RECENTLY PATENTED INVENTIONS.

Electrical Devices.

INSULATOR.—L. STEINBERGER, New York, N. Y. The essential features of Mr. Steinberger's invention comprise an insulator provided with a body portion having a large superficial insulating-surface, great strength, and improved and novel means for securing it in position upon a switchboard, wall, floor, or other supporting member. It relates to insulators for electric conductors of the type especially adapted for supporting conductors carrying high-tension currents.

ELECTRIC MOTOR. — D. MENDELSON, Brooklyn, N. Y. The invention is in the nature of an electric motor of the vibrating type, designed chiefly to be used in small installations for advertising purposes, but applicable also to other uses; and it consists in the novel construction and arrangement of the motor parts, with special reference to securing a large effective power and freedom from polarization and residual magnetism.

SELF-RESTORING TROLLEY.—J. T. ANDREW, Montgomery, Ala. In this instance the invention pertains to trolleys, the more particular object being to enable the trolley-wheel or other analogous member to be readily replaced upon the conductor when dislodged therefrom. By merely pulling the trolley-pole downwardly so as to place the trolley-harp beneath the conductor and then releasing the pole, the operator is enabled to start the car under conditions where he need pay no further attention to the trolley.

Of Interest to Farmers.

MILK AND CREAM SEPARATOR.—F. H. REID, Sioux City, Iowa. This improvement is in centrifugal separators in which a so-called "liner," comprising a series of metal shells of approximately conical form, are arranged within a drum and the whole mounted upon a rotatable shaft, the full-milk from which the cream is to be separated being admitted at the center of the cones and distributed radially between them, the separation of cream being effected by centrifugal action and the two liquids being drawn off from the drum at separate orifices or spouts.

Of General Interest.

HAIR-WAVER.—A. SCHÄRER, New York, N. Y. The purpose in this case is to provide a device for imparting a decided and uniform wave to the hair and to so construct the device that it will not tend to break the hair and that can be conveniently applied, and also to provide a construction which will be of a simple nature, the comb portion, or that which remains in place upon the head for a period of time being made very light.

BOOT AND SHOE.—C. RADOTINSKY, Kirkwood, Mo. The purpose of the improvement is to provide a construction of welt boots and shoes wherein they will not require lasting in the assemblage and attachment of the upper to the welt and the welt to the outer sole and wherein no insole is employed, the welt being attached directly to the upper and then to the sole.

VULCANIZING PROCESS.—H. W. MORGAN, Cleveland, Ohio. The more particular object here is to apply the vulcanizing material to comparatively pliable substances such as would ordinarily be destroyed by the heat of vulcanization. The inventor desires especially to apply a plastic material to particles of wood, paper, and the like, and so vulcanize the plastic materials as to avoid injury upon the objects to which they are thus applied.

TOOTH-BRUSH AND DENTIFRICE BRACKET.—L. W. MCCONNELL and W. V. GAGE, McCook, Neb. The object of this invention is to provide a device which may be attached to any convenient support, and by means of which the brush as well as the dentifrice may be supported in such manner that they are always within easy reach of the user. Means are provided that will facilitate the drying of the brush after its use.

DISTILLING AND RECTIFYING APPARATUS.—U. LORENTZ, Cristobal, Canal Zone, Panama. In carrying out his invention Mr. Lorentz makes use of lightly-burnt clay diaphragms or partitions and also other media formed of the same material for distributing and diffusing the mash or mash liquor in the still-column, the porosity and rough surface of these parts being highly effective in producing the desired separation of the aqueous and alcoholic elements.

BURIAL-CASE.—E. A. KNODLE, Springfield, Ill. In the present patent the object of the invention is the provision of a new and improved burial-case which is simple and durable in construction, cheap to manufacture, and arranged to permit hermetical sealing, and thus prevent escape of all noxious or mephitic gases and germs of diseases.

STERILIZED ERECTED POLE.—H. P. FOLSOM and H. JONES, Circleville, Ohio. The invention relates to the sterilizing of poles which from their erection in the ground become infected by bacteria and fungi and attacked by insects, resulting in the decay and destruction of a portion of the poles. The invention aims to obviate difficulties developed by antiseptic treatment and to secure and maintain a sterile condition of poles for long periods.

