RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

CHILD'S CAP.—LENA STEINTHAL, New York, N. Y. The purpose of the invention is to provide a construction of child's cap and one wherein the parts of the cap are permanently connected and are capable of being laid flat for purposes of washing, starching, and ironing and wherein, further, the parts may be quickly and conveniently drawn together and secured to form the front and back sections of a child's cap, the two sections being needed for the cap's formation.

Of Interest to Farmers.

MILKING-MACHINE.—L. B. STEVENS, Logansport, Ind. A person on the stool by moving a lever downward will cause a downward movement of a piston, and as the valves carried thereby will be closed the milk will be drawn from the udder, and then upon an upward movement of the piston the valve opens, permitting the milk to pass to the under side of the piston, and then by a subsequent downward movement the milk underneath the piston will be forced through a pipe and at the same time a fresh supply of milk will be drawn.

JOINTER FOR STUBBLE-PLOWS.—D. H. DICKINSON, Parker, Ore. The purpose of the invention is to provide an adjustable rolling jointer for stubble-plows which is economic in construction, and which will leave a clean furrow, turn all material from the plow-beam, and effectually prevent material clogging on the beam back of the moldboard, and which will also turn all stubble, weeds, and grass cleanly under the furrow.

Of General Interest.

BUILDING-BLOCK.—J. AITKEN, New York, N. Y. The object of the inventor is to provide a building-block for the construction of walls arranged to insure the formation of light and air-tight joints and to reduce the weight to a minimum and still render the block exceedingly strong and durable and to provide the block with air-spaces to prevent the penetration of moisture into a room by way of the wall.

SAFETY-ELEVATOR.—J. HART, New Orleans, La. In the present patent the invention has reference to elevators or lifts; and the purpose of the improvement is the provision of a safety device which will operate automatically to prevent the cage or car from falling in case of any breakage of the suspending-cable.

BURIAL-VAULT.—A. H. HAVARD, Urbana, Ill. One of the embodiments of the invention consists of a box-like structure built of concrete and having brace-bars imbedded therein, the whole having an inner rabbeted upper edge combined with means for lowering this part of the vault after it is dry and hard into the grave. A metal top fits into the rabbeted edge of the box-like structure and is placed thereon after the casket is placed in position. Thereafter the metal top is covered with green concrete, which knits to the lower portion of the vault and forms a hermetically-sealed case.

SCOOP.—F. C. HOWE, El Paso, Texas. The object of this inventor is to produce a scoop provided with means for weighing the contents of the scoop, the general purpose being to do away with the necessity of placing the substance within the scoop in a scale for weighing the same. The improvement refers to scoops such as used in stores and similar places in selling products, such as flour, sugar, etc. Mr. Howe has invented another scoop such as used as above; and the object of the improvement is the provision of a construction, having a handle or bail attached thereto, with means for determining the weight of the contents of the scoop.

DRAFT APPARATUS.—T. W. HUCKLE, Standish, Mich. The apparatus comprises a body to which power is applied, and is arranged to roll or climb along a holding element, this body having adjustably attached thereto means for connecting it with the weight, so that as the body is moved along the holding element power is applied to the weight. By adjusting said means for connecting the body with the weight the power of the apparatus may be increased or diminished.

PROCESS OF MAKING TERPIN HYDRATE. L. H. REUTER, New York, N. Y. The hydrate produced can be used as a basis for the manufacture of other turpentine derivatives and that by the use of this new process an important industry can be developed in the United States which has heretofore been exclusively carried out in foreign countries. Certain raw and waste products can be employed which have heretofore had to be refined and imported.

SAFETY-RAZOR. — W. SCHMACHTENBERG, New York, N. Y. The object here is to provide a razor which is simple in construction, composed of but few parts, not liable to easily get out of order, and arranged to permit minute adjustment of the blade to bring the cutting edge thereof in proper relation to the guard, and to hold the blade positively against rearward motion to maintain the cutting edge in the adjusted position.

FASTENING FOR HANDLES OF BAGS, SATCHELS, PURSES, ETC.—H. B. WELCH, West Hoboken, N. J. Heretofore handles of bags, satchels, etc., especially of fastenings which involve the use of a bearing having a swivel connection for attaching a handle, have been attached by inserting the ends thereof in sockets, the ends being held in the sockets each by a transverse pin. That fastening is defective, as the pins pull their way out through the handle ends. Mr. Welch produces a fastening by means of which the handle may be quickly attached and secured.

