RECENTLY PATENTED INVENTIONS.

The Inventions described in this Department were Patented through the Scientific American Patent Agency.

Electrical Devices.

TROLLEY POLE CATCHER.—J. H. WALKER, Lexington, Ky. The invention is an improvement on a trolley pole catcher previously invented by Mr. Walker. It consists of a carriage mounted to slide along a horizontal rack on the car roof and links connecting this carriage with a sleeve that rides on the trolley pole. The device will yield sufficiently to permit adjustment of the trolley pole to slight inequalities in the wire; but if the trolley wheel should slip from the wire the parts will operate to arrest the upward movement of the trolley pole.

Of Interest to Farmers.

CULTIVATING MACHINE. — C. SOLTÉSZ, New York, N. Y. The invention relates to the cultivating machine of the type drawn by horses. The operator walks alongside of the machine and manipulates a handle to guide the general direction of travel. The machine is fitted with pairs of cutter disks, with hoes between each pair, and the operator may move either the hoes or the cutters, or both into engagement with the ground. He can also adjust the depth of cut of the hoes or disks at will.

HARVESTER.—C. F. BLAKESLEE, Rapatee, Ill. This harvester is equipped with a draft mechanism that greatly reduces draft strain by enabling the direct transmission of progressive movement from the main driving traction wheel to the other ground wheel that supports the outer end of the grain table, thus causing the ground wheel to travel with the same speed as that of the traction wheel.

Heating and Lighting.

STOVE BASE.—J. SHARON, Canaseraga, N. Y. The object is to mount a stove base upon castors in such a way that the castors are normally in a withdrawn or inoperative position, at which time the weight of the stove base rests upon the legs. When desired the castors may be brought into an operative position so that the stove may be moved conveniently.

BOILER.—W. S. HAWLEY, Landing, N. J. The invention relates to that type of boiler in which the water is contained in a plurality of superimposed communicating sections inclosed in a casing, the products of combustion being caused to pass back and forth between the sections to heat the same. The object of the invention is to provide improvements whereby the space between the sections may be more readily cleaned, the water in the lowermost section more effectively heated, and the series of sections more effectively supported.

Household Utilities.

HOLDER.—ELIZABETH L. LLOYD, Utica, N. Y. This holder is especially designed for holding bed clothes in place on the bed, but it may also be adapted for clamping fabric generally and thus may be found useful as a towel holder, or as a clamping device for hose-supporters and the like. The jaws of this holder are in the shape of rings, one of which will pass within the other, pressing the fabric into cup-shape, and thus securing it against displacement.

PAN HOLDER AND STOVE LID LIFTER. —B. KESSLER, Cabinet, Ohio. This device may be used either as a holder or handle for pans, or as a stove lid lifter. The handle is fitted with a shank which terminates in a toe adapted to fit the slot of a stove lid. This toe may also be fitted into a fork which may be passed under a pan while a catch on the handle serves to grip the rim of the pan.

Machines and Mechanical Devices.

FOLDING BELLOWS PEDAL. — C. S. WRIGHT, Grand Haven, Mich. The invention relates particularly to automatic player pianos and provides an improved folding bellows pedal arranged to permit the user of the piano to conveniently and quickly move the bellows pedals into active position or fold them into inactive position to allow the player to use the action pedals when playing the piano by hand.

MUSIC LEAF TURNER.—J. W. ALBIN, Babylon, N. Y. The mechanism is adapted to support sheet music on a musical instrument and successively turn the sheets. The mechanism also serves to return all the sheets simultaneously to their original position so as to permit the piece to be played over again.

ATTACHMENT FOR TALKING MACHINES. —C. MARTELOCK Oroville, Cal. The particular object of this invention is to provide an attachment for a machine known commercially as the B. C. graphophone. The attachment is designed to increase the delicacy of adjustment between the record and the stylus needle and also to increase the general efficiency of the apparatus.

WASHING MACHINE.—T. C. SÖRENSEN, Copenhagen, Denmark. The invention provides an arrangement in connection with washing machines of the kind that consists of a firm casing containing the washing solution, within which revolves a perforated drum provided with buckets on its outer surface into which drum the clothes to be washed are placed. The buckets are formed by means of curved plates extending the whole length of the drum and at a certain distance from the same and connected to the drum by means of radial plates.

CONCENTRATOR.—R. H. MANLEY, Stockton, Cal. The object of the invention is to provide a concentrator for separating heavy materials from lighter ones, such as gold from sand, or extraneous matter. The device is arranged to allow of effectively treating a large quantity of material in a comparatively short time with or without the use of water.

TAKE-UP FOR LOOMS.—B. WEHRLEN and F. C. MATTHEWS, Pompton Lakes, N. J. The device serves to draw fabric such as a ribbon from the loom, and it is practically impossible to release the fabric from this device owing to its novel construction, hence the possibility of slackening the warp with the danger of interfering with the operation of the weaving is obviated. The take-up leaves the front of the loom entirely free and unobstructed and does away with the cumbersome wooden frame usually employed.

DIGESTER.—C. EDGERTON, Philadelphia, Pa. The invention relates to digesters of the type in which an outer containing vessel is provided interiorly with a rotating perforated receiver suspended within the outer receiver by means of trunnions, and provided with gears for rotation within the stationary container. The invention relates particularly to a novel construction of receiver and container, such as will facilitate the discharge of both solid and liquid matters.

APPARATUS FOR TESTING FLUID METERS.—T. B. DORNIN, Norfolk, Va. In the operation of testing water meters, it is necessary to temporarily couple up the inflow and outflow nipples to a supply pipe so that the supply water flowing through the meter will register on the dial and then discharge into a measuring tank where the volume of water is compared with the registration on the dial. The present invention provides a simple construction whereby a large number of meters may be simultaneously connected with tight joints to the supply pipe, so that all the meters may be tested at once. Mr. Dornin has also obtained a patent on another construction which performs the same office of permitting a number of meters to be tested at the same time.

HAND SCHOOL-LOOM.—BEATRICE E. LINDBERG, Faribault, Minn. The invention relates to kindergarten looms and is an improvement upon previous patents by the same inventor. The present improvement consists in arranging the loom to permit the weaver to conveniently open and change the shed for the passage of the shuttle or needle used for carrying the weft through the open shed.

