RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

REMOVABLE RUBBER HEEL.—J. H. Dempsey, Cleveland, Ohio. The purpose of the inventor is to provide a construction for a rubber heel, which permits the easy attachment thereof to the heel of a shoe, and a removal of the rubber heel where desired, the improved features adapting the heel when mounted for service, to resist strain and prevent its accidental removal if struck against an obstacle.

Of Interest to Farmers.

PLANTER.—E. St. Aubin, Ganeer Township, Ill. The object of this invention is to provide a device for use in simultaneously planting three rows of corn, and arranged so that each of the planting devices will be at all times in engagement with the ground regardless of the inequalities in the surface thereof.

ADJUSTING DEVICE FOR GRAIN-DRILLS.—W. F. Jacobs, Okawville, Ill. The inventor's more particular object is to enable the operator to adjust the depth of the drill teeth, and consequently regulate the depth within the soil to which the seeds are carried. The invention relates to means whereby a number of related parts upon the same machine may all be moved in unison for purpose above indicated, thus saving a multiplicity of separate movements of various parts.

HARVESTER DEVICE.—W. L. Griffin, Scottville, Mich. The invention relates more particularly to apparatus used in the harvesting of potatoes and other similar produce. It provides a device by means of which potatoes can be freed from the earth adhering to them, and by means of which the cleaned tubers can be easily and rapidly filled into receptacles therefor.

COTTON-SEED SEPARATOR.—J. T. Cox, Monticello, Ga. This separator will effectively separate the large and select cotton seed from the small, faulty and undeveloped seed which should not be planted, as healthy plants cannot be grown from such poor seed and when it is intermingled with good seed, the good seed usually germinates first and impairs the development of the good plants.

CULTIVATOR.—A. Brigden, Albertville, Ala. The cultivator comprises a plurality of cultivator hoes having points adapted to till the ground, the forward parts of the hoes being attached to two cross bars arranged substantially parallel and transversely of the implement. With one of this general construction there is a tendency of the teeth of the hoes to become broken at their point of attachment to the rear cross bar, which this invention prevents.

Of General Interest.

SYRINGE.—H. F. Ong, Portland, Ore. One purpose of this invention is to provide a compact syringe, one that can be conveniently carried upon the person and one in which the piston is provided with a chamber adapted to contain medical ingedients to be dissolved in the liquid to be injected.

COLUMN, GIRDER, AND THE LIKE.—J. W. Muldoon, New York, N. Y. The invention relates to improvements in reinforced concrete construction particularly adapted to the formation of columns, girders, walls, etc., and more particularly to that type described and claimed in Mr. Muldoon's previous patent. In this type he utilizes a metallic reinforcement of such a character that it serves the double purpose of holding the concrete in position while it is hardening, and serves as a reinforcement for the concrete after it has hardened.

SAFETY WINDOW CHAIR OR PLATFORM.—J. P. Lundquist, Portland, Ore. The purpose of this invention is to provide a construction that will perfectly guard a person who occupies the same after sitting or standing, from falling off while at work outside of a window that is at an elevation from the ground, even if such person is faint or giddy.

HOISTING ATTACHMENT AND CORNICE-PROTECTOR.—J. H. Marvin, Mount Vernon, N. Y. The invention relates more particularly to a device by means of which a fall and tackle can be suspended from a cornice of a building or the like, for hoisting heavy objects, the attachment being securely in position at the roof of the building, and being so formed that no injury results to the cornice in its use.

ANIMAL-TRAP.—W. M. Kaiser, Berkeley, Cal. In this rat trap there is a receptacle around which are disposed run-ways serving as steps leading to a bait room, in which are pivoted trap doors held yieldingly substantially in horizontal position, there being an opening between the doors, and near the opening, and secured to the under side of one of the doors is a bait receptacle, holding water or acid. The trap is hooded which darkens the bait room and run-ways. At the bottom of the receptable there is a slide by which dead rats are removed.

SYRINGE.—J. R. Harris, Raton, New Mex. The syringe is for use in irrigating and cleansing the internal cavities of the body, and it consists in the construction and arrangement of a two-part syringe, with provision for separating the two members and means for introducing a double current of water and draining away the discharges.

Hardware.

DOOR-CATCH.—H. P. Connor, Englewood, N. J. In the present patent the invention relates to door catches, the inventor's more particular purpose being to produce a device of this character in which the locking of the latch has a positive relation to the pressure exerted by the door or other swinging member in opening.

SAFETY-RAZOR.—B. Kiam, New Orleans, La. One purpose of the invention is to provide a razor having a curved, flexible, detached blade and a guard to co-act with the blade and arranged to be clamped against the latter to straighten the same and thereby provide it with sufficient rigidity, and to permit its adjustment with respect to the guard.

ADJUSTABLE NUT-LOCK.—F. Young, Denver, Colo. The object here is to provide a device which can be easily arranged on a bolt to hold a nut in place, and which is so constructed that, should it be necessary, it can be constantly adjusted as the objects that are held in place by the nut become loose through wear.

MERCHANDISE-HANGER.—S. S. Weaver, Shelby, Ohio. The invention is adapted especially for displaying carpets, floor rugs, and such like articles, and is provided with nine arms, each arm supporting two floor rugs, or twenty-four samples of carpets. By tightening or loosening the nut the outer edges of the supports may be raised or lowered for use in adjusting them with respect to the bracket and to each other.

Heating and Lighting.

COMBINED LIQUID SEPARATOR AND INDICATOR FOR GAS-CONDUITS.—R. L. Dezendorf, New York, N. Y. The improvements are in means for use in separating liquids from gases and indicating when the liquid has collected to such an extent as to prevent the free passage of the gas. The invention is particularly applicable for use in the delivery conduits for illuminating gas and may be utilized at any desired point along the delivery conduit.

COKE-OVEN.—J. F. Donaghy, Charleroi, Pa. The invention is an improvement in coke ovens and particularly in the means for closing the ends of the oven. After the oven is charged and the doors closed, the opening between the upper edges of the top doors and the crown of the oven arch may be filled in as usual, the doors supporting such filling when the latter is applied.

Household Utilities.

CURTAIN-POLE.—J. B. Phinney, Tampa, Fla. In this case the invention is an improved curtain pole which is made telescopic and provided with a screw clamp whereby it is adapted to be secured to window frames of different widths, without the aid of screws, nails, or brackets, which are usually employed for the purpose.