COMBINED NEEDLE AND THREAD CASE.—C. J. EKBERG, San Francisco, Cal. In this instance the invention has reference to cases, and more particularly to those adapted to hold a needle and thread for traveling and like use. The device combines in an extremely small compass a holder for a needle, different kinds of thread, and a threading device for the needle.

BOTTLE AND BOTTLE-CLOSURE. — A. EIMER, New York, N. Y. Mr. Eimer's invention relates to bottles and bottle-closures, and the object of the improvement is the provision of efficient means for effecting the closure of bottles, especially in connection with those containing chemicals. The means employed will overcome the defects arising from the use of cork, rubber, and ground-glass stoppers.

LABEL-PASTING BOARD.—G. N. BYL, Jersey City, N. J. One purpose here is to construct a board upon which labels may be laid in regular order to receive a coating of an adhesive material and to provide means whereby the labels in any row or series may be instantly raised at one of their ends from the board without soiling the hands, the labels occupying the position at that time which enables the operator to quickly remove them with the least inconvenience and without danger of lacerating or soiling the labels.

HOSE-COUPLING.—J. H. BIERY and J. H. ZWANGER, Alliance, Neb. The improvements made by these inventors are intended more especially for use in firmly connecting together adjacent end portions of hose-sections—such, for instance, as are employed between locomotive-engines and their tenders—although such improvements are equally adapted to analogous purposes in the arts.

MOISTURE-PROOF JOINT.—W. I. AIMS, New York, N. Y. This invention relates to tunnels and like structures securing moisture-proof joints at the sections; and its object is to provide a new and improved joint arranged to render the abutting flanges of the sections moisture proof at the bolts connecting the flanges with each other.

Hardware.

PIPE-CUTTER.—J. J. DELEHANT, Chicago, Ill. The aim of this inventor is, primarily, to provide a tool by means of which the tool may be held in engagement with the pipe during the cutting operation and by means independent of the handle of the tool, and also a tool in which the knife may be easily and widely adjusted adapting it to the particular work on hand, so as to increase the efficiency of the tool and the duration of its parts.

Heating and Lighting.

AUTOMATIC IGNITING AND EXTINGUISHING APPLIANCE FOR GAS-BURNERS.—J. HOROWITZ, 45 Rue Servan, Paris, France. The apparatus is constructed so as to control alternately and automatically from a point situated at a greater or less distance the ignition and substantial extinction of any desired number of gas-burners, illuminating-signals, advertisements, transparencies, and generally speaking, signs of all kinds serving for advertising purposes or as luminous signals. It serves for public lighting, railway-stations, theaters, cafes, etc.

BOILER.—G. KINGSLEY, New York, N. Y. Two water-walls are arranged, respectively, at the sides of the furnace and each having short inwardly-projecting water-tubes and having an arrangement with respect to the walls and grate, so that the gases of combustion are caused to circulate between the walls and around the tubes, thus producing a boiler having a great heating-surface and great steam-making qualities, and one in which the dangers of explosion will be reduced to a minimum.

FITTING FOR WATER-HEATING SYSTEMS.—J. O'NEILL, New York, N. Y. The present invention relates to a fitting in which the return from the radiator enters in a line parallel with the course of the water through the system. It relates to an improvement over the heating systems set forth in Mr. O'Neill's formerly filed application for a patent on a heating system.

Household Utilities.

COFFEE-COOKER.—M. M. HERRERA, Caracas, Venezuela. The more particular object in this case is to provide a vessel to be used in connection with a coffee-pot in such manner that the ground coffee is subjected to the action of steam and allowed to become softened and also to permit the hot water used to percolate through the ground coffee into the coffee-pot.

INDICATOR. — H. S. ELLIS, Greenville, Texas. A plate is made of any material and having its edges provided with notches which are arranged opposite peripheral spaces bearing the names of groceries or other articles and a series of knobs, buttons, or other devices having shanks adapted to enter such notches and wires or equivalent means for holding the said devices in such manner that they may be turned over the edge of the plate, and by their position on the front or back of the same to indicate particular articles to order.

Machines and Mechanical Devices.