WOOD-BORING MACHINE GUARD.—E. R. KING, Memphis, Tenn. Operators of wood-boring machines are frequently injured or their clothing is torn by contact with the rotating heads, or clamping screws of the boring bits. To prevent such accidents, Mr. King has devised a skeleton guard which entirely incloses the bit proper and the rotating spindle head.

Prime Movers and Their Accessories.

LUBRICATOR.—J. NOETHE, Elkton, South Dakota. This lubricator is of the four-speed type adapted for use on engines and is so constructed that when the engine is started a pressure is placed on the oil in the reservoir and the oil is mechanically forced through a suitable pipe into the steam chest or other portion of the engine requiring lubrication.

WAVE MOTOR.—R. CRAIG, Los Angeles, Cal. This motor is adapted to be operated by the rise and fall of waves of the sea. The invention provides novel details of construction adapted to effect the positive and continuous conversion of the force of the waves during their rise and fall into a rotary motion of a driven-shaft for the actuation of other mechanism.

Railways and Their Accessories.

CAR WHEEL.—T. M. CREPAR, Fargo, North Dakota. The object of the invention is to provide a simple, strong and inexpensive car wheel, adapted to be mounted with another similar wheel rigidly upon a car axle and having means for permitting the independent movement of each wheel rim in rounding curves. The hub section is made rigid with the axle, while the rim is movable relatively thereto, bearing balls or rollers being interposed between the sections.

HEATING FURNACE.—W. N. BEST, New York, N. Y. This furnace is adapted particularly for heating railroad tires or other bodies, and comprises an improved wall structure for the furnace with means for delivering the heating medium to the interior thereof. The inlet through which the hot gases from the burner pass into the furnace is constructed to give a uniform distribution of heat.

RAILROAD TIE.—R. L. BOWER, Blandburg, Pa. The invention provides a metallic tie arranged to prevent movement of the tie in the direction of its length, that is, transversely to the roadbed, thus rendering the tie eminently useful on curves and other places subjected to great force by passage of heavily loaded or fast trains.

MEANS FOR CONNECTING PARALLEL RAILROAD RAILS.—V. A. WHITE, Aliceville, Ala. The invention provides means for connecting the parallel rails of railroad tracks whereby they are held rigidly spaced apart at the required distance, so that separation of the rails is impossible. The invention also includes means for connecting the meeting ends of railroad rails and holding them in rigid alinement.

CAR STAKE.—N. E. GAGNON, Woodland, Wash. This car stake belongs to that class of stakes adapted for application at each side of a flat car on which logs are loaded. The improved stake is arranged to be applied to the sockets generally found at the side of such cars, or it can be fastened thereto in various other ways.

Of General Interest.

LUBRICATING CUP.—C. STEWART, New York. This oil cup is of air-tight construction with an outlet below the normal liquid level, and is provided with an air inlet which may be adjusted to control the admission of air so as to govern the flow of lubricant through the outlet.

HARNESS BUCKLE.—L. L. ROUNDS, Orange, N. J. The purpose of the invention is to provide a harness buckle, more especially adapted for use on a saddle girth, and arranged to permit a rider to pull the saddle girth tighter without dismounting. Means are also provided to prevent the buckle from opening accidentally.

FIRE-NOZZLE ATTACHMENT FOR VALVES.—J. D. SCHIERLOH, Jersey City, N. J. A combined faucet and fire nozzle is provided by this invention. The handle of the faucet is fitted with a nozzle which may be rotated thereon and the handle also may be rotated on its axis to direct the stream issuing from the nozzle to all portions of the room or compartment. By means of a set screw the handle may be released from engagement with the stem of the faucet valve and the water will then flow through the handle and out of the fire nozzle.

ADVERTISING APPARATUS.—J. REIX, 33 Boulevard des Batignolles, Paris, France. The invention consists in providing a pair of parallel wires which may extend around the house or on the front of a building. Suspended from these wires, which receive current from a source of electricity, is a carriage provided with a motor which causes it to travel along the wires, and a procession of luminous letters which are also suspended from the wires are connected to the motor carriage.

FOUNTAIN BRUSH.—H. KADUSHIN, New Rochelle, N. Y. This fountain brush is designed to contain an acid or other cleansing liquid to permit of using the brush for cleaning type, textile fabrics, and other articles and materials. A special form of slide valve is provided which controls the flow of the acid to the bristles.

IMMERSION REGULATOR PARTICULARLY ADAPTED FOR TORPEDOES.—A. E. JONES, Fiume, Austria-Hungary. The invention has for its object to improve the immersion regulators used on self-propelled torpedoes in which the combined action of a hydrostatic piston and a pendulum is employed. The invention relates particularly to diminishing certain resistances at the joints, thus assuring the operation of the device under all conditions.

FLOWER STAKE.—W. HENSHAW, Springfield, N. J. This stake or support is adjustable to suit plants of different sizes and has a special construction facilitating the attachment of the stake to supporting wires such as are used by florists for holding the plants in an upright position when they are being sprayed.

BOTTLE.—J. A. GAFFNEY, Brooklyn, N. Y. The bottle belongs to that class of non-refillable bottles in which a loose grooved stopper is held in the bottle neck in such manner as to permit outflow of liquid when the bottle is inverted, but which normally seats downward in such position as to prevent ingress of liquid.

FASTENER.—L. F. HAMMER, Omaha, Neb. This fastener is adapted for use on fences, cribs, or the like, for removably supporting cross boards, panels, etc., in position. The fastener is rotatably mounted on its support and may quickly be moved to such position as to permit the removal of any one of the cross boards without deranging those remaining in place.

CHAPLET AND SHRINE OF THE HOLY ROSARY.—W. HENDRICK, New Haven, Conn. The object of this invention is to provide an improved chaplet and shrine of the Holy Rosary arranged to successively display pictures of a religious character, one at a time, and in proper order, according to the intended devotional exercise.

APPLIANCE FOR RELEASING BOATS.—C. L. BEVINS, Jamestown, R. I. Mr. Bevins has invented an improvement in appliances for releasing boats, especially lifeboats from the davits of vessels, docks, and other elevated places. The invention provides means operable to simultaneously disconnect both the bow and the stern of the boat whereby the danger of launching is materially diminished.

WATCH.—J. T. PENDLEBURY, 12 Thornilley Brow, Manchester, England. The invention relates to dust covers for the movements of watches and provides a simple and efficient dust-proof cover which will permit the regulator to be altered without removing the cover. The cover is preferably made of celluloid.

