the Secretary of the Interior, in his late report, into two divisions. The first is that under the direction of Professor F. V. Hayden, and the second that commanded by Major Powell. The area surveyed by Prof. Hayden's parties begins at the northern line of the belt of country already explored and mapped in detail by the survey of the 40th parallel, and extends westward from the longitude of Fort Steele, Wyoming Territory, to that of Ogden, Utah, and northward to the Yellowstone National Park. The primary triangulation party established 26 main stations and surveyed 25,000 square miles, and the topographical and geological parties surveyed 28,000 square miles, and erected monuments at all the important geodetic stations. The regions suitable for arable, pastoral, or mining purposes have been carefully examined and classified, the volume of water in streams adapted to irrigation purposes has been measured, and studies made into the best methods for reclaiming barren lands. Special investigation of the doubtful points in the geological structure of the Rocky Mountain region has shown that, while certain of the groups of strata possess each certain peculiar characteristics, and are recognizable with satisfactory distinctness as general divisions, they really constitute a continuous series of strata, with no well-defined planes of demarkation, stratigraphical or paleontological. Another interesting result of the surveys is the probable determination of the ancient outlet of the great lake that filled the Salt Lake Basin. It is thought that the waters flowed northward, by way of Marsh Creek, into the Portneuf, thence into the Snake River, and thence into the Columbia River. The source of Marsh Creek is in the lowest pass between the drainage of the Great Basin and

that of Snake River. The publications of the survey have been exceedingly voluminous.

Major Powell's party has worked within the Territory of Utah, surveying volcanic plateaux, classifying lands, examining large areas of pine timber, and locating important and valuable coal fields. It is stated that the area of the territory that can be redeemed by irrigation through the utilization of all the streams, but without the construction of reservoirs, is about 1,250,000 acres. The ethnological work of Major Powell's party has been very extensive.

A commission composed of Professors C. V. Riley, Cyrus Thomas, and A. S. Packard have been engaged in the study of the Rocky Mountain locust. Professor Riley's determinations relative to this insect we have already placed before our readers. The work of this commission has been of great value, as it has laid the way for future investigations which will result in the probable abatement of the evil.

With regard to the Yellowstone Park, Secretary Schurz states that nothing has been done, and he recommends appropriations for the laying out of roads and support of other measures calculated to render the natural wonders of the region attractive and accessible.

#### Microscopic Masons.

The *Melicerta ringens* is a microscopic organism which possesses a building apparatus, by the aid of which it manufactures infinitesimal pellets, specific in shape and in situation, and in altitude when placed in position. The gathering members resemble a series of cog wheels which, by rotating rapidly in different directions, produce a stream, which passes by a special organ which selects from its current those particles suitable either for eating or building purposes, by dividing the main stream into four smaller ones. One stream glances off a kind of cushion and is deflected as food to the eating apparatus, another carries off the waste, and the third and fourth go to the pellet or brick making organ.

This last is of cup shape, and moulds the pellet in the form of a Minié bullet, mixing it with glutinous material and rolling it just as a boy makes a snowball. It then passes to another wonderfully delicate little member, which converts the ball into a cylinder, and the brick which is to take its place in the wall is made. In an inconceivably short space of time the particle is grasped, turned, and fixed in position in the row of other pellets which are laid with wonderful neatness and regularity.

While the *melicerta ringens* is a brick maker and brick layer, the *Limnias annulatus* is a plasterer. Mr. F. A. Bedwell, in the *Monthly Microscopical Journal*, says that it secretes fluids and rough particles, and with these it rough-casts its tube on the outside and then stuccoes it smoothly on the inside, and finally smooths down the exterior surface exactly as a bricklayer smooths his stucco with his flat trowel.

#### The Centripetal Railway System.

The New York Board of Trade and Transportation has issued a pamphlet describing the Centripetal Railway system devised by Mr. Albert G. Buzby. This consists essentially of a substantial permanent way, composed of a center or bearing rail and two outer or steadying rails, combined with distance or brace pieces so as to form one continuous structure. The cars and locomotives have double-flanged bearing wheels adapted to the center rail, and side steadying wheels without flanges adapted to the outer rails. Each set of wheels has a separate and independent axle, and all are arranged so as to have a swinging and lateral as well as perpendicular motion, each independent of the other. It is claimed that the load is mainly carried on the center rail, and that there is no grinding action in passing over curves. The center rail may have a face of any width, and thus the adhesion of the locomotive wheels is materially augmented, admitting of the use of heavy gradients. Curves of fifty feet radius are claimed to be possible under the system, and the inventor suggests its adaptation for elevated rapid transit roads, the arrangement proposed being three iron I beams, combined with longitudinal timbers and brace pieces.