PACKAGE-HANDLING DEVICE. — W. R. DENNIS, Denver, Col. By moving a sleeve downward on a staff the jaws will spread apart so that they may be engaged with a box, package, or the like. Then upon releasing the sleeve the springs will move the jaws toward each other to engage with a box, package, etc. In shifting paper or pasteboard boxes, it is not desirable that the jaws shall clamp closely against the same while the box is resting on the hangers. To provide for this, the sleeve may be rotated so that the cam mechanism will lock the jaws at a suitable distance apart.

Heating and Lighting.

COMBINED HEATING AND COOKING STOVE.—J. I. HAMAKER, College Park, Va. By means of the present invention the improved stove is so constructed that it may be produced at a small cost. It practically contains an oven, a water-heater, a steam-cooker, and a warming-chamber, all arranged with a view to the greatest economy of heat and consequently of fuel.

Household Utilities.

STIRRER.—I. W. GREENWALD, Frederick, Md. The invention refers to stirring or agitating attachment for cooking-kettles, and has for its object means of this character which may be simple in construction and applicable to all open kettles commonly employed for cooking apple-butter or general purposes where the fluid or material should be stirred or agitated during the cooking process.

DUSTLESS BROOM.—J. R. PRICE, Fond du Lac, Wis. The object of the invention is to construct the device in such a way that it will prevent the raising of dust when in use, and a further object is to construct so as to enable the handle to be adjusted upon the body of the brush and also to construct the body of the brush in such a way as to enable the straws or bristles to be easily reversed or replaced when worn.

Machines and Mechanical Devices.

HEATING DEVICE FOR SPINNING-LATHES.—R. THIEL, Lubeck, Germany. The invention refers to improvements in heating devices for spinning-lathes whereby it is rendered possible to maintain the device at a proper and uniform distance from the blank while the latter is being spun—that is to say, during the reduction or increasing of the diameter of the respective part of the blank—so that the metal is at all times heated up to the right temperature and cannot become brittle and cracked.

ROAD-GRADER.—E. FAHRNEY, Deep River, Iowa. A purpose here is to proviide a machine that will plow and grade a road at the same time, in which a series of spades have rotary co-operative action relatively to the plow, cross-cutting the furrow as turned up by the plow, which spades when they reach a certain point at rear of machine under action of trip devices consecutively throw the dirt inward with such a quick motion that they scatter dirt in direction of the middle of the road, thus making it smooth, the spades acting equally well in dry, soft, soddy, or weedy roads.

PILE-FABRIC LOOM.—H. SARAFIAN, Yonkers, N. Y. Mr. Sarafian's object is to provide a loom for weaving pile fabrics—such, for instance, as are shown and described in the Letters Patent of the United States formerly granted to him and bearing Nos. 752,712 and 782,178. In order to produce the weave, it is necessary to manipulate three warp-threads of each set in a peculiar manner and relative to each other, and for this purpose a special device is used. In operation of the loom the thread on the bobbin of the shuttle unwinds to form a weft-thread at the time the shuttle goes through the open shed from one side of the loom to the other, and when the shuttle returns the same thread on the shuttle-bobbin forms a certain weft-thread.

SAWING-MACHINE.—S. J. GRAY and J. HORNING, Oakland, Cal. This machine is easily transported from place to place and is supported directly by the object to be sawed, thus dispensing with considerable weight. It may be positioned to cut at an angle upward or downward or may be reversed upon its plates when sawing close to the roots of the tree. Any suitable means may be used for imparting motion to the driving-pulley. Any preferred form of endless saw may be used with the machine.

LOADING-MACHINE.—F. K. HOLMESTED, Claremont. W. Va. The machine transfers any class of loose material from the ground or a platform into a conveyer, its object being to produce a device expeditious and efficient in operation. The invention consists, broadly in a revolving wheel or platform adapted to receive the loose material and discharge it upon a conveyer. The platform is set at a slight incline to the horizontal. A revolving plate combines with a side plate and conveyer-belt disposed across the upper face of said plate.

VARIABLE-SPEED GEAR.—C. E. FUNK, Enterprise, Ore. The invention pertains to variable-speed gears, and is especially useful in connection with machines for shearing sheep and the like. The object is to provide a transmission-gear, which permits the speed of the operating parts to be varied within wide limits and which allows the mechanism to be stopped or started by a simple motion of the operator.