CURTAIN-SUPPORTER.—L. Nachmann, New York, N. Y. The invention refers to curtain supporters, the more particular purpose being to provide means for readily securing the curtain upon rings which may permanently encircle the curtain pole; the invention also making provision for stiffening the upper surface of the curtain so as to prevent the exposure of the pole and rings.

AIR-MOISTENER.—C. G. McKendrick, Monroe, N. Y. The object of this invention is to provide a moistener for use in moistening the air in the room in which the steam radiator is located, the moistener being connected with the steam chamber of the radiator and arranged to allow steam to pass into the moistener and to be diffused by the same into the surrounding air, to moisten the same.

WATER-CLOSET-SEAT PROTECTOR.—G. F. Thompson, East Orange, N. J. The invention refers to means for protecting a closet seat from soiling or other contamination, and has for its object to provide an appliance for a seat, which affords convenient means for placing and holding taut a paper covering upon the seat, and also facilitates the substitution of a clean paper sheet for the one that has been used.

Machines and Mechanical Devices.

BUNDLE WIRING MACHINE.—J. Pfeffer, Spokane, Wash. This machine is to be used in fastening together by wire, bundles of small boards, such as are used in making boxes, and for fastening together shingles into bundles, and other similar uses. It may be used in subjecting a bundle of materials to pressure in order to get the same into compact condition and to hold it while the binding wire is being applied.

CABINET.—J. W. Schauer, Kalispell, Mont. The object of this invention is to provide a device which is provided with movable shelving for retaining articles, and which has means for rotating the shelving so that the articles can be successfully brought to register with an opening through which they can be removed, whereby a small opening only is necessary.

TRANSMISSION MECHANISM.—M. Bouchet, 22 Rue Alphonse de Neuville, Paris, France. The object of the invention is a transmission movement, automatically modifying the speed of the driven member according to the force to be overcome, and serving at the same time to limit the transmitting force. The device is applicable to automobiles, and in an automobile provided with the device, the speed of the vehicle will be inversely proportioned to the resistance to be overcome.

BALING-PRESS.—J. C. Damron, Roanoke, Va. The present invention provides a machine adapted to be operated by power, such as horse-power or the like and to furnish tripping devices for automatically releasing the shifting and locking devices for the gear mechanism when the plunger reaches the end of its pressing stroke. It is an improvement on a former patent granted to Mr. Damron.

BALING-MACHINE.—C. E. McLin and J. S. Bachman, Rome, Ga. Guides are disposed on a table, some being connected through the table top by operating mechanism, a core being disposed in the ties, which are then doubled on themselves, transverse pins being secured to the upper terminals of some of the guides, between which the ties are disposed and by means of levers and links the guides disposed through the table top, are forced downwardly, pressing the ties between the pins and the table. The guides are held yieldingly upward, and held down independently of the levers and links.

Prime Movers and Their Accessories.

STEERING DEVICE FOR TRACTION-ENGINES.—A. Harrold, Lima, Ohio. Mr. Harrold's invention is an improvement in steering devices for use on traction engines. When the plate is swung in one direction, the friction wheel on one side will engage the rim, thus rotating the drum in one direction, while a reverse movement of the plate will rotate the drum in the other direction. The shaft on which the wheels are mounted is provided with a cranked portion to which are attached the piston rods of the engine in the usual manner.

Railways and Their Accessories.

TIE-BAR FOR RAILWAY-RAILS.—J. H. Crowley, Duluth, Minn. This bar is preferably in the nature of a T-iron extending crosswise of the track with its face turned upwardly and abutting underneath the base flanges of the rails, and at each side of each rail it is provided with one or more fingers engaging over the rail flanges. These fingers on the inside of the rails prevent the rails from turning outwardly and the other pins insure that no spreading of the rails will take place.

DROP-DOOR STRUCTURE FOR CARS.—F. W. Bradley, McKees Rocks, Pa. The more particular object here is to provide a car body with swinging doors, that under certain conditions, when closed, the doors are by their own weight and by the weight of materials resting upon them, forced toward each other and thus prevented from opening, said doors being locked in this position to prevent their receding from each other in order to open, and also being locked independently of their pressure against each other.

Pertaining to Recreation.

AMUSEMENT-STEPS.—J. H. Cross, Philadelphia, Pa. The apparatus is in the nature of steps, certain of which are adapted to sustain the weight of a person, and others designed to sink under slight pressure. These two types of steps, which are termed firm steps and yielding steps, are arranged in sections, and so distributed in a stairway that the same cannot be traversed or climbed over without taking a circuitous route, which route is adapted to be changed by the unlocking or locking of certain of the yielding steps.

FISH-HOOK.—C. M. Willis, Austin, Texas. The invention refers to a hook wherein duplicate hooks are provided that are spaced apart by the pull of a fish on the line. The improvement adapts the hook for reliable service, and positively insures the divergence of the hook members upon the application of draft strain.

AMUSEMENT APPARATUS.—B. J. Sagehomme, New York, N. Y. The invention may be defined as consisting of tracks, each track composed of a series of reverse curves regularly arranged about a common central axis, with the tracks intersecting at the points of change of curvature, and the sets of cars simultaneously movable over the tracks in opposite directions.

Pertaining to Vehicles.

SLEIGH-RUNNER.—W. E. Turner, Escanaba, Mich. The runners are in the nature of I-beams, each having a knee applied thereto provided with opposed jaws, with the beam of the sleigh provided with approximately semi-circular grooves near each end and at both sides, receiving the jaws of the respective knees, which admit of a slight relative endwise movement of the runners and thus relieve the connections of the bench of undue shock.

Designs.

DESIGN FOR A PLATE OR PLATTER.—L. Rouquart, New York, N. Y. This ornamental design shows a circular form of plate. The rim rises from the bottom of the plate slightly fluted up to near the edge which latter is embellished with a scroll border of beautiful design.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12025) J. L. asks: Kindly state in your paper what meerschaum is, and if it was ever sea foam in any form? A. Meerschaum is a hydrated silicate of magnesia which occurs in veins and nodules, principally in Asia Minor. It has nothing whatever to do with the sea as regards its formation, and owes its name to an imaginary resemblance of some of the nodules in which it occurs to sea foam. It is occasionally found floating in the Black Sea, freed from its matrix, being lighter than water, which may be a further derivation of its name.