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.

Full hints to correspondents were printed at the head of this column in the issue of August 8th, or will be sent by mail on request.

(10888) J. L. M. asks: What is the most practical and least expensive process to produce, as near as possible, an absolute vacuum in a chamber containing about four cubic feet? Will it require a greater capacity of power to empty a large space than it will a smaller one? A. To exhaust so large a space it will be necessary to use a mechanical air pump. It is not possible to produce an absolute vacuum by any means of exhaustion. It will, however, not require any greater power to empty a large reservoir. It will require more time.

(10889) E. V. V. writes: I have had some little trouble in convincing a man that ice forms on the bottom of a running stream of water, but having seen the same I know I am right. Would you kindly answer same in your valuable paper? A. Anchor ice is often to be seen fastened to the stones on the bottom of a stream, and also to the timbers around a mill. Very frequently mills are stopped by the anchor ice during a very cold snap.

(10890) B. H. G. asks: Please inform me through your Notes and Queries the principle and details of the radiometer? A. The radiometer is a heat instrument. Light has no connection with it. It consists of a glass globe, usually about two inches in diameter, exhausted to a suitable degree. Within is a steel pivot upon which revolves a cross arm carrying four vanes of aluminium, one face of which is blackened by carbon. When heat falls upon the vanes the black faces absorb more than the bright and are hotter. The molecules of air coming in contact with the black faces are heated more than those coming in contact with the bright faces and rebound with more force. The reaction of this rebound causes the vanes to revolve with their black faces in the rear. The globe itself has been made to show a tendency to rotate in the opposite direction to the vanes, this being due to the bombardment of the inner surface of the glass by the stream of molecules which rebound from the vanes. Thus the radiometer is a heat engine, transferring heat from the black side of the vanes to the surface of the glass opposite. A satisfactory explanation of the phenomenon is given in Barker's "Physics," price $3.75 by mail. See also SUPPLEMENTS 13, 37, price ten cents each. 2. Please state also whether energy exists in light, and to what extent. A. Light and heat are now classed together as radiant energy by scientists, and the energy of both is measured by absorbing some material and determining the heating effect it produces. The energy of light as light has not been measured by any mechanical effect which it can produce.

(10891) C. M. A. asks for information concerning sodium silicate. A. Silicate of soda (or soluble glass) is prepared by fusing together carbonate of soda and sand, or by boiling flints in caustic soda under great pressure. It is not soluble in cold water, but dissolves in five or six times its weight of boiling water. It is employed in the manufacture of soap, in fixing colors, in preserving stones from decay. In admixture with other silicates, silicate of soda occurs in glass; and it (equally with silicate of potassa) imparts the property of viscidity before fusion to such mixtures, which is of great value in the working of glass.

(10892) J. N. P. says: 1. Why and how does water put out fire? Why does the water have the same effect whether hot or cold? A. Water puts out a fire by reducing the temperature of a flame below the point of ignition, and is especially efficient for this purpose because of the large amount of heat that is required to turn it into steam. It is almost as effective when hot as when cold, because of the great amount of latent heat in the water. 2. Does the sun shining directly on a cooking stove have any effect upon the cooking? Does it lessen the baking in any way? If when shining on a fire in an open grate, does it reduce the heat? A. The sun shining directly on a stove or fire in an open grate tends to increase the temperature slightly, just as it tends to increase the temperature of any other object. The bright sunlight, however, may make the fire appear less brilliant, and therefore appear to give out less heat. This effect, however, is deceptive.

(10893) W. B. H. writes: I was given a question in a recent examination that the examiner stated was proved in a copy of your magazine; but he could not state the date the example appeared nor prove it himself. The problem read: "Do the amperes or volts increase when the electricity passes through an ordinary spark coil for gas lighting?" I said volts, yet my examiner says the answer is amperes, which I doubt. A. The volts are raised in the action of the ordinary spark coil in gas lighting. This coil has but one winding, no secondary. It is not an induction coil in the usual sense. The spark is produced by the self-induction of the current in the turns of the primary upon itself. This produces a higher E. M. F., which causes a considerable spark. There can be no more amperes in the circuit than the generator can produce.

(10894) W. A. P. asks: 1. Should an ampere-meter be placed in the positive or negative terminal of a direct-current 110-volt dynamo? A. The ammeter may be placed at any point whatever in an electric circuit, since the same current flows through every part of a circuit. This is just like the flow of water through a pipe. If you had a pipe 1,000 feet long from a reservoir to your house, the same water and just as much would flow through every foot of the pipe, and a meter might be put into the pipe at any point in its length and the quantity of water flowing through the meter to be measured. 2. How much more would it register in the former than in the latter? A. It would register the same in either side of the circuit. It makes no difference where the ammeter is placed.

(10895) A. E. S. says: May I ask you to kindly inform what chemical changes take place during the setting of Portland cement, plaster of Paris, and similar substances. A. Mortar, which is made of slaked lime and sand, when exposed to the air, slowly changes into carbonate of calcium, and the entire mass becomes extremely hard. The water contained in the mortar soon passes off. When limestones that contain magnesium carbonate and aluminium silicate in considerable quantities are heated for the preparation of lime, the product does not act with water as calcium oxide does, and this lime is not adapted to the preparation of ordinary mortar. On the other hand, it gradually becomes solid, in contact with water, for reasons which are not known. Such substances are known as cements. Plaster of Paris is found in nature in the form of gypsum or anhydrite, and consists of calcium sulphate and water. A granular form of gypsum is called alabaster. Calcium sulphate is difficultly soluble in hot and cold water. When heated to 100 deg. Cent. or a little above, it loses all of its water and forms the powder known as plaster of Paris, which has the power of taking up water and forming a solid substance. The hardening is a chemical process, and is caused by the combination of the water with the salt to form a crystallized variety of calcium sulphate.

(10896) H. H. M. says: Would you kindly inform me if I could get an object to float that is heavier than the water it displaces? For instance, are these large ocean steamers heavier than the water they displace? A. If a rigid body or solid be immersed in a liquid, both being at rest, the resultant action upon it of the surrounding liquid is a vertical upward force called the "buoyant effort," equal in amount to the weight of the liquid displaced, and acting through the center of gravity of the volume of displacement. From this it will be readily seen that you cannot secure an object to float which is heavier than the water it displaces. In the case of the vessel, because of the particular form of the hull, the law of displacement remains the same. The weight of the water displaced by the hull equals the entire weight of the ship and its cargo.