#### What's in a Name?

Trials of the Bell telephone were recently conducted before the Emperor of Germany at the palace in Berlin. His Majesty manifested the liveliest interest in the invention, and deigned to inquire its name, whereupon a high Post Office functionary coined the title, "Fernsprecher," which means "Far talker," and which the Emperor at once approved, so that it is now a part of the German language. The acquisition of an Imperial godfather for his device may perhaps console Professor Bell for this remarkable change in the baptismal title of his offspring, although he will probably agree with us in failing to see the improvement. Still, when he remembers that the name emanates from the nation which inflicts suffering chemistry with "anisidibenzhydroxylamene" and a host of like jaw wrenchers, he may be grateful that the infant telephone is not smothered under the usual Teutonic avalanche of syllables.

#### Habits of Moths.

A correspondent of *Nature* describes some interesting experiments upon moths to test their sense of smell and hearing. Certain moths when captured feign death. While they are thus motionless, if a sharp sound be made such as is produced by striking a piece of glass, they will be suddenly roused and will attempt to fly. On the other hand, a

strong solution of ammonia, uncorked close to moths, has no effect in driving them away; they do not seem to smell it and only move away from the fumes slowly when oppressed by them. The latter experiment must occasion surprise, because it was believed that moths possessed an unusually effective sense of smell, since the males of certain species will come from great distances to visit a female kept in captivity, and it has been hitherto supposed that they were guided in their quest by the olfactory sense.

#### Endemic Tetanus in Long Island.

In the eastern portion of Long Island there has existed for many years an endemic tetanus of both the spontaneous and traumatic varieties. Cases of the disease are known to have occurred in one in about every 200 wounds, or about 150 times as frequently as it happens in New York city. Again, it seems to be confined to a particular county, the southern and central parts of which are exposed to ocean air, salt air from bays, and to the mingling of fresh and salt water. The disease is also most fatal in the months of July, August, and September.

Dr. George M. Beard has recently investigated the phenomena of the malady, and he comes to the conclusion that it is in no wise owing to the large amount of decaying fish about the vicinity, but is due to the dampness of the ocean air, combined with the local dampness of the soil. He holds the pathology of the disease to be in general a cold in the spinal cord, which has been made irritable by irritation propagated from some form of peripheral injury. The remedies recommended are Calabar bean and application of ice to the spine.

#### A 502 Dollar Rooster.

That famous \$50,000 cow which was so much talked about in this country a few years ago, has found a rival in point of proportionate pecuniary worth in a \$502 chicken. The *English Agricultural Gazette* says that a game cock was recently sold for the above excessive price, and suggests that in the future the raising of such chickens would prove a very lucrative source of income. The same journal, we notice, says that over \$13,000,000 worth of eggs were imported into England in 1876, and yet the supply was short of the demand. Here is an opening for poultrymen, and a wider field for inventors of egg-preserving processes and egg-carrying devices.

#### The Telephone and the Telegraph.

We have received several letters from correspondents narrating instances of the telephone's reporting messages from neighboring telegraph wires. In answer to numerous queries as to the cause of this, we would say that it is occasioned by the inductive effect of the electric currents on wires near and parallel with the main line with which the telephone is connected. The use of two wires for the telephone (parallel and near together) would be very apt to neutralize this effect of other wires, by causing it to act in opposite directions, through the spool wire in the telephone, which would of course have its two terminal wires connected direct with the two line wires and be independent of any earth connection.

#### TO OUR SUBSCRIBERS.

In accordance with our usual custom, at the beginning of this new year we turned over a new leaf in our subscription book, placing thereon only the names of those whose subscriptions have been renewed, or that have not expired.

All whose papers have ceased to come may know that their subscriptions have expired; and we hope they will be prompt in sending the money, \$3.20, for renewal for one year, or \$1.60 for six months. We will supply the back numbers, commencing with the year.

#### Remarkable Marksmanship.

Captain Bogardus, a well known marksman, recently accomplished in this city the remarkable feat of breaking 5,000 glass balls inside of as many consecutive minutes, the missiles being shot from a double barreled gun. The balls were thrown up from spring traps and were shattered in the air. The feat was accomplished with a margin of 19 minutes and 25 seconds to spare. It is stated that the weapon, weighing 10 pounds, was lifted and aimed 5,300 times, which work is equivalent to 318 foot pounds per minute, accomplished by the arms alone and continued for over 8 hours. This must be added to the brain work involved in aiming the gun, in order to perceive the nature of the remarkable skill and endurance of the marksman.