(12026) J. H. asks: What is the consensus of authority and scientific opinion on the true value and usefulness of lightning rods as a means of protecting buildings from strokes of lightning? Do they afford real protection? Are they worth what they cost, in preventing fire? Doubtless you know how opinions differ on this subject. Many people declare that lightning rods are worse than useless; they actually invite danger. Others contend that they are as necessary as fire insurance in every well-regulated establishment. A. We are of the opinion that lightning rods are a distinct advantage to a building in the open country and in thinly built portions of a city; also upon tall spires and chimneys in any part of a city. The method of protection to be employed has been many times discussed in our paper. You will find a note in the Queries column of our issue, Vol. 99, No. 16, October 17th, 1908, which you must have on file. The Weather Bureau publications named therein will be a sufficient guide to you. Lightning rods not only greatly reduce the damage to the building upon which they are used when struck by lightning, but actually decrease the liability of disruptive discharges of atmospheric electricity occurring at all when they are present in quantity. The town of Johannesburg is a notable example: electric storms were so frequent there and the resulting damage so great that nearly every building in the town was protected by lightning rods. Now lightning in the common sense of the term is most rare there, the formerly common electric storms being dissipated by brush discharges on the forest of lightning conductors.

(12027) A. K. S. asks: Take (for illustration) one cubic foot, v, of hydrogen gas at 32 deg. F., t, under a pressure, p, of one atmosphere. It will weigh, w, approximately 0.0056 of a pound. Let P remain constant and t —273 deg. C. or absolute zero. Then $V = 0$, by contraction, for nothing has been taken away excepting heat. Heat has no weight, therefore w remains 0.0056 pound, but $V = 0$, accordingly $W = 0$. What is wrong, the assumption that $V = 0$ at —273 deg. C., or that when $V = 0$, $W = 0$, or do the conditions existing in the theoretical state of absolute zero counteract one another? A. Your difficulty with absolute zero is simply a logical one. What you require is to state the conditions more clearly. The law of contraction of a gas upon which the absolute zero depends is true of gases; it is not true of liquids or of solids. So long as hydrogen is a gas it will contract in the ratio of 1/273 of its volume for a loss of 1 deg. C., but when it approaches its temperature of liquefaction it is no longer a gas but a vapor and no longer obeys Boyle's law nor the law of contraction. Neither will it do so after it liquefies. The proper statement with which to start the discussion is, if conditions remained the same, at —273 deg. C. the volume would be zero, and all heat would be gone. We do not see any contradiction in the matter excepting the pressing of the logic too far. What is true of a gas is not necessarily true of a liquid or a solid.

(12028) H. W. A. asks: 1. How many volts and amperes should a continuous current dynamo give to ignite a three-horse-power stationary gasoline engine? A. The current for electrical ignition of gas engines varies from 6 to 14 volts, and from 4 to 2 amperes. Perhaps one may go beyond these limits. You can get a good ignition dynamo from the Holtzer-Cabot Company, Boston, Mass., or from the Dayton Electrical Company, Dayton, Ohio. 2. What difference, if any, is there between the construction of a continuous-current motor and dynamo, volts and amperes the same in each machine? A. There is no electrical difference between a dynamo and a motor. Such differences as are to be seen are due to the nature of the service to be performed by each. 3. How is the gage of sheet iron arrived at? Has it any reference to the B. & S. wire gage? A. There is much confusion in the gaging of sheet metal. It may be specified in thousandths of an inch, and this is at present the best way. The American or Brown & Sharpe gage is the same for wire or for sheet metal and is sometimes used, but it differs from the U. S. standard gage which has been the legal standard for sheet metal since 1893.

(12029) C. E. P. asks: Will you kindly answer the following questions? 1. I have an induction coil of the Collins type. The core is $1\frac{1}{2}$ x 14 inches. Primary consists of two layers or sections of No. 12 D. C. C. wire. There are 200 turns. Secondary consists of 10 pounds No. 30 D. C. C. wire. The coil is supposed to give 4-inch spark. Independent interrupter is used. Can I use battery energy to operate such a coil? Please state number of cells, and the volts and amperes that are necessary. A. Try four or six good cells of bichromate battery for your coil. You may need to vary the number as the cells become exhausted, or to vary the area of plates immersed when the cells are fresh. For this purpose the plunging form of bichromate battery is best. One is given in full detail in our SUPPLEMENT No. 792, price ten cents. Next to this probably would be the Edison primary battery, of which you will require more cells; perhaps eight will answer. 2. If water has a great resistance for electricity, why is it that a wet floor conducts better than a dry one? A. The water which is on a floor is not water, but a solution of any substances which may be on the floor also. Dirty water may be a fair conductor of electricity; pure distilled water is not to be classed with conductors. Any substance which can form ions in water will increase the conductivity of the solution.

(12030) P. E. G. asks: A question has arisen, does an ox push or pull? Please give me your opinion on this question, also several reasons for same. A. The answer to your question depends entirely upon the sense of the words "push" and "pull." The ox leans against his yoke and thereby pulls forward the plow or other load attached to it; a horse can pull in no other way, i. e., only by pushing with his shoulders against his collar or breast plate. A man in an approximately vertical position can pull no more than his weight; in a tug-of-war he pulls no more than he pushes against the ground with his feet. Standing above a weight he can lift a good deal more than his own weight, but still no more than he pushes against the ground with his feet; action and reaction are equal and opposite, and there is practically no pull without a corresponding push.

(12031) J. A. C. asks: Kindly tell me whether or not helium has been liquefied. If so, when and by whom? A. The liquefaction of helium was described in the SCIENTIFIC AMERICAN, vol. 99, page 59, and in the SUPPLEMENT, vol. 66, page 186. It was liquefied by Prof. Onnes, of Leyden, Holland. To accomplish the result, gaseous helium was expanded from 200 to 40 atmospheres, having been previously reduced to about 15 deg. absolute. The temperature of the liquid was 4.5 deg. absolute. Its freezing point is below 3 deg. absolute.

(12032) A. R. asks: Suppose a boiler say 12 inches diameter by 48 inches long be filled with water, filled absolutely full, so that there would not be even an air bubble, and then a screw plug put in the opening so that the water would be compressed (if such is possible), and under such condition there would be no room for steam? The boiler is supposed to have stood a test of 300 pounds to the inch. Now a fire is built under the boiler, and the water reaches the boiling point (212 deg). Can it be made hotter, there being no room for steam? What would be the result? A. The force exerted by the expansion of water due to heat in a boiler under the conditions you describe would be enormous, being equal to that which would be required to bring the expanded liquid back to its original volume. Water expands 0.00043 of its volume in being heated from 212 deg. to 213 deg.; it is almost incompressible, being compressed only 0.0000036 of its volume for every pound of pressure. The pressure would therefore be increased by nearly 117 pounds for every degree through which the temperature was raised, neglecting expansion of the boiler.