(10897) G. J. R. asks: Can you give me the reason for the vibration in a motor or generator when the armature and shaft are balanced as nearly as possible? I would like to see what your opinion is in regard to it. A. The slightest excess of weight on one side will cause a perceptible vibration of an armature. As little as one-thousandth of the total weight will cause a very considerable vibration. If an armature is perfectly balanced, it will run so quietly that it is difficult to tell whether it is in motion or not. The process of balancing an armature is described in Crocker's "Electric Lighting," Vol. I., price $3 by mail.

(10898) G. H. E. writes: In an informal conversation the statement was made that of the energy stored in a given amount of coal an extremely large proportion is lost in the attempt to employ it productively, as in the steam engine, and that the utilization of the energy wasted by the present methods is an important scientific and economic problem. This statement was challenged, and in the resulting discussion the following questions arose. 1. How large a proportion of energy stored in a given amount of coal is lost by methods commonly in use? A. From 20 to 25 per cent, and sometimes more, of the heat value of the coal is now lost. 2. At what stages in the process of transformation, and how, do the chief losses occur? A. Mostly by the heat going up the chimney, and to a small degree by bad stoking and radiation of heat from defective insulation of boiler setting and pipes. 3. What percentage of the energy in a given amount of coal can be (not is) used in producing steam? A. The possibilities for utilizing the full energy of coal are very small. Little may be expected over the best practice of to-day. It is the converting of the steam into active power wherein the trouble lies. 4. How is the amount of energy in a given amount of coal ascertained? A. The absolute amount of energy in coal is found, first by an analysis of its combustible constituents, from which the heat units are computed; second, by actual combustion of a given weight and measuring its heat producing property by absorption of the heat in water or by melting ice in a calorimeter.

(10899) J. A. M. writes: Will you kindly inform me whether the following facts are new, or only so to the writer? The mechanical equivalent of heat as given by Dr. Joule's experiment of a weight falling through air, actuating thereby wings in water, is 778 foot-pounds according to William Kent. Now you will note that the relative weights of water and air are as 1 to 774. Is there not an equation here between work, water, heat and air? Might not the slight variation of 774 and 778 pounds be due to the slip of the water? William Ripper gives the equivalent as 772 pounds. A. The mechanical equivalent of heat, which is called Joule's equivalent, as determined by Dr. Joule, was 772 foot-pounds. That is, to lift 772 pounds to a height of 1 foot requires the same amount of work as to heat 1 pound of water 1 deg. Fahr. This work was done between 1840 and 1843. Considering the condition of mechanical science at that time it work was a marvelous piece of work. He employed the friction of water and measured the heat produced. Joule also determined the equivalent by means of the electric current. Others investigated the same constant by other methods, the compression of metals, the specific heat of air, the induced electric current in metals, and the velocity of sound, with results fairly in agreement with that of Joule. Joule's method was that of direct determination of the number of foot-pounds of work used in actually heating one pound of water one degree. Other methods were indirect. That these coincided fairly well with the direct method was all that could be expected. All methods are open to errors, and more or less close approximations are all that could be attained. In 1879 Prof. Rowland took up the problem with the finest appliances of modern science. He employed water friction, as did Dr. Joule. His results were immediately accepted. Probably the work will not be done over again for a generation. Some of his results involved as many as 12,000 distinct observations. He proved that the mechanical equivalent varies with the temperature. Between 41 deg. and 68 deg. there is a change of nearly eight-tenths of one per cent in the latitude of Baltimore. The mean of Prof. Rowland's results is 778 foot-pounds, which for all ordinary purposes is at present considered the true equivalent. Prof. Rowland's experiments showed that the specific heat of water diminishes from 32 deg. to 84 deg., and then increases till the boiling point is reached. Rowland was able to produce a change of 63 deg. in the water where Joule could produce a change of only 1 deg. He also used the sensitive air thermometer instead of the slow mercurial thermometer.

(10900) J. C. A. asks: Please inform me how to make a strong magnet of Jessop steel. I have tried to make some ½ inch square by 3 inches long, straight bars, by passing them through a spool of wire with a 300-volt current, by which they were strongly magnetized, but lost almost all magnetism in about three weeks. How can I make such magnets which will retain their strength for a long time? A. Heat the bars to be magnetized to a red heat and plunge them into water. They are then to be magnetized. Straight bars do not retain magnetism well. They should lie in pairs with opposite poles toward each other, side by side, not end to end, or else in pairs with an iron keeper across the poles. They may be laid four in a square with opposite poles against each other. Laid down alone without keepers, the magnetism is rapidly lost.

(10901) W. F. G. asks: Will vulcanized fiber answer for the insulation on static machines, and are vulcanite and vulcanized fibers identical? A. Vulcanized fibers will be but little better than wood as an insulator in this position. Vulcanite is hard rubber and is a different substance from fiber.

(10902) E. L. asks: 1. Can you tell me, without knowing the amperage, the voltage being 50 volts, if a 75-watt dynamo or 1-6 horse power as motor will light 5 lamps of 10 candle power at full capacity? A. Ten-candle lamps may be taken to be from 3 watts to 4 watts per candle. One lamp will consume from 30 watts to 40 watts, and 75 watts will light two such lamps. 2. What is the resistance of No. 16 iron wire? A. Pure iron has a resistance of 6 times as great as copper. Ordinary telegraph wire has a resistance 15 times as great as that of copper of the same size. No. 16 copper wire has 248.81 feet per ohm. Pure iron wire of the same size would have 41.47 feet per ohm, and No. 16 ordinary iron wire would have 16.19 feet per ohm. 3. If a current of 10 amperes at 108 volts goes through 540 feet of No. 16 iron wire, what will be the electromotive force and current remaining after it has gone through, and how to calculate it? A. There will be 10 amperes remaining. But there will not be any volts remaining, if the wire constitutes the entire circuit between the mains. The same amperes flow through the entire circuit and come out at the other end, just as the water flows through the entire length out of a pipe open at both ends and comes out at the other end. The drop of potential along a wire is proportional to its length, provided it is of uniform sectional area, as it may be presumed to be in this case. This being so, there will be a drop of one volt for each four feet along the wire. 4. Can we run a direct-current motor with an alternating current? The motor is not loaded. A. Yes; if it be started and brought up to synchronism with the current by hand, or by some other power. It will then keep step, and run by alternating current.