HAND-POWER PROPELLER.—N. JOHNSON, Chicago, Ill. In this case the invention has reference to hand-power propellers, and has for its object the provision of means for propeling small boats upon park-lakes and similar places without the use of oars, and thereby enable such boats to move about freely, without interfering with each other.

CIGAR CUTTER AND LIGHTER.—F. A. WIDMANN, Philadelphia, Pa. One purpose here is to provide a form of cutter and lighter wherein a tension-controlled fountain for liquid fuel, such as gasoline, is provided with a wick for ignition and pivotally mounted upon the base for movement to and from the sparking device in an electric circuit the batteries whereof are concealed in the base, so as to produce a spark at the exposed portion of the wick as the fountain is swung outward to light a cigar, the current being closed and opened at moment of passage of the fountain to and from contact with the sparking device.

BALL-BEARING.—J. F. SPRINGER, Girard, Pa. The object of the invention is to provide a bearing arranged to insure a true rolling motion of the balls, unaccompanied by sliding between balls and bearings, to bear heavy strains, and to allow convenient adjustment with a view to taking up wear, and more especially designed for use on journal-bearings and the like, in which the main portion of the strain is approximately perpendicular to the axis of the shaft.

LABELING-MACHINE.—A. MARCUS, Shreveport, La. In operation a bottle or package is placed on a seat. A label is then taken off the pile and is passed over an exposed surface of the pasting-roller from left to right to apply the paste, and the label thus charged uniformly with paste or glue is by continuation of the same movement quickly slipped onto the bottle in about the same plane, thus getting the label on the bottle immediately after pasting it and before it has time to curl up. Location of labels on bottles is uniformly the same by the indication afforded by the marker.

AUTOMATIC WEIGHER.—A. MCLEOD and J. H. MCLEOD, Marietta, Kan. The grain is received into a stationary hopper and discharged therefrom into a movable weighing-hopper which is so connected with weighing and other mechanism that when filled it tilts automatically and the weight is duly recorded or registered, the hopper being then automatically restored to its first position, whereupon it receives another charge of grain and tilts and discharges as before. It is an improvement upon the weigher for which the inventors formerly received Letters Patent.

Prime Movers and Their Accessories.

STUFFING-BOX.—M. BERECKY, New York, N. Y. The object of the invention is to produce a box which will present a metallic packing and absorbent or vegetable packing and in which special provision is made for conducting the lubricating fluid to the vegetable packing. It relates to stuffing-boxes such as used for pistons, tail rods, and similar moving parts.

METALLIC PISTON PACKING. — N. PFLAUM, Pittsburg, Pa. The invention pertains to metallic piston-packings, such as shown and described in Letters Patent of the United States formerly granted to Mr. Pflaum. The object of the present invention is to provide a packing composed of comparatively few parts and arranged to prevent leakage of steam in the cylinder from one side of the piston to the other and to compensate for all wear of the interior contacting surfaces of the engine-cylinder and the piston-packing, thus requiring no reboring of the cylinder.

Railways and Their Accessories.

SAFETY APPLIANCE FOR AIR-BRAKES.—W. H. WINKS, Baltimore, Md. In this case the improvement relates to safety appliances for air-brakes, and has for its object to provide means whereby the brakes on a locomotive and train of cars will be quickly applied when a switch is open or a danger-signal set should the engineer from any cause fail to note the open switch or danger-signal.

RAIL-BRACE.—W. M. JENKINS, Guthrie, Oklahoma Ter. The brace securely fastens rails to the cross-ties. The brace has an anchorage underneath the tie. There are many advantages. Each tie is firmly anchored at each end to the two rails, so that the rail is immovable against all strains. There is great saving in spikes, and as the ties are not pierced at any point their longevity is greatly increased. Stability of the track also increases safety of travel and avoids much loss of life and property. Tension of rail-joints is maintained which deadens sound and avoids all initial looseness. The brace will allow the height of the rail to be increased without danger of the rail turning.

RAILWAY-TIE.—E. A. RASMUSSEN, Hot Springs, S. D. In this patent the invention has reference to improvements in metallic ties and rail-fastenings for railways, the object being the provision of a metal tie that will be comparatively light, yet strong and serviceable, and having novel means for securing the rails. The tie is inserted in the road-bed and the interior filed or packed with dirt, cement, or the like.

COMBINED TIE AND RAIL-FASTENER.—E. P. BERGMAN, Concordia, Kan. The improvement pertains to metallic railway-ties and means for securing the track-rails. The object had in view is to provide a tie and rail-fastening means which shall afford improved securing means for the rails and prolonged use of the tie over all similar ties and rail-fastening means.