(12033) Seattle asks: What is the longest board, one foot wide and sawed off square at each end, that can be put on the floor of a room 10 feet long and 8 feet wide? A. Your problem is one partly of geometry and partly of arithmetic. The longest line which can be drawn in a 10 x 8-foot room is the diagonal, the length of which is the square root of the sum of the squares of the sides = $\sqrt{10^2+8^2}=\sqrt{164}=12.8=12$ feet $9\frac{5}{8}$ inches nearly (9 39/64 inches). The ends of the board being cut off square, the length of the board will be shorter than the above by the height of a small triangle at the two opposite corners of the room. That triangle is similar to the triangles into which the diagonal divides the room, two of its sides being the same lines and its hypotenuse being at right angles to theirs. Its hypotenuse is the end of the board, 12 inches long, and one side. One angle and the proportions of the other sides and angles being known, the length of its other sides can be computed. So can the length of a perpendicular dropped from its right angle onto its hypotenuse, and this perpendicular is the amount by which the longest board which can be laid in the room is shorter at each end than the diagonal. The length of that perpendicular for your case is nearly $5\frac{3}{4}$ inches; so that the longest board 12 inches wide with square ends which can be laid diagonally across a 10 x 8-foot room is therefore 12 feet $9\frac{5}{8}$ inches — $11\frac{1}{2}$ inches = 11 feet $10\frac{1}{8}$ inches. [As you do not give your name, we can only reply through this column.—ED.]

(12034) N. T. W. asks: Do you publish a SUPPLEMENT giving instructions for rewinding the dynamo described in SUPPLEMENT No. 600, or rewinding the armature, so that it will develop a current of 110 or 115 volts? If so, I would like to secure it; and if not, I would like to be advised concerning the practicability of doing this. A. If you wish to alter or modify the dynamo of SUPPLEMENT No. 600, you had better get the SCIENTIFIC AMERICAN, vol. 85, Nos. 1 and 7, price ten cents each, and take note of Queries 8250 and 8316, in which you will find how others have made alterations which are improvements in the machine. The wooden sleeve on the shaft and the paper washers are a very decided disadvantage to the generating power of the machine. They were in general use when the machine was designed, but have been abandoned long ago. The winding data for 110 volts with the core and field, as in the SUPPLEMENT No. 600, are as follows: Field of No. 23, cotton-covered magnet wire, 3,640 turns, about 14 pounds; armature, No. 22 wire, 24 coils of 25 turns each. A field resistance of about 200 ohms will be required.

(12035) C. C. C. asks: Will you please decide this argument? Does the steam going into the cylinder of a locomotive engine when it is going forward drive the piston back? I claim it drives the engine ahead by forcing up against the cylinder. On a stationary engine the steam drives the piston forward and back, but not on a locomotive when it is going ahead. I claim the motion of a piston on a locomotive is only forward when the engine moves forward, making the piston apparently stand still, then the piston shoots forward again, and so on. A. The steam pressure in a locomotive cylinder acts equally upon the head and upon the piston, but the piston moves relatively to the engine, whereas the cylinder head does not. It is true that if the length of the stroke is less than the hemi-circumference of the driver (which it almost invariably is) the piston never moves backward relatively to the rails when the engine moves forward, but it moves relatively to the engine. The common argument as to whether a locomotive piston moves backward or not is entirely a question of whether the motion is relative to the engine or to the rails, but your view is not completely correct in either case. If the engine were pushed forward by the pressure of the steam against the cylinder head as you suggest, without motion of the piston relatively to the rails, the engine would go forward by the length of one stroke of the piston if the throttle were opened at the beginning of the backward stroke while the drive wheel was fastened down to the rail, which is of course impossible.

(12036) A. E. H. asks: I am interested in electroplating flowers, etc., and have had considerable success in coppering and silvering, using no wax. Now I want to permanently color these copper flowers various shades. 1. Would dyes dissolved in clear shellac or other varnish be practicable? A. Copper may be coated with any desired color of lacquer and so given a luster and finish. All sorts of lacquers are described in the "Scientific American Cyclopedia of Receipts," which we will send for \$5. 2. How can I oxidize copper quickly? A. Copper and brass are oxidized by the same methods, since it is chiefly the copper in the brass which gives the color to the oxidized brass. A great many methods are to be found in the "Cyclopedia of Receipts." One formula is 2 ounces nitrate of iron and 2 ounces hyposulphite of soda in a pint of water. Dip till the desired color is produced, wash, dry, and burnish. 3. What colors can I simply get on copper chemically? A. Anything from green to black may be produced upon copper by chemical action. 4. Can I oxidize clean copper in oxygen to get the deep copper red, or would some chemical solution be better? I have formulæ for coloring brass, but not for copper. A. You cannot oxidize copper by the direct action of oxygen in the form of a gas. Oxygen acts with extreme slowness upon copper in the air. 5. How is the coloring done on the jewelers' hat-pin roses? A. Articles of copper are colored by some one of the processes referred to above. We doubt that any new or secret ways of doing this work are known. 6. Kindly suggest all the coloring processes you can. I hope this may interest your readers of Notes and Queries. A. We cannot write out receipts which are already in print in our book, which we sell. It would cost more for us to get them copied than the book will cost you.