(10903) E. B. asks: 1. I want to magnetize an ordinary twist drill, making a magnet of it. Will I have to draw the temper of the drill first, or can I make a magnet of it as it is? A. The cutting end is already hard enough for your purpose. Heat the other end to redness and plunge into water, then magnetize. 2. How many amperes of current will it take to magnetize it by means of a coil of 6 or 8 layers of No. 18 silk-covered wire, the current being 110 volts? A. You must be governed by the heating of your coil. Use only so much current as will not heat the coil so that the insulation burns. That would destroy the coil. 3. In making a permanent magnet of tool steel, shall I first soften the steel before magnetizing it, or should it be hardened at the ends? A. Harden the bar at the ends glass hard.

(10904) E. S. D., Jr., writes: 1. I would like to know if you could give me the formula for a solution for bichromate cells, with a good ampere output, in the right proportions, and how to mix it, etc.? A. A good solution may be made after the method described in Supplement No. 792, price ten cents. 2. Which is the best form of bichromate to use for making electropoion fluid—the sodium or the potassium? A. The sodium salt is easier of use. 3. What is the best way of amalgamating a zinc? A. The usual method is to clean the plate with dilute sulphuric acid, and then rub mercury over the plate, dipping it into the dilute acid if necessary to make the mercury take to the surface. 4. I would like to know if I could have a battery rheostat made for these batteries, steady current, etc.? A. Yes; though there is little need of one. The amount of current can be regulated by immersing the zincs to a greater or less depth in the liquid.

(10905) A. B. McK. asks: Will you kindly give me what information you can on the following subject? Take a piece of steel and cut in two pieces. Make one as soft as possible and the other as hard as possible; now, what will be the difference in resistance in ohms, if any? A. Barus and Strouhal give the specific resistance of glass-hard steel as 45.7 and of soft steel at the same temperature as 15.9. This is the resistance in thousandths ohms of a bar one square centimeter in cross section.

(10906) C. W. asks: Please inform me as to the difference between an aneroid and a holosteric barometer. A. The word *aneroid* is from two Greek words meaning without liquid, and the word *holosteric* is from two Greek words meaning wholly solid. They are two names for the same thing. There is no difference between them.

(10907) G. M. D. asks: What should be the dimensions, size and amount of wire for a 12-inch coil, 15-inch coil and 18-inch coil? Is there any definite relation existing whereby the above information may be determined from a known coil? A. The dimensions of induction coils are the result of experience rather than of calculation. The properties of the magnetic circuit and the effects of induction are well known, and can be applied to an induction for giving sparks; but almost every builder works from designs which have been wrought out by experiment and are known to give good results. The sizes and windings of certain large coils are given in Hare's "Large Induction Coils," price $2.50 by mail.

(10908) F. J. B. asks: I would thank you if you would treat upon the hardening of copper and aluminium, and if the discoverer of same would be amply rewarded. A. There is a very old belief that the ancients knew how to temper copper as we temper steel. No tempered copper is in existence, and there are scholars who do not believe it ever was done. We doubt very much whether there would be a wide use for hardened copper or aluminium, unless their tensile strength could be greatly increased by the process. We have assisted in making experiments to this end, but without success. If aluminium could be made as strong as iron, there would be a great market for the wire for electrical purposes.

(10909) J. J. S. asks: 1. In making Leyden jars, I have had great difficulty in coating the inside with tinfoil. Will you kindly advise me on the following points: Would it do equally well to half fill the jar with tinsel, of course coating the outside with tinfoil? A. No. The tinsel will not be continuous, nor will it be in contact with the sides of the jar. 2. Would it do to shellac the inside up to the proper height and shake in bronze powder? A. Not so well as tinfoil. 3. In using tinfoil, should the bottom, inside and outside, be covered? A. Yes. There is not much difficulty in placing the tinfoil properly in the jar. Cut the foil into strips of two inches or thereabout in width. Apply the paste to the inside of the jar with a long-handled brush. Put the foil in with forceps or in any other convenient manner, and bring it to its place and rub it down with a dry brush with long bristles. 4. I have made a Wimshurst machine with 18-inch plates, but can only get a spark of ¾ inch. Is this all a machine of that size is capable of, or have I made some mistake in construction? A. The spark is not long when a Leyden jar is not used. And indeed when the jar is used, its effect is to render the discharge intense rather than to lengthen the spark.

(10910) M. O. C. asks: Can you inform us how to copper common iron castings without a battery so they will not rust, or how to whiten them by dipping? A. To copper iron castings, the articles must be made perfectly clean, and then dipped in a solution of 1½ pounds copper sulphate in water to which 1 ounce sulphuric acid has been added. They are then washed and dried.

(10911) W. H. asks: Please give me the best formula for a dry primary battery. A. One of the best dry cells is said to be filled with the following mixture: Oxide of zinc, 1 part by weight; sal-ammoniac, 1 part; plaster of Paris, 3 parts; chloride of zinc, 1 part; water, 2 parts.

(10912) F. J. R. says: Hearing there is a certain tree which grows in salt water, please give me the name of said tree. A. There are a number of trees which will grow in salt water, of which perhaps the best known is the mangrove. There are many places in the tropics, notably in Papua, Borneo, Java, and other East Indian islands, where for miles there is no "coast" in the ordinary sense of the word, vegetation being reached directly from the ocean some distance, often miles, before solid ground is reached, forests of mangroves growing out of the shallowing sea, between which it is possible to cruise in small boats by innumerable sheltered waterways, locally known as "trusons," among the mangrove stems and roots.