GRINDING-MACHINE.—G. PEISELER, Charlottenburg, Prussia, Germany. The machine differs from those which have hitherto been known by the surfaces to be ground of the article operated upon being brought into contact with the grindstone by imparting a rolling motion to the article. This is attained by a work-holder or holding-arm carrying the article being revolubly mounted on a pin and being pressed against the grindstone under the action of a load, the pin carrying the holder being moved according to the nature of the object to be ground.

SPRING-MOTOR.—H. S. ESCH, New York, N. Y. The object of the invention is to provide a motor capable of running for a considerable length of time without requiring rewinding of the springs and arranged to permit storing and desired amount of power for future use by the employment of a plurality of springs adapted to be thrown automatically and successively into action relative to the part to be rotated at a uniform power and speed.

Prime Movers and Their Accessories.

LUBRICATOR.—F. W. KNOTT, Madison, Wis. In this patent the improvement refers to force-feed lubricators; and its object is to provide a lubricator arranged to automatically and periodically force the desired quantity of the lubricant to the bearing, cylinder, or other part or parts to be lubricated.

Railways and Their Accessories.

RAILROAD-SIGNAL. — E. C. LOMBARD, Peoria, Ill. A train may pass freely along the track without affecting the signal in any way; but should two trains get within the same section the torpedo is immediately placed, and when either train gets within a short distance of said torpedo it is exploded to warn the engineer of impending danger. The signal is automatic. Means are employed to enable electric lights to operate simultaneously with torpedo placing and exploding device, and serve as an additianal signal.

SEAL-LOCK.—T. E. VAN DERWERKEN, Green Island, N. Y. The principal objects here are to provide means whereby a destructible seal can be applied to a lock in such a manner that the opening of the lock will cause the destruction of the seal, to provide means whereby the car can be locked with an ordinary wired seal either when the seals which are intended to go with the lock are absent or even when the door is not fully closed, also to provide means for holding the seal and for destroying it.

Pertaining to Recreation.

MECHANICAL TOY.—H. C. MURRAY, Gulfport, Miss. One purpose of the invention is the provision of a mechanical toy adapted to be pushed over a surface and wherein as the toy is moved backward and forward the head of the object carried by the toy will be automatically turned from side to side.

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.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8534.—Wanted, a Crookes tube for connection to a Wimshurst machine.

For mining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 8535.—Wanted, a slivering machine for preparing hemp for spinning into bender twine.

Pattern Letters. Knight & Son, Seneca Falls, N. Y.

Inquiry No. 8536.—Wanted, manufacturers of large needles.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 8537.—Wanted, manufacturers of selenium cells.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 8538.—Wanted, an electrically-operated corn-popping machine.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 8539.—Wanted, address of a manufacturer of a machine for making wooden meat skewers.

WANTED.—Copies of our "Manufacturers' Index" issued some eight years ago. State price. Munn & Co., 361 Broadway, New York.

Inquiry No. 8540.—Wanted, manufacturers of elastic bands for hose supporters.

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods, Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

Inquiry No. 8541.—Wanted, manufacturers of portable firewood saws.

The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St. N. Y. C.

Inquiry No. 8542.—Wanted, the addresses of the Birkeland E. Y. de Process, also the apparatus for the artificial production of nitrates.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8543.—Wanted, machinery for carding, spinning and making twine, rope and plaited cord, from cotton, mohair and Angora goat hair.

Inquiry No. 8544.—Wanted, rotary engine for oil or alcohol.

Inquiry No. 8545.—Wanted, makers of typewriter ribbons.

Inquiry No. 8546.—Wanted, manufacturers of devices controlling valves by electricity.

Notes and Queries.

HINTS TO CORRESPONDENTS.