(12037) H. R. T. asks: 1. How much loss is there in compressing air to lift water from artesian or deep well, say with a lift of 40 to 80 feet, over raising it direct with a centrifugal pump of best designs? A. The losses in pumping with compressed air vary considerably with conditions, principally depth and consequent air pressure required. but as there is already a loss in converting steam or other power into compressed air power, there should be a saving in applying the same power directly to pumps. 2. Is a centrifugal pump as economical as a plunger pump for raising water from 40 to 80 feet in large quantities for irrigation purposes? A. The efficiency of centrifugal pumps is generally higher than that of plunger pumps, that is to say, direct-acting steam plunger pumps, which we suppose you mean, especially where conditions facilitate condensation in the steam pipes leading to the pump. The only disadvantage of centrifugal pumps is the difficulty of maintaining the proper alignment of their shafts when the latter are vertical and of great length. If properly set up and carefully watched they are very efficient, and for such a lift as you mention they should not present the above difficulties. 3. In raising water with any pump, how large should the delivery pipe be to deliver 2,000 gallons per minute say 50 feet vertical? A. The larger the discharge pipe, the easier the work for the pump; for 2,000 gallons a minute the discharge should not be less than 8 inches, and had better be 10 inches. 4. How fast should water be moved through pipes to do it in the right or most economical way? A. The speed of the water through the pipe for a given quantity discharged varies inversely as the square of the diameter, i. e., 2,000 gallons per minute discharging through a 12-inch pipe would have to travel four times as fast to be discharged through a 6-inch pipe. Beyond a speed of 400 feet per minute friction increases rapidly. 5. Would it be economical to put in an electric plant and transmit the power about ten miles and pump wells against a single plant for each well? These wells would be run about three months each year, and my idea is to install a steam plant on the railroad and generate a current and use a motor of about 12 to 20 horse-power at each well. There would be at least a hundred wells I could pump, and each well waters one hundred acres of land, and the owners would pay \$5 per acre per year for this work. A. For such a system of well pumps as you describe, a central station distributing electric power to each well would be much cheaper than an individual power plant for each well in first cost of installation, and you would effect a much greater economy in cost of operation by the former means. Large boilers are always more efficient than small, other things being equal, and the economy in fuel alone of generating the total power required at one central station as compared with its generation at one hundred individual stations would go far toward paying for the plant in the first year. Centrifugal pumps, efficient for the depths you mention, are admirably suited for being driven electrically, and by means of high-voltage alternating current (locally transformed by simple automatic apparatus to a safe low voltage if desired) you can distribute any quantity of power over a radius of 10 miles with almost no loss and comparatively low first cost of conductors. 6. Please give me your opinion on this and the raising water problem and oblige me very much. A. One hundred wells watering 100 acres each at \$5 an acre—\$50,000—sounds like a very remunerative investment. If you have not already done so, we should advise your having made a pulsometer test of the capacity of the various wells before guaranteeing a delivery of 2,000 gallons per minute from them.

(12038) P. R. F. asks: To decide an argument, will you kindly answer the following question through the columns of your paper? Will a perfectly solid or solidified chunk of lead, of its own weight, reach bottom of the ocean at the deepest depth? A. It is very commonly supposed that at great depths in the sea iron ships and similar weights sink no farther because of the pressure, and no superstition is more erroneous. The pressure at great depths is enormous, but water is so nearly incompressible that its density increases almost not at all. At a depth of one mile the density of water is increased less than one per cent, and lead is more than ten times as heavy as water of that density. If a well could be sunk to the center of the earth and filled with water, your piece of lead would go to the bottom with no appreciable diminution of the rate at which it sinks in 10 feet of water by acceleration due to gravity. Further than that, there is no conceivable depth at which lead (or iron or any high specific gravity material) would not sink in water, because it is as compressible as the water or more so, and its density would be proportionately increased.

(12039) J. M. M. asks: Tests made in a furnace-heated house show the air to be dry. A simple hygrometer was used, possibly not very accurate, but near enough for the purpose. The instrument used shows the variations in moisture by the coiling and uncoiling of a spiral formed of some substance easily affected by dampness. A pointer attached moves on a scale, which is intended to indicate the percentage of moisture in the air, and is divided as follows: 100 full saturation, 80 moist, 65 normal, 40 dry, 20 very dry, 0 absolutely dry. In the trials referred to, on a mild day with considerable moisture in the outside air, the pointer would remain about 20 or 25. On a cold dry day, when a brisk fire was needed, it would go to 0. The air from outside, already at a low moisture point in cold clear weather, is by passing through the furnace raised in temperature from 40 to 60 degrees, or more, with no opportunity of taking up the water it would naturally contain at the higher temperature. By many persons such extreme dryness, combined with high temperature, is thought to be detrimental to health, causing colds, throat troubles, etc. One noticeable effect is that a much higher temperature is needed to produce a comfortable feeling of warmth, than would otherwise be required. With plenty of moisture a room will feel comfortable fully ten degrees lower than with very dry air. The small water tanks sometimes attached to furnaces seem to have slight if any effect, not sufficient moisture being taken up by the moving current of air to produce any noticeable difference on the hygrometer. One point in favor of the furnace, however, is that it brings into the house a constant supply of fresh air. A. We published a valuable series of articles on this subject in SUPPLEMENT Nos. 325, 6, 7, 8, 9. a shorter article devoted more especially to hot-air heating in No. 213, and another on healthful temperature and humidity in No. 1337, with reference to schools, where of course the conditions for growing children are most important. There is nothing unwholesome in dry air, *per se*; you hit the nail on the head when you speak of the air *feeling* warmer with more moisture. The unwholesome part of dry air is that it is not so sensibly hot, and that consequently people remain in a temperature much higher than they are conscious of, and are more liable to chill by change of temperature on going out, The air will always have a natural and therefore healthful amount of moisture if the fresh air duct to the furnace is properly proportioned and kept wide open. The trouble is that many persons think they are not getting enough heat unless the air coming from the "register" (a senseless term, but commonly used) is sensibly hot, and close up the fresh-air duct, thereby restricting the inflow of naturally moist air, so that what is delivered to the rooms is unduly dried. The air will not rise in the pipes at all unless it is warmer than that of the rooms, which is to say sufficiently warm (except in the rare case of a strong wind blowing directly into the fresh-air intake) and the simple practical way to provide sufficient moisture for health is to have an amply large fresh-air intake open to the south or southwest side of the house and to keep it wide open. We cannot express an opinion as to the best system, as circumstances alter cases and the systems are many and various.

(12040) A. S. L. writes: During the snowstorm of last Sunday, the thermometer ranging from 10 deg. to 12 deg. F. above, the snow changed to hail, and rain also fell at this temperature. Notwithstanding that this appears contrary to nature's laws, it is a fact that can be attested to by witnesses that rain fell with the temperature from 10 deg. to 12 deg. F. A. The falling of rain when the thermometer was below freezing showed that the temperature of the cloud above the earth from which the rain came was higher than the freezing point. Hail is frozen rain drops and not crystallized frozen moisture, as are snow flakes. Hail probably started from the cloud as rain and froze in the air. When it is warmer at a higher point in the air, it is called an inversion of temperature. For examples see Davis's "Meteorology," which we send for \$2.50.