(10913) A. G. asks: Kindly advise where I can procure the formula for calculating the horse-power of a 4-cylinder 4-cycle gasoline engine, cylinder 5¼ x 6 inches, 400 revolutions per minute. This is for marine engines. I need a certain power for an experiment I am trying, and find considerable difficulty in getting reliable data. A. There is no difference between the formula for calculating gas engine horse-power and that for steam engines, namely, horse-power $= \frac{plan}{33{,}000}$ in which $p =$ the mean effective pressure, $l =$ the length of the stroke in feet, $a =$ the area of the piston in square inches, and $n =$ the number of effective strokes. The last-mentioned point is the only one in which a mistake is likely to be made. Whereas in an ordinary double-acting steam engine (with steam acting on both sides of the piston) the number of effective strokes is double the number of revolutions, in a 4-cycle gasoline engine taking gas only on one side of the piston there is only one effective stroke in four, i. e., the number of effective strokes is half the number of revolutions. There is more difference between indicated and brake horse-power in gas and gasoline than in steam engines, because in the latter the difference is only friction of the parts, whereas in the former it includes overcoming the inertia in the inspiration and exhaust strokes and compression of the gas.

(10914) E. H. A. writes: All text books on physics will state that action and reaction are equal. Yet reaction applied records more failure than success. Branca's turbine, the little twirly-twirly sprinkler in the yard, reaction ship propulsion, have all proved that reaction is not equal to action. The Pelton wheel is efficient because it is an action wheel mainly. The only record of a reaction device being a success is the Avery steam turbine, an American invention. However, it seems to have been short-lived. Of course, you stand ready to affirm that action and reaction are equal. Could you then shed some light on the weakness of all reaction? A. We regret that we are unable to take your view of the law of action and reaction. Perhaps the other form of statement might be plainer: "The mutual actions between two bodies are equal and opposite in direction." The meaning of the statement is that a force exerted on any body is exerted by some other body, and this other body experiences an equal and opposite force to that it exerts upon the body against which it acts. A bat strikes a ball. The bat loses the amount of momentum which it gives to the ball. In other words, the ball reacts against the bat to the same amount as the bat acts upon the ball. This satisfies us, and it has satisfied mathematical calculations of forces and their effects for a very long time. We are unwilling to give it up till its place can be supplied with a principle better than this.

(10915) C. A. S. writes: Referring to query 10860, Scientific American, September 26, 1908, will you allow me to suggest that the term "weight" is the source of much misunderstanding, as it is indiscriminately used in two senses? Generally and commercially, the "weight" of a substance is simply a measure of the quantity of matter in the object weighed. In this sense it is always the same when weighed on the ordinary commercial scales, whether on, above, or under the surface of the earth. When "weight" is used in place of "force of gravity," then it varies with the altitude, as explained in the above query, because, in that sense, it is altogether a different thing. Generally speaking, the lever scale is a *matter-measuring* machine, and the spring balance is a force-measuring machine. The amount of matter as on a high mountain as determined by the lever scales; but the *pull* of the force of gravity on that same body is less on the mountain than it is on the surface of the earth, as determined by a spring balance (a force-measuring machine, or dynamometer). A. We are not able to agree with your use of the word "weight" in two senses. The textbooks all use the word in the sense of "measure of the force of gravity." We do not know any other scientific sense of the word. Mass is universally employed for "quantity of matter," which, as you say, is invariable. The distinction might be made as you give it, but it is not in the scientific world and in the textboks which our youth study, and it would take too long to introduce it. The game is not worth the candle. We had better continue to say mass when we mean mass, and weight when we mean weight.

(10916) H. C. E. asks: In the experiment "to measure the velocity of sound by a resonance tube," we add to one-quarter the wave length or the length of the resonant tube, a fractional part of the diameter, which correction Lord Rayleigh gives as one-half. Will you tell me why the diameter affects the experiment and necessitates this correction? A. The fact that a pipe is not an exact fraction of the wave length of its fundamental tone is determined by experiment, and the fractional part of the diameter or radius to be added as a correction can then be determined. It is true that the calculations are not exact, and the allowance for the "end correction" is not entirely satisfactory. It is to be taken as nearer 0.6 than 0.5 of the diameter. The reason is found in the reflection of the waves from the yielding air at the open end of the pipe. This has the effect to move the node farther out beyond the end of the pipe. This effect is greater in a large pipe than in a small one, since there is a broader surface of air over the open end than in a small pipe. It is simple, then, to make the end correction depend upon the diameter of the pipe. This is discussed at some length in Poynting and Thompson's "Text Book of Physics," Sound, pages 104 to 108.

(10917) R. F. K. asks: Is there any substance that can be interposed between a horseshoe magnet and a piece of steel that will prevent the attraction of one for the other? A. There is no substance which can be interposed between a magnet and a piece of steel to cut off the action of the magnet upon the steel, excepting a heavy piece of iron, heavy enough to furnish an easy path for the lines of force of the magnet. They will then take the path through the iron, and will not reach the piece of steel farther away. Magnetism cannot be insulated as electricity can.

(10918) C. S. says: Which color on a window curtain will be the most effective in keeping out heat from the direct rays of the sun? A. White is supposed to be the coolest color, that is, to keep out the most of the heat of the sun, and therefore to be coolest for clothing and curtains.

(10919) D. O. V. says: Suppose we have a 3-phase, 60-cycle, 220-volt alternating-current motor on a constant load. We apply 220 volts at the terminals, and the motor carries the load on 10 amperes of current. Now suppose we apply 440 volts at the terminals, how many amperes will the motor draw? What will be the result? Will the amperage be higher or lower than in the first case? A. If you should apply 440 volts at the terminals of a motor wound for 220 volts, the result would be that you would have to call out the fire department, and lose the machine if the fuses did not blow. It would cause a burn-out. Consider Ohm's law: Amperes equal volts divided by ohms. With an alternating current you must also introduce the induction and reactance as increasing the resistance and reducing the amperes, but if you double the volts you must of necessity greatly increase the amperes. With a direct current, doubling the volts doubles the amperes, the resistance being the same. A good book from which to learn the characteristics of electric currents and machines is Sloane's "Handy Book," which we send for $3.50. It should be in every electrician's library.