METALLIC TRUCK FOR RAILROAD-CARS.—F. GEBHARDT, Alliance, Ohio. The invention refers to trucks for cars such as shown and described in the application for Letters Patent of the United States formerly filed by Mr. Gebhardt. The object of the present invention is to provide a truck for cars which is exceedingly strong and durable and arranged to provide a solid bed for the car-body to rest on and to readily accommodate the draw-bar timbers.

Designs.

DESIGN FOR A FRAME.—G. H. RICE, New York, N. Y. In this ornamental design the inventor produces a form of almost a true circle in the interior of the frame. Exteriorly the frame presents an almost square appearance secured by the four corners being extended and capped with scrolls. Mr. Rice has also designed another frame with nearly identical lines and scrolls (the latter six in number), excepting that the frame adopts an oval interior and an oblong outer form.

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

Notes and Queries.

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.

(10331) A. C. L. asks: Is it possible to convey a current of electricity from a battery, stored in a locomotive, to the rail, through the axle and wheel? Does not the oil bearing interfere with a perfect connection? A. We presume it is possible to convey a current of electricity from the locomotive to the rail through the axles and wheels, though we never tried the experiment. We think so, because the current from the overhead trolleys goes through the motor and the axles to the rail and returns to the power house in that way only.

(10332) W. J. C. wishes to know how to remove indelible ink marking from clothing. A. Indelible inks are of such variable character that it is quite impossible to reply. Many of these inks have nitrate of silver as a basis; in this case, a solution of hyposulphite of soda might help. Some other inks might possibly be bleached out with javelle water and weak muriatic acid; this can be used only on white goods, as most dyes would be destroyed. Possibly also a solution of sulphurous acid might be of service.

(10333) G. B. D. asks: Can you tell me how to construct a lamp or light that will burn under water (outside of an electric device). Any hints how to proceed will be appreciated. A. Any lamp will burn under water if protected from the water and supplied with air. We do not know any other way to produce a light under water. An electric light does not need air, a fact which renders it easier to have light under water by electricity, but this is out of the question with you. The metal potassium will burn under water. No means has been devised for utilizing the fact for illumination. Its cost is too great for such a use.

(10334) K. T. asks: 1. Is it possible to synchronize a dynamo and a motor, the latter run by the former, with reliability as to small variations of speed? A. The single-phase motor must closely synchronize with the dynamo which furnishes the current. Direct-current motors need not do so. 2. If so, will you give directions for building a simple and inexpensive model to illustrate the fact? For my purpose the minimum speed would be about 600 revolutions a minute and the maximum 2,400. The sensitivity ought to be such that

any small variation of speed in the dynamo is transmitted to the motor with reasonable accuracy. A. The simplest model you can have to illustrate this is two similar machines, one driven as a dynamo and the other turned by it as a motor. 3. Can a 110-volt direct-current readily be transformed to a 52-volt alternating of any frequency, and how, with the lease expense? A. A direct-current 110-volt is readily transformed into an alternating current of 52 volts pressure by a rotary converter such as is used in stations for this purpose. 4. Can a 100-volt direct current be used for heating metals by immersing in water, and how? A. A 110-volt direct current is not of a pressure high enough to heat metals quickly in water, as in the water pail forge; 220 volts are needed. Salt water is put into a pail in which a lead plate forms the electrode, while the iron attached to the pole is inserted into the water. It is instantly made red hot.

(10335) W. A. B. asks for a formula for glaze or glazing used in the manufacture of candies and crackers. A. Boil sugar and water to a point just before it will pull out stringy between the fingers. Dip in this solution.

(10336) C. R. says: If I were to take a cannon 3 inches in diameter and 1 inch bore and fit a screw cap firmly on the mouth of it, and then explode a piece of guncotton within, while the cap is screwed on: 1. Would the cannon burst? A. Plugging up a cannon charged with guncotton is a dangerous experiment. The charge would burst the cannon or blow out at the vent. 2. After cooling it would there be any explosion upon unscrewing the cap? A. There will be no danger in opening the cannon after explosion if it did not open itself. 3. Do you think the heat generated within the cannon would be sufficient to melt an iron or brass screw ¼ inch or ⅛ inch in diameter? A. The heat of the explosion is too quick to melt the screw.