(12041) B. M. asks: A certain problem is now confronting me, and in a last effort I appeal to you for information. I am about to build a handsome theater to be known as the "Aquarium." On either side of the lobby will be two large glass tanks containing fish of all descriptions. I would like to devote one to deep-sea or salt-water fish, and there is the obstacle of the salt water; and the information I would like to obtain is, will they live in artificially-made salt water? If they will, what should be the proportion of sea salt to water? I have been told that at St. Louis during the Exhibition they had a large collection of deep-sea fish in tanks. How did they get the salt water? A. The experiment of using artificial sea water has been tried in the government aquarium controlled by the Fish Commission, in Washington, D. C., but without success. The best Turk Island salt was employed, and great care was taken that the artificial water should have the same density or degree of saltness as sea water itself. The fish did not thrive, and some valuable ones were lost. It is not known what element sea water possesses that the artificial water lacks, but the result indicates that some necessary element is not crystallized into the salt. Since that test, the Fish Commission has used natural sea water, which was brought from the ocean in tanks. A circulating pump is used, by which the water is continually being taken out of, and forced back into, the tank, passing on the way through a filter which removes the foreign matter and makes the water pure and clear. Air is required to be forced in continually. This is done in two ways. One method is to allow a small stream of water to fall from a height of a few feet, say two to four or five feet, and, in entering the tank, the falling stream carries with it considerable air. This, however, is not generally enough, and artificial aeration is produced by forcing a current of air into the bottom of the tanks through a finely apertured nozzle. For this purpose, a plug of some form of porous wood, such as rattan, is employed, the plug being inserted in the mouth of the air pipe where it enters the tank. You will of course be able to obtain natural sea water without difficulty, and by a circulating pump and an air pump you will easily be able to preserve fish. Since, however, a considerable expense is incurred in purchasing and using an air pump, we suggest that it is possible an efficient substitute might be provided by introducing a series of small pipes into the current of water that is circulated through the tanks, particularly if at some point the current be sent through a single pipe of quite small diameter, so that the current will have a considerable velocity. By curving the ends or nozzles of the small air pipes so that they will lie in the direction of flow of the current, air would be drawn in, and would of course mingle with the water flowing through the tank. We make this as a suggestion simply.

(12042) H. A. E. asks: Will you please tell me the meaning of gage in wire and sheet metal, as 14 gage, 22 gage, etc.? Also the meaning of 10 ounces, 14 ounces, 20 ounces, etc., in regard to sheet copper? A. There is in this country no uniform or standard gage, the same numbers representing different thicknesses of wire or plate in different gages, of which the commonest are the American or Brown & Sharpe (B. & S.), the Roebling or Washburn & Moen, the Birmingham (B.W.G.), and the British Imperial Standard. In 1893 a United States standard gage for iron and steel was established by act of Congress, based on the fact that a cubic foot of iron weighs 480 pounds, a sheet 1 foot square and an inch thick weighing 40 pounds, or 640 ounces, so that a sheet of that size weighing one ounce should be 1/640 of an inch thick, the distinguishing numbers representing a certain number of ounces in weight per square foot and the same number of 640ths of an inch in thickness. Unfortunately, however, there is only an arbitrary relation between the gage numbers and the thicknesses; thus, No. 16 gage sheet weighs 40 ounces to the foot and is 40/640 thick, which happens to be 1/16, but No. 5 gage weighs 140 ounces to the square foot and is 140/640 or 7/32 inch thick, which has no relation to 5, and No. 31 gage, 7 ounces to the foot and 7/640 thick, has no relation to 31. This well-intended measure only added to the existing confusion, although it differs but little from previously existing gages, as shown by the following figures, the thickness of a sheet or wire corresponding to the same number by the different gages being shown in decimals of an inch.

Gage.	B.W.G.	B. & S.	Roebling.	British.	U. S. Standard.
1	0.3	0.289	0.283	0.3	0.281
3	0.259	0.229	0.244	0.252	0.25
9	0.148	0.114	0.148	0.144	0.156
20	0.035	0.031	0.035	0.036	0.037

A joint committee of the American Society of Mechanical Engineers and the Railway Master Mechanics' Association recommends, as a remedy to the existing confusion, the adoption of a decimal gage in which "0.25 gage" can mean nothing but a thickness of 25/1,00 or 1/4 of an inch, and "0.06 gage" nothing but 6/1,00 of an inch, or 1/16 nearly. This has already been adopted by many manufacturers.

(12043) J. S. asks: Is it possible for the temperature to be twice, or any number of times, as warm or cold as any specified degree of temperature? Can this be measured or computed? For instance, how cold is twice as cold as 0 deg. F.? A. In terms of degrees of the Fahrenheit or any other scale, reckoning from the zero point, the question has no answer and no meaning whatever. Degrees of the scale of any thermometer are not to be compared by multiplication or division, excepting those of the absolute scale. This is reckoned from the absolute zero, which is 459 deg. below the Fahrenheit zero. Half as hot as 0 deg. is then — 229.5 deg. absolute F.

(12044) A. T. G. A. writes: In your issue of October 3rd, 1908, T. B., No. 10867, asks why the days and nights are not equal on the days the sun crosses the celestial equator. I have for many years been impressed with the care, patience, and directness of your answers to the many inquiries. It has been the most interesting column of the paper to me. In this one particular case, however, may I suggest you do not include the main reason for the discrepancy? In some almanacs the time of sunrise and sunset is computed for the instant the first glimpse (or the last) of the sun's disk would be seen on the true horizon. Allowance is made for the semi-diameter of the sun and for the refraction of the atmosphere. This would cause the sun to appear a few minutes earlier in the morning and to be seen a few minutes longer in the evening, making the day (sometimes) 8 or 9 minutes longer than it would otherwise be. When this happens during the time of lengthening days (as in March) it would cause the equal days and nights to come earlier, and to come later in September. The matter of semi-diameter and refraction is not taken into account by all almanac computers, some giving the moment when the center of the sun would be on the horizon if there were no atmosphere. In such almanacs the equal days and nights come exactly on the days of spring and autumnal equinox, but only theoretically so. The equation of time would have the effect only of transferring the time of both sunrise and sunset earlier or later, as the case might be, and so would have no effect upon the length of the time of daylight. There would, of course, be a slight effect due to the change in the equation of time between sunrise and sunset, but that would scarcely amount to as much as one minute. Pardon my "butting in" in this matter. My appreciation of the uniform accuracy of your answers in all other cases causes me to feel you will understand the spirit in which this correction is sent. A. We appreciate the substance as well as the spirit of the correction. Our readers will find this matter fully discussed in Todd's New Astronomy, under the topic "Sunrise and Sunset." We send the book for $1.50 postpaid. An almanac should give the moment when the last ray of the sun is seen on the horizon as the time of sunset, and the first ray as the time of sunrise. What all almanacs do give we are not able to say.