#### A Great Oil Pipe Line.

A new oil pipe, known as the seaboard pipe line, is soon to be laid from Butler county, Pa., to Baltimore, a distance of 230 miles. The transporting capacity will be 6,000 barrels of oil per day, and the flow will be incessant. It is expected to bring into Baltimore annually about two million barrels of crude oil, about equal to the quantity now carried there by two railroads.

THE *Boston Journal* says that the shipbuilding tonnage of Maine for 1877 has reached 76,308 tons, showing an increase over that of 1876 of 2,734, and over that of 1875 of 1,247 tons.

**Feeding Horses.**

For a period of over 30 years, more or less, says a correspondent of the *Country Gentleman*, horses have been under my control. I personally superintended the feeding. During this time no horses have died, and I have had little sickness. A straw cutter, with rawhide rollers, has been in continual use till the present time. In the cutting of the food for two teams, enough is saved in one year to pay for its purchase. While the horses are eating their dinner, enough can be cut for the next meal; then watered, to moisten it and destroy the dust, and with it four quarts of meal is ample for each horse. The meal is one third corn, one third oats, and the other shorts. A variety is made by giving a few small potatoes or carrots weekly. The benefits resulting from this manner of feeding are that we have no sick horses, they being always in good health and order; there is no danger of founder from hired men feeding when too warm: they can eat it sooner, and are ready to go out; neither is anything wasted (by throwing from the manger, etc.), and it does them more good, I believe, as no whole grain is passed and lost. Being out of meal for a few days, a number of feeds were given them of small ears of corn, with plenty of out hay, moistened. Two had to be taken to the city immediately for treatment of colic, and, by prompt action at once, they recovered. This is the last of whole grain feeding. Of course the same good quality of hay and grain is given when cut as when they cut it for themselves.

**THE COLORADO MUD VOLCANOES.**

The curious mud volcanoes of Southern Colorado are located about ten miles to the southeast of Mount Purdy, an extinct volcano, some 600 feet in height. The remarkable aspect of this region is well shown in the annexed engraving, from *La Nature*. In its center is a mud lake which constantly boils, throwing up jets of thick viscous liquid. Around this seething cauldron are hundreds of craters of dry grayish mud. The cones are from three to six feet in height and five to twenty feet in diameter. Some, having a narrow opening, eject sulphurous vapors; others, with large mouths, seem filled with mud, which they throw out at irregular intervals to heights of from four to six feet. The temperature of the mud and of the sulphurous vapors is about 210°. A small stream of clear water near the central lake reaches 199°, and ponds in the neighborhood are found to be respectively at 96° and 100°. Lieutenant Wheeler, in his geographical survey, discovered a vast hill near this mud lake which was the product of ancient eruptions. The soil is chiefly composed of sulphur, which exists in many cases in a purely crystalline state.

It has been suggested that the pitted surface of the moon might be caused by volcanoes of this sort.

**THE REGNIER ELECTRIC LIGHT.**

We take from *L'Inventeur* the annexed engraving of a new form of the Regnier electric light, which operates continuously for 24 hours. The essential feature of the apparatus is the circular carbon plates used instead of points, the voltaic arc passing between the edges of the rotary disks.

The device will be easily understood by the following reference to the illustration. *a* is the base, *b b'* forked standards, *d d'* carbon disks or rheophores having a continuous rotary motion imparted to them by the clockwork motors, *f* and *f'*. At *g g'* are the trunnions on which both disks and motors oscillate; *i h* is a forked lever connected to the motor, *f*, by a long curved rod; *k* is a button screwed on the end of this lever, and ending in the cup, *l*. By means of this screw the motor, *f*, is caused to move backward or forward in order to adjust the carbons.

*m* is a solenoid commanding a soft iron magnet (not shown). Through the rod, *p*, crank, *r*, and arm, *s*, this magnet pulling downward moves the motor, *f*, to the rear and determines the separation of rheophore, *d*. At *t t* are springs moving the rheophore, *d*, in contact with the rheophore, *d*, to establish the light. These springs, attached at *u* and at *v*, act on the motor, *f*, through crank, *r*, and arm, *s*. *x y x* is a forked lever attached at one end to the springs and carrying at its other extremity a set screw by means of which the springs are more or less extended and the lamp regulated. At 2 and 3 are the binding screws for the battery wires.