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

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

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

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10254) G. L. M. asks: 1. Please give me the difference between Eastern, Central, and Western standard time and where it is changed. A. Eastern time has the 75th meridian west of Greenwich as its central line and is 5 hours behind Greenwich time. Central time has the 90th, Mountain time the 105th, and Pacific time the 120th meridian as its center. Theoretically the meridians half way between those above named are the lines where the change of time is made, and each is one hour earlier than the next to the east. Practically the convenience of the railroads controls the matter in the United States. Thus, the change of time is made at Buffalo on roads starting from that place, east or west. It is made at Pittsburg for roads having that as a center. This is better than changing the running time an hour at some small way station. The line north and south along which the time changes is not a straight line. 2. Also the difference between Eastern, Central, and Western sun time and where it is changed. A. Sun time is the time at the particular place. It is noon by the sun when the sun is exactly south of one, and clocks which are set to sun time are said to keep *local time*. This is not called eastern or western. It is the time of that meridian only. It is the same local time upon a line due north or south over the earth. For a change of one degree of longitude the local time changes four minutes, being four minutes earlier for each degree to the west, and later by the same amount for each degree to the east of any place. This is the time that was kept everywhere in the world before standard time was introduced. Now nearly the whole civilized world has standard time based upon the meridian of Greenwich.

(10255) B. C. B. asks: Can you furnish me a book of instruction on the wiring of an electric light plant that explains fully the testing of lines for breaks, that explains the arc lamps, the incandescent lamps, the transformers and everything about an electric light plant? A. There is no single book which covers the range of topics upon which you desire information. We can furnish the following: Crocker's "Electric Lighting," Vol. 1, "The Generating Plant," price $3; Vol. 2, "Distributing System and Lamps," $3.

(10256) P. S. writes: 1. Can commercial calcium sulphide be used for phosphorescent paint or light? A. No. 2. If it cannot, what are its uses? A. It has some use in medicine. It may be used for the preparation of sulphureted hydrogen. 3. What is the chemical action of a secondary battery made of copper, zinc, and lye? A. In general, zinc is taken from the solution while charging and deposited upon the zinc plate; oxygen is evolved, which attacks the copper and forms copper oxide upon the positive plate. In the discharge the opposite changes take place. 4. If two pieces of annunciator wire about ten or more feet in length are laid parallel with the insulations touching and with the terminals at one end not connected and those at the other end connected through a telephone receiver and secondary of a medical coil in series, or one terminal to the platinum-pointed screw of a buzzer through the receiver and the other terminal at the same end connected to the vibrating contact, is the sound produced in the receiver caused by leakage, induction between the wires or do the wires act as a condenser? (This also takes place to an extent when the ground is used instead of either wire.) A. We scarcely understand your arrangement from the description, but, if there is a sound produced upon an open circuit, it is by means of waves transmitted across the space separating the wires, as is frequently the case by induction in the working of the telephone. 5. Are the use of the magneto, the galvanometer and similar instruments the only ways for testing for leaks? A. For methods of testing wires and cables, see the book on that subject by Webb, price $1; or Kempe's "Electrical Testing," price $7.25. Latest editions. 6. What is the average or extremes of resistance in woods? A. Dry wood is an insulator and wet wood may have any resistance according to its wetness.

(10257) O. F. N. writes: In your answer to question No. 10210 you state that the moon rotates on its axis. Permit me to express my opinion that said rotation cannot be understood so that the moon has its own

axis to rotate on. It seems to me that it would be more correct to say that the moon rotates on the earth's axis. "The moon rotates on its axis once while it revolves around the earth once." It might be true in one sense, but not in the common way we have the idea of rotating bodies. We are all revolving around the earth, but it would not do, I suppose, to state that we are all rotating on our own axes. We must, I think, have the idea that we are all rotating and revolving on and round the axis of the earth. If we suppose that the moon is a solid ring round the earth, would it then be correct to state that every part in length, as the thickness of that ring, were rotating on its axis? Certainly not. The ring was rotating on its center, the common center for all the parts of the ring. That is to say, every part of the ring would rotate on the center of the ring. Consequently, therefore, as the moon can be considered as a part of the ring, the moon has no axis of its own but is rotating on the axis of the earth. A. Two knights are said to have disputed once whether a certain shield were silver or gold. After nearly killing each other they found that both were right, because one side was silver and the other was gold. So with the discussion of our correspondent; he stands on the earth and sees the same face of the moon all the time, and declares that it does not rotate at all, but has the same axis as the earth. Astronomers viewing the moon as if from some point of external space see the moon present all sides of its orb to them every revolution, and say that it rotates once on its axis in every revolution around the earth, its central planet. We agree with the astronomers, but do not expect to convince any one who takes the opposite view. One's opinion often depends upon one's point of view.

