

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.