(10337) W. M. C. says: I have a brass coil boiler, in which there is a great deal of sediment and scale and which is steaming poorly; please advise me what preparation I can clean it out thoroughly with. A. You can clear the sediment and incrustation in your boiler by injecting a strong solution of caustic soda, say 10 per cent of the contents of the boiler, using it for the day; then blow out while steam is up, and repeat for a few days.

(10338) C. G. asks: How can I remove nitric acid stains from a blue cloth coat and bring it back to its former color? The acid having been dropped on the cloth and pressed with a smoothi g iron. causing the part of the cloth where the acid dropped and was pressed to turn yellow. A. The stain caused by nitric acid on blue cloth can be removed by the *immediate* use of ammonia, in case the acid was weak. Strong acid will usually give a permanent stain. With an old stain from nitric acid nothing can be done.

(10339) J. L. B. asks: 1. What battery shall I use, and how many cells of the same, to light two 8 candle power lamps of 8 volts and 2 amperes? A. Five cells of the plunging bichromate battery will light two 8-volt 2-ampere lamps. The battery is described in Scientific American Supplement No. 792. 2. Why is the magnet in a telephone receiver permanent? A. The magnet in a telephone is permanent in order to furnish the field of force which causes the current in the transmitter to vary with the vibrations of the diaphragm. An electro-magnet would be more expensive and difficult to maintain. 3. What is the difference in construction of a direct current and an alternating current motor? A. A direct-current motor has a commutator, an alternating-current motor has rings to receive the current. The windings of the alternating-current motor are designed for the forms of current, as single or multiphase, while in some forms there is only one set of windings. To learn all the points of difference you should study the books on the subject.

(10340) C. T. M. asks: What is meant by a twenty per cent grade? A. A twenty per cent grade rises or falls 20 feet for every 100 feet measured horizontally and not on the slope. In other words, the grade is measured by the tangent of the angle of inclination and not by its sine, so that a 100 per cent grade corresponds to an inclination of 45 deg. and not to an inclination of 90 deg. A slope, as of an embankment, is usually designated as of so many to 1; for instance, the usual slope of earthwork is 1½ to 1. meaning 1½ horizontal to 1 vertical. But, conversely, the grade of a road is sometimes given as of 1 in so many, meaning a rise or fall of 1 foot vertically for so many feet measured horizontally; for instance, a grade of 1 in 20 would be a 5 per cent grade and of 1 in 5 would be a 20 per cent grade. You will find such matters explained in Trautwine's "Civil Engineer's Pocket Book." Price $5.

(10341) F. W. H. asks: I wish to make an electro-magnet with the greatest lifting power possible to be furnished current from a 110-volt 75-ampere plating dynamo. What size and how much wire should I use, and what size and length of core? Do you think such a magnet could be so insulated as to be used under solution for raising iron articles from bottom of tanks? A. A magnet can be made which will lift any weight from nothing up to several tons with the current named above, provided the armature were in contact with the poles of the magnet; but to draw articles from the bottom of a tank through an open space, that is, a space not filled with iron, is a different matter. It would require an enormous power to lift a very small weight from the bottom of even a shallow tank. The method proposed is not economical or practical. Better fish them up in the old-fashioned way.

(10342) G. M. T. asks: In still air will two spheres of the same size, one of aluminium and one of lead, fall from a given height in the same time? A. Since the velocity of a freely falling body is dependent only upon the mass of the earth, it follows that all bodies will fall in a vacuum with the same velocity, viz., 32.16 feet at the end of the first second of fall; and since the air will resist two spheres of the same size equally, because they displace the same weight of air, it follows that the two spheres of the same size will fall with the same velocity under the action of gravity in the air, and therefore will fall through a given height in the same time.