(10258) C. M. C. writes: May I trouble you with a request for information on the following phenomenon, to me curious, and as to which so far I have been unable to find any explanation? An ordinary incandescent electric-light bulb after the current is cut off exhibits for some hours a peculiar phosphorescent glow, emitted apparently from the inner surface of the glass and quite strong enough to enable a coarse print to be read if placed close to the bulb. This glow or phosphorescence becomes dimmer and stronger in pulsations of about three seconds. It becomes stronger when the hand is brought close to the glass, say within half an inch, and concentrates at the point of the bulb nearest the hand. Perhaps I should say it becomes brighter at such point, as there is no diminution of the light in other parts of the glass. The light is pale and green. It more nearly corresponds to a phosphorescent appearance than any other kind of luminosity. It does not seem to be traceable to leakage of electricity. The filament or carbon of the bulb exhibits no light whatever. A. This phenomenon can be produced in most lamps by holding them near the pole of the secondary of an induction coil. We suspect that this is the same thing and that the circuit is an alternating one, so that the alternations of the E. M. F. produce the fluorescence in the bulb, which lasts long enough after the current is turned off to be visible in the dark. It may be that the lamp, too, is exhausted just to the degree that makes this possible. Another lamp in the same place may not show the same effect.

(10259) E. K. asks: What is the difference in the meaning of the terms "mass" and "weight" as applied in physics? Textbooks are indefinite, some giving mass as the weight divided by gravity, others that they are used synonymously. A. Mass is the quantity of matter a body contains; the weight of that body is the measure of the attraction of the earth upon that mass. The mass of a body will be the same everywhere, so long as the quantity of matter it contains does not change. Its weight changes as it may be moved about on, above, or down in the earth. If we divide the weight of a body at any place by the intensity of gravity at that place, the quotient is always the same for that body. This quotient is therefore the mass of the body, since as we have said the mass of a body does not change.

(10260) H. A. M. asks: In one of our largest engineering plants a discussion has been carried on for several months past, and which is apparently likely to continue for many months longer unless it is settled by a recognized authority. The question is, "Does the inner rail or the outer rail support the weight of a locomotive or car when it is passing around a curve?" Kindly settle the argument through the columns of Notes and Queries. A. Each rail of the railway track usually bears a part of the weight of a locomotive. We have heard of locomotives taking a curve at so high a speed as to lift the inner wheels clear of the rail, but we never saw such an occurrence. In building a track the outer rail is raised on a curve enough to throw the locomotive toward the inside of the curve sufficiently to counterbalance the centrifugal force, which would throw the engine over outward. In this case an engine going at the calculated speed would round the curve in exactly the same way that it would run on a level, and half the weight would be borne by the inner rail and half by the outer rail.

(10261) W. I. asks: Would you kindly tell me, through your paper, what would be the apparent size or diameter of our sun, if an observer viewed it with the unaided eye from the planet Jupiter? A. The apparent diameter of the sun as seen from the earth is about 32 seconds of arc; as seen from the planet Jupiter it would be reduced in the ratio of the distances of the earth and Jupiter, or 92,300,000 to 483,300,000 miles, approximately one-fifth as large in diameter.

(10262) F. M. asks: Please describe in your Notes and Queries column the building of a spark coil suitable for electric gas lighting, the size of wire to be used, how to insulate it, and if the spark could be regulated by a movable core. How many sal-ammoniac batteries would be necessary? Could it be connected on batteries used for bell work? A. For a gas-lighting coil make a core of No. 16 B. and S. iron wire, 10 inches long and 1½ inches in diameter. We see no advantage in having the core movable, still it may be made to slide out of desired. In this case a spool must be used for winding the coil upon, otherwise the coil may be wound directly upon the core, insulated with paper. Wind the coil 8 inches long and have 13 layers of No. 16 B. and S. double cotton-covered copper magnet wire. A battery of four sal-ammoniac cells should be sufficient for a line around a house; if not, add more cells to the battery. The same battery can be used for ringing bells, if the wires for the two services are separate and each has a separate connection to the battery; that is, the two wirings are to be in multiple on the battery.