**Progress of the Great Jetties.**

Captain M. O. Brown, U.S.A., Government Inspecting officer at the mouth of the South Pass of the Mississippi, has made a survey which shows a twenty-two foot channel over two hundred feet wide, entirely through the works; and a practicable channel with a least depth of twenty-three feet. This entitles Captain Eads to the second payment of \$500,000. The Secretary of War will have a survey made by a special board of engineers before making the payment.

**LOVEGROVE'S TWO-HORSE POWER ENGINE.**

We illustrate herewith a small two horse power engine and boiler which the manufacturers claim possesses all the qualities of durability, good design, and economy of fuel.



The cylinder is of the ordinary three-ported construction, and the steam chest is cast upon the cylinder. The piston is cast iron with self-adjusting packing rings which work free. Suitable provision is made to take up lost motion wherever it is likely to occur. The bearings are long and

diameter, 3 inches face, turned for a belt. The boiler is made of the best charcoal hammered iron, has lap-welded tubes, and is tested to 200 lbs. pressure before leaving shop. It is of the vertical tubular type, 18 inches in diameter, 42 inches high, with twenty 2 inch tubes 30 inches long. It is furnished with grates, base dome, safety valve, steam gauge, water gauge, gauge cocks, blow-off cock for check, and cock between boiler and pump, complete and ready to run.

For further information address Lovegrove & Co., manufacturers, 121 South Fourth street, Philadelphia, Pa.

**New Mechanical Inventions.**

Messrs. Estavau Gorriti and Pedro Unanue, of Navarre and Guipozcoa, Spain, have patented a new Automatic Feed Water Regulator for Steam Boilers. Water chambers are arranged on the top of the boiler, which are, by suitable connections, alternately filled with water and discharged into the generator. The arrangement is such that the required quantity of water is always supplied, whether the tank is located above or below the water level. In the latter case the regulator acts as a feed pump.

A new Brick Machine, devised by Mr. R. W. Brownhill, of Walsall, England, is an improvement upon that class of apparatus in which a vertical plunger drives down the clay from the hopper into a mould. The clay is afterwards pushed to one side, and compressed into shape by steam-heated plungers actuated by cams. The brick then passes to a traveling belt for removal.

Mr. W. H. Field, of Taunton, Mass., has improved upon the Nail Plate Feeder patented by him December 14, 1875. The new features are exceedingly ingenious but cannot be clearly described without the aid of drawings. Their effect, however, is to render the machine more reliable and accurate in operation and less liable to get out of order or to need adjustment.

An excellent device for bookbinders has been invented by Mr. Carl Theene, of Minden, Germany. It is a Book-Stitching Machine, constructed on the general principle of a shuttle sewing machine, with a needle-lubricating apparatus attached to the presser bar and foot, and a continuous feed and guide arrangement that is adjustable for the different sizes and thicknesses of boilers.

In order to extract the silky Fibers from the "Pita" Leaf, Mr. Carlos de la Baquera has devised a machine, which embodies a scutching wheel of peculiar construction, and also an adjustable chute and holder. The action of the scutching blades, hackling combs, and wire brush, effectually removes the outer coating and pulp from the leaf, leaving the fibers clean and unbroken.

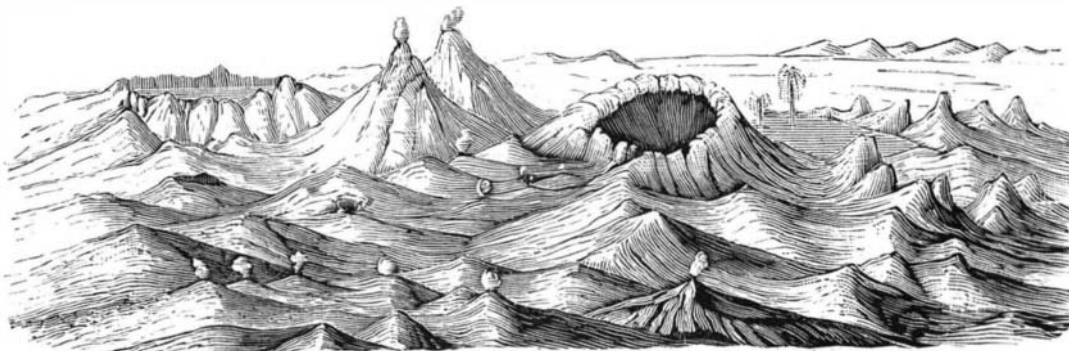
No less than thirteen new devices are embodied in the Brick Machine recently patented by Mr. Z. Vanier, of Westborough, Mass. After being placed in a hopper the clay goes to a cylinder and thence to moulds, being agitated and wedged downward by blades. Toggle devices afford the pressure, and the bricks are then carried forward and discharged by a follower, a table having risen to receive them. The entire construction is ingenious and mainly new.