(10343) J. H. R writes: I desire to purchase books which would thoroughly inform me upon the followi g case: A buildirg is lighted with 23 incandescent lamps arranged in parallel. The current is supplied through a transformer which reduces the voltage from 2200 to 110. A man takes hold of the socket of one of the lamps and is killed. I want to be able to inform myself on the following questions: First, the precautions necessary in handling high-tension currents and where the danger points are. 2. The liability of transformers to leak, break down, etc., thus delivering the full voltage to the wire leading from it, etc. 3. What is the cause of death? Is it wattage, voltage, amperage, and what is the usual amount necessary to kill a person? Would the current coming from a transformer cutting it down to 110 volts and necessary to supply 24 incandescent lamps be sufficient? Would that supplied to one of these lamps be sufficient? A. Thompson's "Elementary Lessons in Electricity," price $1.40 by mail, contains as much as is given in any one book upon the topics concerning which you inquire. Rubber gloves and tools with insulated handles are necessary for handling wires carrying current above 110 volts. This pressure may have inflicted severe injury or even death in extreme cases, but we do not recollect any instance of death from it. In the case cited it would seem as if there must have been a connection with the primary of the transformer. Death is caused either by the shock of the current or by the disintegration of the vital tissues from its continued action on them. The amperes are the agent of electrolysis: the volts determine the amount of amperes which can flow through a circuit in proportion to its resistance, as expressed in ohms. The resistance of the human body is a variable quantity, from a few hundred to perhaps five thousand ohms. What current a man can get is not a question of the supply of one lamp or any number of lamps. It is a matter of the voltage of the current and the resistance of the body.

(10344) H. S. L. asks: 1. About an ink which can be used with a drawing pen upon zinc and which when dry or burned in will be acid-proof. A. Ink for Zinc Labels: Take 1 drachm verdigris, 1 drachm sal-ammoniac powder and ½ drachm lamp black, and mix them with 10 drachms water. This will form an indelible ink for writing on zinc. 2. A means for an amateur to impart a polish (high) to chestnut boards. A. Fill the wood with any good filler, let it dry, then apply a good varnish, two or three successive coats. Rub it down with powdered pumice stone, then with rotten stone, and finally finish with whiting, all in water. Apply with a felt or flannel rubber.

(10345) A. P. F. asks: 1. What would be the effect on a corrugated iron roof if lightning should strike it? Is it dangerous to the inmates of a house to use such material for a roof? A. If your corrugated iron roof is connected with water or moist earth at several points by heavy telegraph wire or small iron rods, it will serve very well as a lightning rod to protect the premises from being struck. If not connected to the earth, we think it is a source of peril. 2. Of what cheap material can we make a belt about 8 feet in length for light service. width 1½ inches? A. Belts are either made of leather or webbing. They must be inelastic, so as not to stretch in service. We do not know of any cheap substitute for regular belting.

(10346) A. B. D. asks: In applying gold leaf to sign work, what would be the sizing used? A. In wood signs use gold size, For glass signs use a thin solution of gelatin.

(10347) E. A. B. writes: I would be pleased to know by what chemicals or solutions blue prints may be changed from their original color (blue) to colors heretofore discovered? A. Blue Prints, to Change to Brown: Borax, 2½ ounces; hot water, 38 ounces. When cool add sulphuric acid in small quantities until blue litmus paper turns slightly red, then add a few drops of ammonia until the alkaline reaction appears and red litmus paper turns blue. Then add to the solution 154 grains of red crude gum catechu. Allow it to dissolve with occasional stirring. The solution will keep indefinitely. After the print has been washed out in the usual way, immerse it in the above bath a minute or so longer than it appears when the desired tone is reached. An olive brown or a blackish brown is the result. To Make Blue Prints Green: Make four solutions as follows: Solution A. Water 8 ounces and a crystal of nitrate of silver as big as a pea. Solution B. Hydrochloric acid 1 ounce and water 8 ounces. Solution C. Pour a solution of iodide of potassium (iodide of potassium 1 ounce and water 8 ounces) into a saturated solution of bichloride of mercury until the red precipitate is just dissolved, and then add four times as much water as the resulting solution. Solution D. Water 16 ounces and iodide of potassium 1 drachm. Then take the blue print and bleach it with solution A, when the image will become pale slate color or sometimes a pale yellow. Then wash thoroughly and immerse the print in solution B, when the image will again become blue. Then, without washing, immerse the print in solution C, when the image will become green but the "whites" will be of a yellow tint. Then put the print in solution B again, without washing. Then wash and pour solution D over the print to purify the whites and to give the green image a bluer tint; but do not leave print in this solution too long, as it has a tendency to make the print blue again.