(12045) S. B. asks: Will you kindly inform me through the columns of the Scientific American what the corrosive and electrical resistance of aluminium is, as compared to brass, copper, and tin? A. The specific electrical resistance of the metals you name is as follows: Aluminium 2.98, copper 1.59, tin 13.1, and brass, containing 66 parts copper and 34 parts tin, is 6.3. If you wish to have the data more exactly, we would refer you to Foster's "Electrical Engineer's Pocket Book," pages 134 to 140. We send the book for $5. If by "corrosive resistance" you mean the resistance to the action of acids, etc., we would say that aluminium is acted upon more slowly than any of the others by most chemicals, and tin would be placed next to aluminium, while copper would probably be acted upon more than brass for the above reason by most corrosive chemicals. No figures can be given for any general statement of this sort. Figures would differ for each chemical tested.

(12046) Dr. V. D. B. asks: Will you kindly let me know who was the first engineer that introduced structural steel in the construction of buildings? A. We should say that it would be most difficult, if possible, to answer your question positively. If you refer strictly to steel in the technical sense, its use must be comparatively modern, but the transition from iron to steel in buildings must have been as gradual as it is vaguely defined in manufacture of the metal. There are many iron bridges in Europe more than a century old, one of the oldest being that over the Severn, built in 1776. Possibly you do not use the term "buildings" in a sense to include bridges, but iron could hardly have been used for such a purpose long before its introduction in roof trusses for large spans. That use was commonplace before the introduction of railways, the earliest termini in Europe being so roofed, and we should say that the use of iron imbedded in or in conjunction with masonry would date back a century or more. An article in one of our early Supplements, May 12th, 1877, abstracted from a paper read before one of the engineering societies, refers to the imbedding of iron in masonry as "too old to be patented," even then, which means that it must be more than a century old.

(12047) L. E. B. says: There seems to be a common belief among barbers that a razor after much usage becomes tired. That is, the razor will not keep in condition with the care usually given it. After it is laid away to rest it seems to become all right again. If this is true, what are the causes, and is there any remedy besides the rest cure? A. The only scientific explanation of the benefit of "rest cure" for razors is that honing, and more particularly constant stropping, tend to increase the smoothness of the edge; and whereas this is an advantage within certain limits, the best cutting edge of a razor looks under a microscope like a saw, the better the steel and the edge the more regular the "teeth," and in correct shaving the operation is that of sawing and not slicing off the hairs. However carefully a razor may be dried before putting it away, a certain amount of oxidation takes place, and this in the case of a good razor of homogeneous steel should tend to deepen the "teeth," just as a barrel hoop with an edge one-eighth of an inch thick may by exposure to the weather become so sharpened as to saw wood. This natural process could probably be imitated more rapidly by the action of acids.

(12048) E. K. asks: Would you please inform me which wheels have the tendency to rise off the ground when an automobile is rounding a curve at high speed? The principle is the same on trains, carriages, and trolley cars, is it not? A. When an automobile or any other vehicle is turned sharply in one direction, its momentum tends to carry it straight on. If its speed is sufficient and its front wheels are turned sufficiently sharply, it will turn over on its right side in rounding a curve to the left, the left or inside wheels therefore leaving the ground first. This is readily demonstrated by the fact that the tendency to go straight on or turn over in railroad trains is corrected by the super-elevation of the *outer rail*, throwing the center of gravity nearer to the inner wheels, to keep them down and counteract their tendency to rise.

(12049) R. A. asks: Will you be so kind as to furnish the information as to what number of degrees Fahrenheit is required in the surrounding temperature to cause ice to melt? A. Ice begins to melt the moment the temperature of the surrounding atmosphere rises above 32 deg. F. The reason ice melts so slowly is that it requires more heat units (transferred from the surrounding atmosphere or somehow) to melt ice at 32 deg. to water at 32 deg. than it does to raise the same quantity of water through 1 deg. of temperature, on account of what is called the latent heat of fusion, but that does not affect the temperature at which fusion commences.

(12050) F. A. J. asks: In a Supplement for May, 1908, you had a design for small alternating current motor, and I have found it very simple in all but one thing, which is the inductors for the rotor core plate. I do not quite understand if the No. 4 wire which you give for the inductors should be peeled of the entire insulation and laid in without insulation or with the insulation left on the wire. Kindly let me know which is the correct way. A. The inductors in the rotor of the motor of Supplement No. 1688 are not made of insulated wire. The holes into which they are put are drilled with a drill 0.213 inch in diameter, and the No. 4 wire is 0.204 inch in diameter. There is no room for insulation unless, as the article says, thin paper is used and glued upon the wire. The wire is bare copper wire. If you refer us to a phrase in a long article like this, you should do so by page and column and part of column, so as to save our time in reading the entire article till we come to the part in question. It is a mistake to suppose that the editor knows all the articles which have been in the paper in all the past. He must find the matter of the inquiry and consider it before he can answer the inquiry. This often takes much time; and if correspondents can save us time they ought surely to do so, since our work is entirely in their interest and is not directly a source of profit to the editor or the paper.

(12051) B. B. M. asks: Will you please inform me what purpose the brushes serve in the Wimshurst electrical machine? That is, whether the brushes cause friction or act as inductors to carry the electricity. A. The rods with brushes at their ends upon the Wimshurst machine act by induction. Suppose a charge upon one of the tinfoil sectors acts inductively upon the sector of the other plate, which happens to be opposite it at the moment and in contact with one of the brushes. That sector and the brush in contact with it will become charged oppositely to the sector, which acts inductively upon it, and the other end of the rod, its brush, and the sector in contact with it will become charged similarly to the sector on the other plate. This action takes place upon each pair of opposite sectors of both plates as they rapidly pass each other. Thus the charge upon the sectors is rapidly built up. You will find a good description of the action of the influence machines in Carhart's "University Physics," vol. 2, which we can send you for $1.50.