(10263) J. J. S. S. asks: Kindly inform me whether a Sprengel air pump is a draw or force pump. There has been a dispute among some students as to which was right. I thought it a draw pump. A. The Sprengel pump acts by the expansion of the air in the reservoir, from which the air is to be removed into the tube of the pump, where the air pressure is less than in the reservoir. In this way it may be called a "draw" pump, although the term is not an exact one as applied to the action in question.

(10264) W. T. R. asks: A floating vessel displaces its own weight of water—does it? Well, suppose we take a plaster cast of the vessel's bottom, and so arrange that she will have, say one-fourth of an inch of water all round her (below the water line, of course), won't she float? In that case she does not displace her own weight! Question: Will the earth's attraction overcome the thin layer of water, and cause the vessel to bump the bottom of mold? A. The statement that a floating body displaces its own weight of water means that if the space in the water which is occupied by the vessel were filled with water, that water would weigh the same as the vessel weighs. This is not difficult of experimental proof, and has been known for many centuries. It was discovered by Archimedes. If the mold you propose were filled full of water, the vessel when placed in the mold would displace a volume of water whose weight is just equal to that of the vessel. If the mold were never filled with water, the effect is just the same. The volume of water equal to that of the vessel below the water line on the mold weighs the same as the vessel weighs. The earth cannot make such a vessel bump the bottom of the mold. The water sustains the weight of the vessel, even if it weigh many tons. This is the case with a large ship in a drydock before the water is pumped out. It floats just clear of the bottom of the dock. We confess we do not understand your difficulty.

(10265) J. E. D. asks: 1. Please inform me a complete formula of the construction of an up-to-date dry cell. A. You will find complete instructions for making a dry cell as good as any in our SUPPLEMENT, Nos. 1383 and 1387, price ten cents each. 2. What salt or chemical can be added to a dry cell to increase the voltage, the solution used in same being sal-ammoniac and zinc chloride? A. The voltage of a dry cell is 1.4 volts. This is due to zinc, sal-ammoniac, and carbon. It cannot be increased. 3. What is the direct cause of sal-ammoniac crystals forming on the zinc element of a dry cell, the saturated solution consisting of one to three parts? A. If sal-ammoniac crystals form on the zinc in a cell, the solution has too much sal-ammoniac in it, and requires more water or less sal-ammoniac. If you refer to the crystals which often are to be seen on the zincs of sal-ammoniac cells, these are not sal-ammoniac, but a very complicated compound, and are not soluble in water to any extent. They are soluble in hydrochloric acid, and it is possible that you may have had reference to this in your second question. These crystals are a double chloride of zinc and ammonium. They increase the internal resistance of a cell, and reduce the E. M. F. also.

(10266) F. W. G. asks: I have a camera with two 1¼-inch diameter 7-inch or 7½-inch focus meniscus lenses, as illustrated on page 334, "Experimental Science," Fig. 2. I want to place a plano-concave lens between the meniscus lenses, same as Fig. 12. Of what focus must the plano-concave lens be? A. To adapt your lenses to portrait work after the manner described in "Experimental Science," page 334, Fig. 12, you will need a concave lens slightly stronger than 16 inches focus. A 14-inch lens should enlarge the image sufficiently for portrait work. The difference between a lens with 7½-inch focus and one of 8-inch focus is very slight.