(10348) C. S. asks: Please answer the following questions. I do not know whether the name is correct, but I have heard that selenium, a metal, changes its resistance to electricity when light strikes it. Kindly inform me about the price, the resistance it offers per square meter of surface, and whether the supposition that it increases its resistance when light strikes it is correct; also how sensitive it is. A. Selenium is not a metal, but an elementary substance which in its ordinary condition is a brittle solid of a glassy luster and fracture and a brown color. It melts at about 430 deg. Fahr.. vaporizes at about 1300 deg., and burns with a blue flame, giving out an odor resembling that of putrid horseradish. Ordinary selenium is a very poor conductor, having an electrical resistance 37,500,000,000 times that of copper. When annealed for several hours at a temperature just below its melting point, with subsequent slow cooling, it forms a crystalline substance with a lower resistance. It is now sensitive to light. Its resistance is reduced, not increased, in proportion to the square root of the illumination; and also the effect is greater with a high electromotive force than with a low one. Narrow strips of annealed selenium are formed between the edges of broad plates of metal, so that the cross section is considerable, and thus the resistance is reduced while the area exposed to light is considerable. This is a "selenium cell." When the light strikes it, its resistance may be reduced as much as one-half. A cell whose resistance in the dark was 300 ohms dropped to 150 ohms in the light. Such a cell is not a generator of electricity, but a measuring instrument for determining the intensity of light.

(10349) A. L. V. asks: 1. Will you kindly explain the action of the inductor alternator, of the type *not* having a large cylinder at one end? A. The toothed projections upon the moving portion are called the inductors. The surrounding frame has projections of the same shape and size, which constitute the cores of the armature coils. When these two sets of projections are opposite each other, the magnetic reluctance is at the minimum and the magnetic flux through the armature coils is at the maximum. Similarly, when the inductors are in the intermediate position, the flux is at a minimum. Thus the current is produced without moving wire, or collecting devices, with their attendant risk of chafing and loss of energy by friction. See Sheldon's "Alternating Current Machines," price $2.50, by mail. 2. Why is it that, although the current from an X-ray induction coil is alternating, the discharge passes through the tube in only one direction? A. The secondary current in an induction coil is not alternating when the discharge points are drawn out so far that the spark passes only when the primary circuit is broken. The current then is a succession of impulses all in the same direction, the current produced by the making of primary current is suppressed, not being able to leap the gap. The X-ray tubes used with direct current in the primary coil are all energized in this manner. Their current is unidirectional and discontinuous, and not alter ating. 3. In the 110-volt alternating-current system of incandescent lighting, why is it that, though the circuit is always complete through the primaries of the transformers, more power is required when more lamps are put in use on the secondary circuit? A. In any system of incandescent lighting by multiple arc, or parallel arrangement, when one lamp is on, the resistance is such that only the current required for that lamp can flow; when two lamps are turned on, the resistance is half of what it was before, and twice as much current flows. More power is therefore required of the generator. If no lamps were lighted, the generator would not be called upon for any current, and it would run free, offering no resistance to motion except the friction of its armature shaft. This is true of all dynamos. alternating or direct.

(10350) I. L. asks how to metalize insects so as to render them capable of coating by the galvanoplastic process. I have tried phosphorus and bisulphide of carbon, but find it very dangerous, as it is liable to burst into flames instantly. A. Dissolve 1 ounce of phosphorus in 1 pound of bisulphuret of carbon by frequent agitation. Add to this solution 1-3 pound of beeswax and mutton tallow 1-3 pound. Dissolve by gentle heat and guard against fire, as the mixture is very inflammable. To this add 1 pint of spirits of turpentine and 2 ounces of pure unvulcanized rubber dissolved with 1 pound of asphaltum in bisulphate of carbon. When the solution is complete, it can be applied to insects, flowers, etc., which are then dipped in a weak solution of nitrate of silver or chloride of gold. In a few minutes the articles are covered with a thin film of metal. They can be plated in the usual way.

(10351) E. H. writes: I have need of a resistance of 25 ohms in the form of a strip of German silver ⅝ inch wide, 24 inches long. How thick must it be. or what gage? If I should use it ½ inch wide, 24 inches long. what gage must I use? A. To get 25 ohms resistance with a strip of German silver ½ inch wide and 24 inches long will require that it be five millionths of an inch thick. If it be ⅝ of an inch wide, it may be a thought thicker. German silver has 13 times the resistance of copper. Hence a copper wire for the same size might be 26 x 2 feet or 26 feet long. And if 26 feet have 25 ohms, one ohm will be 1.04 feet long. Our wire table gives No. 39 wire as having 1.20 feet per ohm, which is near enough. Hence a German silver wire of the same size would have 25 ohms for a length of 2 feet. The problem then is to find the thickness of a plate whose sectional area is as great as a No. 39 wire, and whose width is a half inch. The diameter of the wire is 0.00353 inch. Its area is 0.00001 square inch. One half of this is 0.000005 inch.