Mr. Edward L. Byron, of Moes River, P. Q., Canada, has invented a new Hand Truck, the frame of which, when it is used for moving small packages, rests upon the axle. When, however, large bundles are to be carried, the frame may be easily elevated and the load thus raised above the wheels.

In a new Machine for Filing Gin Saws, patented by Mr. Patrick O'Neill, of Murfreesborough, Tenn., three-cornered files are suitably held and caused to reciprocate by a crank movement. Means are provided for moving the saw cylinder ahead, guiding the files, etc. The apparatus is an ingenious and efficient machine.

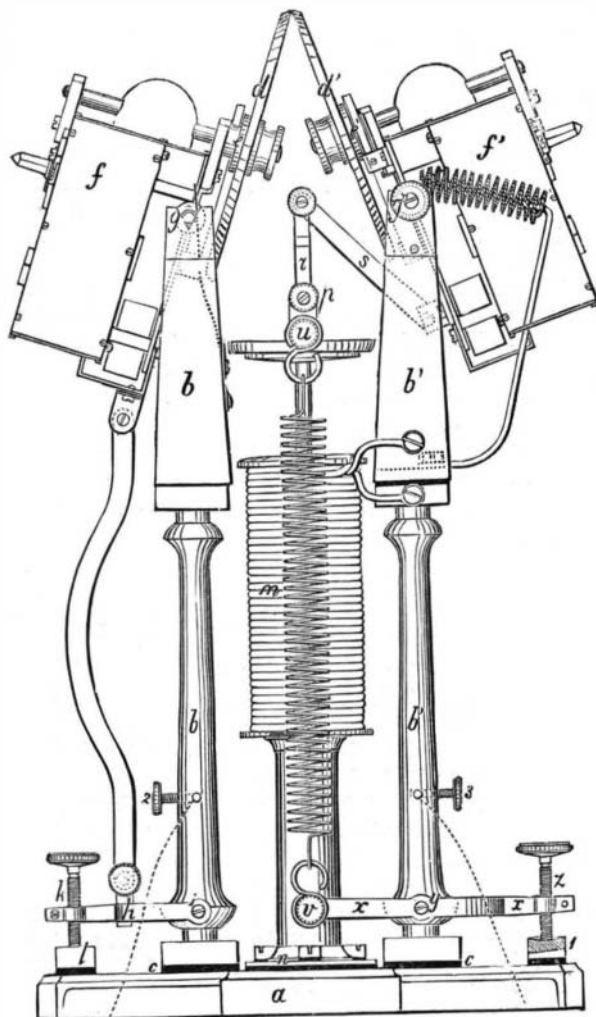
A new Windmill has been patented by Mr. John J. Reed, of Lyons, Iowa, which is so made that the wind, as it increases in force, will turn the wheel more and more aside, and finally stop it. Means for accomplishing the same end by hand are also provided. The vane may be made more or less sensitive to the wind by a simple adjustment.

Royal C. Grant, of Middleport, Ohio, has patented a Rotary Nail Machine for making cut nails. The nail plates are placed in a vertical hopper having spiral inclines for guiding them into the feed tube, by which they are held and rotated while being cut into blanks. Each plate is oscillated in a vertical plane, to change its inclination to the cutters, by means of spring bars, which press against the side edges of the plate and are oscillated by a tappet at each half revolution of the feed tube. The cutting, gripping, and heading devices are attached to a rotating cylinder, located directly beneath the tube through which the nail plate is fed, and by which it is rotated. The end of the nail plate is gripped, the blank cut off, then lowered into alignment with the header, next gripped by a die, and finally headed and released from the gripping device, and delivered from the cylinder into a suitable receptacle.



**THE COLORADO MUD VOLCANOES.**

large. The pump is connected to the shaft and is driven by a crank. It is so placed as to be accessible at all times. The base is in one piece and so constructed as to admit of belting from the fly wheel in any direction. The diameter of the cylinder is 3 inches, stroke 4 inches; fly wheel 12 inches



**THE REGNIER ELECTRIC LIGHT.**