(10267) J. W. E. writes for instructions for tinning cast iron. A. To be successful in coating cast iron with tin the castings must be absolutely clean and free from sand or oxide. The greater the care in cleaning at the outset the better the resulting work. Before the castings can receive a coating of tin it is necessary to remove the coating of scale or oxide, so the clean metal will be exposed to the tin. The castings are usually partly cleaned by means of a "rattler," which removes much of the scale. They are then to be placed in a pickle of dilute muriatic acid until a clean surface is the result. If the pickle is warmed by means of a steam jet the operation will be hastened. The castings can be examined occasionally while in the pickle and any sand or black spots removed by means of a scraper or wire brush. The castings can then be washed, and if desired kept for a length of time by being placed under clean water. As long as they are covered with water they are not subject to oxidation. For a flux the castings are dipped in a mixture composed of 4 parts of a saturated solution of sal ammoniac and 1 part of muriatic acid. "Boiled" acid, as that combined with zinc is sometimes called, is not to be used. For tinning the best block tin is required, and this should be melted in an iron pot, care being taken that it is not burned or overheated in melting. After the tin is melted it can be cleaned of impurities by taking a piece of green or wet wood secured to a pointed iron rod, and fastening same so the wood will be kept at the bottom of the pot of melted metal for one or two hours, depending on the amount of impurity in the metal. The surface of the metal is to be skimmed occasionally by means of a perforated iron skimmer. To protect the surface of the metal from oxidation it can be covered with sal ammoniac. There is nothing to be added to the tin. Another method is to cover the surface of the tin with tallow or palm oil. The casting is taken up by means of suitable tongs, dipped in the flux and then immersed in the melted tin and held for a sufficient time to allow the surface to be tinned. The tin should not be so hot as to discolor when casting is removed. If desired the casting can be held for a time in another pot, which is to be partly filled with tallow or palm oil and kept at a temperature that will melt tin. This bath of grease will allow the casting to retain an even coating of tin, and allow any superfluous metal to drain off. The castings may be cleaned from the grease by first rubbing in sawdust and then in bran.

(10268) E. B. C. asks for a good noncorrosive, easy-flowing jet black ink. A. An exceedingly fine ink is said to be produced by the following recipe: 11 parts galls, 2 parts green vitriol, 1-7 part indigo solution and 33 parts of water. Here the relatively larger quantity makes the gum unnecessary, while the indigo solution makes the brilliant black seem still deeper. Writing executed with this ink may, it is true, be removed by means of dilute acids, but it may be rendered visible again by chemical means.

(10269) M. E. H. writes: I would like a formula for oil paint such as used for painting photographic backgrounds, and would like to ask if you could help me to secure such a receipt. A. The following retains sufficient flexibility to enable the sheet to be rolled: Soft soap, 2 ounces. boiling water, 12 ounces. Dissolve and work well into usual oil paint, 6 pounds.

(10270) G. L. asks: I have an induction coil guaranteed to give a 1-inch spark. What amount of current will be required to make the 1-inch spark, and what number of 1900 dry cells or Bunsen's batteries will operate it? A. Two or three Bunsen, or twice as many dry cells will probably run the coil to its full efficiency. We should not advise the use of the Bunsen cells with nitric acid. The fumes in the house will corrode all metalwork. Better use chromic acid solution.

(10271) A. C. asks: A farmer in plowing around a square field, having plowed a strip ten rods wide, finds that he has one-fourth of his field plowed. How many acres in the field? A. The problem you send is not an arithmetical problem, but requires for its solution an equation of the second degree in algebra. The solution is as follows:

Let x = one side of the field, then will
$x - 20$ = the side of the square piece left after the strip is plowed around the outside.
x^2 = the area of the field, and
$x^2 - 40x + 400$ = the area of the square piece.

This area is three-quarters of the area of the entire field. Therefore,

$$\tfrac{3}{4}x^2 = x^2 - 40x + 400$$

Solving this equation, we obtain for the side of the field, 149.2 rods; and for the area of the field, 139.3 acres.

(10272) J. M. L. asks: 1. Will you please give me the two laws of thermodynamics? 1. The first law of thermodynamics is: "Whenever work is performed by the agency of heat, an amount of heat disappears equivalent to the work performed; and whenever mechanical work is spent in generating heat, the heat generated is equivalent to the work thus spent." (Deschanel.) The formula is $W = JH$. W is the work in foot-pounds, if English measures are used; H the degrees which one pound of water would be raised in temperature by the heat; and J, Joule's equivalent, 772 foot-pounds, as determined by Joule, or 773 foot-pounds as redetermined lately by Rowland. The second law is variously stated by different authors. Perhaps the simplest form of the law is: "It is impossible for a self-acting machine, unaided by any external agency, to convert heat from one body to another of a higher temperature." (Clausius.) Another form is: "The efficiency of a completely reversible engine is independent of the nature of the working substance, and depends only on the temperature at which the engine takes in and gives out heat; and the efficiency of such an engine is the limit of possible efficiency for any engine." (Deschanel.) 2. If the specific heat of gold is 0.03244, what weight of it at 470 degs. C. will raise 1 kilogramme of water from 12.3 degs. to 15.7 degs. C.? A. The water is to be raised 3.4 deg. C. 1,000 grammes require 1,000 calories per degree of rise of temperature, and for 3.4 deg. rise require 3,400 calories. The gold is to lose 470 deg. —15.7 deg., or 454.3 deg. One gramme of gold gives out 0.03244 calorie for each degree of loss of temperature, and for 454.3 deg. will give off $0.03244 \times 454.3 = 14.737$ calories. As many grammes of gold will be required as 3,400 contains 14,737, which is 230.7 grammes of gold.