(10920) J. W. B. says: I have been reading your paper for several years, and have found your answers to correspondents to be all right, except I wish to disagree with you in your answer to query 10826, in which you state that to make ground connection with the steel cresting with heavy telegraph galvanized wire would be as good a protection against lightning as could be had. Now, in the first place, you know as well as I do that copper is a better conductor for electricity than steel or iron, so I claim that the only real way to protect from lightning is to properly rod the building with a pure copper lightning rod, putting it on in one continuous piece of cable and erecting pure copper joints not less than 5 feet long nor over 24 feet apart, nor over six taps to two ground connections. I have seen buildings badly damaged by lightning that were protected just as you recommend in 10826 answer. Also I have seen telephone poles split all to pieces that had a galvanized wire grounded and run 5 inches above top of pole. So if a wire of that sort would not protect a little telephone pole, what good would it do on house or barn? A. We regret that you are unable to agree with our note upon the use of heavy galvanized wire as a lightning rod, and that we also find ourselves unable to agree with your idea of a suitable lightning rod, the tall copper rod with points raised several feet above the roof. We are minded to present a somewhat full discussion of these points from the standpoint of the most recent articles by authorities upon the matter. As to points upon the rod, we quote Dr. Neesen of Berlin, Germany, in Supplement 1503. Describing the failure of points to discharge a Leyden jar, he says: "If the small charge of a Leyden jar cannot escape during the approach of the cup, the immensely greater discharges of the air can surely not be dissipated in this way. Millions on millions of points, like the leaves and twigs of a forest, are needed. But even in a forest it happens that a single tree is struck by lightning. Conductors without points can draw the discharge to themselves from other parts of the building. In recognition of this fact, intelligent makers of lightning protectors have discarded the points of platinum, carbon, etc., once so highly esteemed." This we published in 1904. Perhaps it escaped your notice. Later in the same article the professor describes the network of wires as the most efficient means of protecting oil tanks and powder mills, and approves the use of metal ridge plates, roofs, gutters, and leaders, although the danger of air gaps in such parts of a building would render the reliance upon these rather doubtful. Turning now to some English authorities, Maxwell proposed to cover the house with a network of wires, making it in effect a Faraday's cage for protection from lightning. That so complete isolation is not a necessity in our country would prevent the use of this method here. Prof. Silvanus P. Thompson and Sir Oliver Lodge, both of the highest authority, agree that iron is to be preferred to copper. Their rules are to be found in Thompson's "Electricity and Magnetism," page 320, price $1.50. We quote for you the principal points, although we printed them in full not many years ago in the Scientific American: "1. All parts of a lightning conductor should be of the same metal, avoiding joints, and with as few sharp bends or corners as may be. 2. The use of copper for lightning rods is a needless extravagance. Iron is far better. Ribbon is slightly better than round rod; but ordinary galvanized iron telegraph wire is good enough. 3. The conductor should terminate not merely at the highest point of a building, but be carried to all high points. It is unwise to erect very tall pointed rods projecting several feet above the roof. 4. A good deep wet earth should be provided, independent of gas or water pipes. 5. Connect gas and water pipes metallically. 6. Insulate the conductor away from the walls, so as to lessen the liability to lateral discharge to metal stoves and things inside the house. 7. Connect all external metal work, zinc spouts, iron crest ornaments, to each other and to the earth, but not to the lightning conductor. 8. The cheapest way to protect an ordinary house is to run common galvanized iron telegraph wire up all the corners, along all the ridges and eaves, and over all the chimneys; taking them down to the earth in several places, to a moist stratum, and at each place burying a load of coke. 9. Over the tops of all chimneys it is well to place a loop or arch of the lightning conductor made of any stout and durable metal." We may use for an American authority Prof. Carhart of the University of Michigan, of whom you doubtless know. We quote from his textbook, "University Physics," vol. 2, page 229, of the latest revision, price $1.75. He says: "The revision of theory and the results of experiment have left much of former recommendations relating to lightning rods of doubtful value. For the condition of steady strain pointed conductors are still advisable; but it is not necessary to provide the elaborate terminals formerly deemed essential. Nor is a copper conductor of large section necessary or desirable. It is far better to provide a number of paths for the discharge down several different parts of the building, each consisting of a large galvanized-iron wire sharpened at the top, avoiding short bends and loops, and ending in a mass of iron or charcoal buried in moist earth. Such a conductor may be fastened directly to the building without insulators. It is probable that No. 4 or 6 iron wire, B.S.G., will safely carry off any discharge that is likely to traverse it. The writer has known a much smaller iron wire to conduct safely a discharge which converted smaller copper wire into vapor. Tall chimneys may be adequately protected by three or four iron wires ranged around the outside, not placed together, but connected at frequent intervals, and all well grounded." We have quoted thus at length so as to place within your reach opinions to which you may not have access, although if you have your file of the Scientific American and the Supplement you have all and much more at your hand if you search it out. The only basis of preference for copper is its durability, freedom from corrosion near gases from chimneys, as compared with iron. It has no electrical advantage over iron. Its greater cost renders it less desirable than iron. It is rarely a question of electrical resistance. Benjamin Franklin long ago noted the leaving of a good conductor by the flash to take a small wire or a streak of gilt metal on a wall paper, having an enormous resistance, relatively. Some other reason must be sought. It is found in this: There are different kinds of electrical discharges, in only one of which is resistance of any account. If the cloud rises steadily in intensity and induces a similar quiet condition of charge in the earth below, by and by the cloud and the earth will equalize, by a lightning discharge, and the strain will be relieved. Such a discharge will follow a conductor almost as well as a battery current. Such discharges are not uncommon. Lightning rods carry these off safely, and the copper rod you describe will do it well. But so will the iron wire just as well. A frequent discharge is of another sort. It is called the impulsive rush. To quote Prof. Carhart, page 228: "In this case the electric pressure is developed with such impulsive suddenness that the dielectric (the air) appears to be as liable to break down at one point as at another. Such sudden rushes are liable to occur when two clouds spark into each other and then one overflows into the earth. [You may have seen this.] The highest and best conducting points are then struck irrespective of points and terminals. The conditions determining the path of the discharge in the case of these impulsive rushes are entirely different from those of the steady strain, and points are incompetent to afford protection by preventing them." This last condition describes exactly the case of the telephone pole which you have seen struck when it had a guard wire. It is found not infrequently in the long transmission lines of the West, especially in mountainous regions, and constitutes the greatest danger from lightning. Against it no rod is effective, and the heavy copper or even iron rod, some of which we have seen put up an inch thick, is entirely worthless. Finer wires are better in this case, although not a safeguard, since if struck they may be melted and thus dissipate the electric energy by using it up as heat. Indeed, the best protection would probably be rendered by a system of wires fine enough that the current would melt them and thus save the building. One could however hardly put up a new system of wires after each stroke of lightning. There might not be time to install the new wires between the strokes, for lightning does strike twice in the same place. As we said before, we have published many articles upon lightning protection since these new facts caused a revision of practice in putting up lightning rods, and they may be found in our columns within fifteen years. Although this note is probably already the longest we have ever printed, we would add a reference to the work of the U. S. Weather Bureau upon this matter, which completely agrees with the foreign and American authorities we have so freely quoted. Any one interested may obtain these reports from the Superintendent of Documents, Government Printing Office, Washington, D. C. They are "Lightning and the Electricity of the Air," 50 cents, and "Recent Practice in the Erection of Lightning Rods," 10 cents. Inclose the money in coin or postal order, not in stamps. Valuable articles may be found in our Supplements 1212, 1452, 1581, 1524, and others to be found by reference to our Catalogue of Valuable Articles, which is sent free upon request.