(12052) R. H. T. asks: Can you tell me to what extent common water has ever been compressed? A. Pure water is compressed by a pressure of 15 pounds per square inch at the temperature of its freezing point 0.0000503 of its volume. The amount of its compression at various temperatures is given in a table in the book called "Smithsonian Physical Tables," page 83, to which we would refer you. It can doubtless be found in the library of the Polytechnic in your city.

(12053) M. M. asks: 1. Do you know of a London firm which offers a large sum to any one who will invent a method of dispelling fogs? A. We do not know any offer of a prize for a fog-dispelling device. The electrical apparatus of Sir Oliver Lodge has been entirely successful in dispelling fog over small areas, but the large first cost of equipment has prevented its general adoption for larger areas hitherto. 2. I have an idea on which I should like to have your opinion. If the X-ray will show objects through opaque flesh, why cannot it be made powerful enough to show objects through opaque fog? A. The statement that X-rays show opaque objects through the flesh is not quite correct. X-rays cast the shadows of bones, etc., upon a substance which the rays also cause to glow with light. These shadows are thus made visible by the light around them. The eyes are in the dark box of the fluoroscope, and do not see any object but the luminous fluorescent surface of the screen. People commonly say they see the bones, but they do not see anything but a shadow of a bone cast upon the screen. Our eyes cannot see X-rays. They do not affect the optic nerve, and do not excite the sense of vision in any manner whatever.

(12054) J. C. asks: I. If a disk of iron or steel be magnetized, how will the poles be located? The disk is 1/8 of an inch thick and 4 inches in diameter. A. If a steel disk is magnetized, drawing it over a magnet, its poles will be at the opposite ends of a diameter of the disk, near the edges of the disk. If it is magnetized by placing it flatwise between the opposite poles of a pair of magnets, it may be magnetized so that one face of the disk shall be north and the other will be south. 2. Also which will make the most powerful magnet—an iron or a steel disk? A. An iron disk cannot be made into a permanent magnet of any degree of strength. Only steel can be strongly magnetized permanently. 3. I suppose that in an ordinary compass the end of the needle which points north is the south pole of the magnetic needle of the compass. Is this correct? A. Do not confuse yourself about the names of the poles of magnets. In America it is well-nigh universal to call the end of a compass needle which points north, the north pole, and the end which points south, the south pole. This has nothing to do with the kind of magnetism which is resident in the poles; it simply tells the direction the ends of the needle assume when it comes to rest. We also name the ends of all the magnets in the same manner. A pole like the north end of a compass we call the north pole. 4. There is a power located in the north direction which attracts one end of the needle of the compass. Is there any such power located in the south direction which attracts the other end? A. The earth acts as if it were a huge magnet, with a pole in the northern hemisphere, and one of opposite nature in the southern hemisphere, as a general statement. It is impossible form a single magnet pole. The having of a positive pole involves the necessity of having an equal negative pole. One pole cannot exist alone, so far as we are able to control the matter on the earth. The nature of the magnetism in the north magnetic pole of the earth is the opposite of that of a compass needle which is directed toward the north on the earth. That is all it is necessary to say. If we call the north pole of a bar magnet or a compass needle plus, as we do call it, we must say that the magnetism of the earth is negative at its north pole, and positive at its south magnetic pole.

NEW BOOKS, ETC.

Accurate Tool Work. By C. L. Goodrich and F. A. Stanley. New York: Hill Publishing Company, 1908. Pp. 200; fully illustrated with photographs.

This work produced in the excellent style of the Hill Publishing Company, is conformable with the Hill Kink Books except in the matter of size and arranging the same sort of useful information more in the form of a continued treatise. The developments referred to in a preceding review have increased the importance of the tool-maker's art and also caused the application to many industrial machine shops in order to obtain interchangeability of parts the extreme accuracy, delicacy of finish, and the processes for obtaining them which were formerly used only in watchmaking. Jigs, master plates, and refined test indicators are more and more commonly used, and even the compound microscope with the adjustable cross-hairs arranged as a profile gage for screw threads. The uses of all of these are carefully described and the book, which is admirably illustrated with clear photographs and diagrams, should be as valuable to the practical man as it is interesting to the amateur, the development of these particular refinements having been so rapid that there is practically no literature on the subject. A chapter on trigonometry in the tool room assuages the fears of the non-mathematical workman by the claim that it contains neither equation nor Greek letter, and the practical nature of the work is assured by the fact that the first-named of the authors is a department foreman for the Pratt & Whitney Company.

Modern Power Gas Producer Practice and Application. By Horace Allen. New York: D. Van Nostrand Company, 1908. Pp. 326; 136 illustrations. Price, $2.50.

The author's aim has been to describe the practical commercial types of products and their application so far as they have been developed while defining briefly the ruling principles of the gasification of fuel which govern design. The result is a compact and complete work of reference for the investigator and the practical operator of gas producer plants, if, perhaps, a little condensed at the expense of clearness in places for the interested amateur. Many of the economies shown by the substitutions of producer gas for steam plants in industrial works are very remarkable. The figures given for corresponding economies in weight and space occupied per horse-power for marine engines are not so large as some recent claims have contended, but in fuel economy alone, i. e., in the greater distance run for a given quantity of fuel, the results more than warrant the growing attention to this method of ship propulsion. The author gives a brief chemical analysis of fuel and gas necessary for intelligent study of the operation of gas plants and of the direct determination of the heating value of fuels by calorimeter tests. A useful chapter is also added describing briefly all the patents issued on producer gas accessories from which investigators can see in how far their work is overlapping that of others.

Freehand and Perspective Drawing. By H. E. Everett and W. H. Lawrence. Chicago: American School of Correspondence, 1909. 8vo.; pp. 125; ill. Price, $1.

This volume, like the rest of the series of the Correspondence School, is intended especially for self-instruction and home study, and it appears on the whole to fulfill this requirement although its "foreword" applies rather obviously to the series in general rather than to this work in particular. The opening paragraphs on drawing, while beautifully put and in no way too technical, are probably a little beyond the depth of the class of students for which the correspondence school is primarily intended, but the instruction itself is perfectly clear and sound, and also has the merit of being original. The author of the first part has wisely adopted the freehand perspective exercises of A. R. Cross, which could hardly be improved upon. The explanations of perspective are as clear as possible to anyone who is familiar with descriptive geometry, but might perhaps have been expressed in terms a little simpler for the benefit of those who are not. To the careful student there is, however, in