(10273) T. A. says: The following method is given in "Cyclopedia of Receipts" for deodorizing petroleum: Mix chloride of lime with petroleum in the proportion of three ounces to each gallon of the liquid to be purified. It is then introduced into a cask. Some muriatic acid is added and the mixture is well agitated, so as to bring the whole of the liquid into intimate contact with the chlorine gas. Finally the petroleum is passed into another vessel containing slaked lime, which absorbs the free chlorine and leaves the oil sufficiently deodorized and purified. Can you suggest the quantities required of muriatic acid and slaked lime? Also if the cask should have one end open or agitated with the bung in? Is there any danger attending this process? A. The quantities of muriatic acid and slaked lime to be used in deodorizing petroleum are not important. If an excess of acid were used, it would disappear when the liquid is passed through the lime. Probably 3 fluid ounces per gallon will be sufficient to furnish enough chlorine for the process. Similarly, the bung may be in or out of the cask. There will not be excessive pressure in the operation; yet if the cask is open, the escape of chlorine will not be very annoying in the open air. The only danger we can see in the work is the inhaling of chlorine gas. This would be disagreeable, and if a large quantity were taken into the lungs, it would be dangerous.

(10274) E. J. asks: Does liquid when boiling give off air, in the shape of bubbles which pass to the surface? If this is the case, why does mercury do so if this metal is always used to extract air from tubes, etc.? Or is it only the vapor of Hg that bubles? A. When a liquid is boiling it is giving off its own vapor into the air, if it has been heated for a time sufficient to drive off the contained air. Even mercury contains air under ordinary conditions. Only after it has been heated is the air driven out. In filling a barometer tube the mercury is boiled to get rid of its contained air which would injure the vacuum.

(10275) W. C. P. asks: Some few years ago I saw on sale a self-lighting gas-tip which I believe was referred to as a platinum sponge. Have you any publications which treat on this subject, its principle and method of construction? A. Self-lighting gas jets are made by placing a lump of spongy platinum so that the gas will strike it. The absorbing power of the sponge is very great, and the absorbed gas becomes so hot that the sponge is heated to a red heat and ignites the gas. Platinum sponge can be obtained from dealers in chemicals. It is simply the Doebereiner's lamp or philosopher's lamp, as it was called, which was used for lighting lamps, etc., before the invention of the friction match. The sponge for some reason soon loses its efficiency.

(10276) D. E. asks: Please let me know if there is a cheap and simple way to change 110-volt 1 1-5 ampere alternating current to a steady current? A. A rotary transformer is the only practical way to change an alternating to a direct current. This is a motor run by the alternating current and having a winding leading to a commutator, by which the direct current is taken off at the other end of the shaft of the machine.

(10277) J. D. S. asks for a stove blacking or varnish that will give a black gloss and not burn off. Brunswick black gives the gloss but burns off when applied to top of stove. A. Take plumbago, make into a thin paste with sodium silicate or water glass. This makes an excellent stove polish and should be brushed thoroughly.

(10278) H. B. says: 1. I have a closed-circuit battery in which there are two plates of carbon and one plate of zinc. What would be the solution I could use in this battery to best advantage? A. Use a bichromate solution of a chromic acid solution. 2. In winding the field magnet and the armature core of an electric motor, is it absolutely necessary that the same gage wire be used? That is, must the wire on the field be the same size as the wire on the core? A. No. The gage of wire is determined by calculation, and one may be either larger, the same size, or smaller than the other.