NEW BOOKS, ETC.

Telephone Construction Methods and Cost. By Clarence Mayer, formerly Cost Statistician and Facilities Engineer, Chicago Telephone Company. Appendix A on Cost of Materials and Labor in Constructing Telephone Line, by J. C. Slippy, Consulting Telephone Engineer; and Appendix B on Miscellaneous Cost Data on Pole Line and Underground Conduit Construction, compiled by the Editors of Engineering Contracting. New York and Chicago: Myron C. Clark Publishing Company, 1908. 8vo.; pp. 284. Price, $3.

This is a highly technical book, particularly adapted for the practical man, to whom a knowledge of construction costs is essential. It contains actual cost records which have been carefully compiled, as well as practical and flexible systems for the collection of such records and methods of computing, proportioning, and prorating costs of all kinds. Its pages contain the most approved methods of doing telephone work, and give the costs of such work in all its details.

An Introduction to Electricity. By Bruno Kolbe, Professor of Physics at St. Ann's School, St. Petersburg. A translation of a second edition of "Einführung in die Elektrizitatslehre," with corrections and additions by the author. Translated by Joseph Skellon, late Assistant Master at Beaumont College, Old Windsor. Philadelphia: J. B. Lippincott Company, 1908. 8vo.; pp. 430. Price, $3.

Although we have many works on elementary electricity, the present volume will be welcome for the fact that it deals with the subject in a manner that is decidedly out of the ordinary. The material was originally delivered by Prof. Kolbe in the form of lectures to his class in St. Petersburg; and in order to present the subjects in a practical way, and one that would impress the students, he made a collection of electrical experiments which were new and directly to the point. Many of the experiments were original, and others were unearthed from the back numbers of scientific periodicals where they lay buried from the gaze of the general public. As a result the book entirely lacks the stereotyped illustrations which one invariably finds in works of this character. Part I covers first the subject of static electricity, and dynamic electricity is taken up in the second part. The volume closes with an appendix containing historical remarks, repairs, and supplementary and practical hints.

The Principles of Mechanics. For Students of Physics and Engineering. By Henry Crew, Ph.D. New York: Longmans, Green & Co.; London, Bombay, and Calcutta, 1908. 12mo.; cloth; 295 pages; 110 figures. Price, $1.50.

The author of this book is the Fayerweather Professor of Physics in the Northwestern University, and his work comprises lectures which during several years have been given to second-year students in physics in the institution. The previous training needed for pursuing the education laid down to the students is a course in general physics and one, either concurrent or antecedent, in the calculus. This course in the science of mechanics consists of kinematics, kinetics, some applications of general principles to special problems, friction, dynamics of elastic bodies, and fluid motion.

The Wonder Book of the Atmosphere. By Edwin J. Houston, Ph.D., Author of "The Wonder Book of Volcanoes and Earthquakes." New York: Frederick A. Stokes Company. 12mo.; cloth; 326 pages; 69 illustrations. Price, $1.50.

The attempt has not been made in the book to explain all atmospheric wonders, the author assuming that they can be better treated in other Wonder Books in the series. The field of discussion has been wide enough to include, among other matters, the composition of the atmosphere, its temperature, climate, wind, moisture, dust, navigation, ozone, weather myths, and prodigies. The work is sufficiently painstaking and reliable, and a valuable contribution to scientific research of the phenomena of our thin shell of air. It is also a large addition to atmospheric folk-lore, to such an extent that much of the volume might be considered as material fitted for a wonder book of the imagination.

Deutscher Schiffbau 1908. Herausgegeben aus Anlass der ersten deutschen Schiffbau - Ausstellung in Berlin. Chefredakteur: Geh. Reg. Rat Professor Oswald Flamm, Charlottenburg. Lex. = 8°, 230 Seiten mit 239 Abbildungen. Verlag Carl Marfels, A.-G., Abteilung: Zeitschrift "Schiffbau," Berlin S. W. 68, Zimmerstrasse 9. Price, $1.

This volume may be regarded as an expression of German engineers on German shipbuilding. The principal articles are "The Development of the German Navy," by J. Rudloff; "The Marine Engine, its Modern Design, and its Future Prospects," by Prof. Krainer; "The Marine Steam Turbine," by H. Schmidt; "Development and Present Status of Marine Boilers and Marine Auxiliary Machinery in Germany," by Prof. Walter Mentz; "Marine Gas Engines," by Prof. F. Romberg; "High School Training in Naval Architecture," by C. Flamm; "German Iron and Steel Industry and German Shipbuilding," by Fritz Luermann; "Shipyards," by Prof. W. Laas; "Cranes at the German Shipbuilding Exposition of 1908," by C. Michenfelder; "The German Shipbuilding Industry," by F. Meyer; "General Review of the Institutions and Authorities Identified with the Mercantile Marine," by Matthaei; "Electrical Plants for Ships," by C. Arldt; "Fitting Out Ships," by Fr. Jappe.

Autogenous Welding of Metals. By L. L. Bernier, M.E. New York: The Boiler Maker, 1908. Paper; 45 pages; illustrated. Price, $1.

The chapters in this small work are translated from Reports of the National School of Arts and Trades of France, and illustrated by numerous figures and engravings. They describe the application of autogenous welding to the manufacture of tanks; gasometers; receptacles for liquids or gases, with or without pressure; steam and hot water boilers; kettles; small boats; automobiles; piping, either steel, copper or brass, and coils of all kinds; and also its application to repairing old or new castings injured through such defects as blowholes, cracks, etc. To these are added its application to the manufacture of steel, brass, bars and plates, and to the destruction of metals, structures, etc.

INDEX OF INVENTIONS

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