(10352) R. R. S. asks: Why cannot the high-voltage alternating currents induced in the secondary of an induction coil be changed to direct currents and used the same as other currents of high voltage? A. The induction of an alternating e. m. f. is a necessity of the action of an interrupted direct current. When the primary circuit is made, the induced current in the secondary is in the opposite direction from the current which induced it, since that is the proper effect of an increase of magnetic flux upon the turns of the winding; when the primary circuit is broken, the opposite effect is produced, and the induced current is in the same direction as that of the current which induced it. The induction of an alternating current by an interrupted direct current is therefore a necessity. Now, as to the transformation of such an alternating current into a direct current. When a condenser is employed with an induction coil, the induced e. m. f. upon making the primary circuit is much weaker than that which is set up by breaking the circuit. Because of this fact, when the spark terminals of an induction coil are separated so far that the e. m. f. set up upon making the primary circuit cannot throw a spark across the gap between them, the spark passes only upon the breaking of the primary circuit, and the induced current is a direct current, acting by impulses, there being as many impulses per second as there are interruptions of the primary current at the vibrator or interrupter. This is the method in which induction coils are ordinarily used for experiments. If one would see the spark at making the primary circuit, he can produce it by bringing the spark terminals nearer together, till a spark is produced upon making the primary circuit. This spark is from positive to negative in the opposite direction from the spark upon breaking the primary circuit. No way has been discovered for using such an arrangement as a source of power or for lighting lamps, so that it can compete with the alternating-current dynamo, generating an electromotive force high enough for all practical purposes. Any transformer is operated at some loss, and the induction coil, throwing a spark through a wide gap of air, is not an economical transformer.

(10353) G. C. W. asks: An electric company charges for current 10 cents per kilowatt-hour. How many kilowatt-hours are required to run ten 110-volt 16 candle power lamps 10 hours? Also, how many for a 5-horse-power motor, 110 volts, and a 220-volt motor for the same time? A. A 16 candle power lamp at 110 volts may be assumed to take one-half an ampere, and thus use 55 watts per hour. Ten lamps will use 550 watts, and in 10 hours will use 5,500 watts, or 5.5 kilowatt hours, which at 10 cents per kilowatt hour will cost 55 cents. An electrical horse-power is 746 watts, 5 horse-power for one hour will use 3,730 watts, and in ten hours will use 37,300 watts, or 37.3 kilowatt hours. This at ten cents per kilowatt hour will cost $3.73. It is common to reckon 1 1-3 horse-power per kilowatt hour. If reckoned thus, the bill would be $3.75. The voltage does not affect the horse-power. If the current were supplied at 220 volts, the amperes would be halved, but the watts would be the same, and the bill calculated would be the same. The real bill as found from a meter might be very different from this. The motor does not run at best efficiency unless it runs at full load. If it is not using 5 horse-power. it takes more than the proportionate part of 5 horse-power to drive it; how much, it is not possible to say in general terms.

(10354) E. A. asks: During a rainstorm a click, and sometimes a very brief ring of a telephone bell is frequently audible, and is always coincident with a heavy stroke of lightning. It seems very evident that the click of the bell is due to the lightning being coincident with it, but how does the lightning cause the bell to click? A. The ringing of the telephone bell when a discharge of lightning occurs in its vicinity is explained by induction. The electric discharge affects the wire in the same manner as the discharge of a battery current through the wire would do. The magnet attracts the armature, and the bell rings. It is a frequent occurrence with both telegraph and telephone lines.

(10355) J. D. A. writes: On several occasions I have read in the answers to questions of your valuable paper, that lightning is due to atmospheric disturbances. I have also noticed that this theory is advanced in most of the electrical books that have come to my hands. Though it is undeniable that there must be some disturbance, yet such theory does not seem to me entirely satisfactory, for it is open to the question, What is the nature of such disturbance? I am of the opinion (and the more I study the subject the more I adhere to it) that lightning is caused by the heat thrown off in the sudden condensation of the water vapors suspended in the atmosphere; the condensation being caused by the atmospheric pressure, and taking place whenever said pressure becomes greater than the expansive force of said vapors. Is not this possible? I would like to know your opinion on this theory, either through the columns of your paper or otherwise. A. While the condensation of water vapor in the air may be concerned in the production of electrification of the water drops in the air, it is not easy to see how the pressure of the air can be any different from the pressure of the vapor of water in the same place in the air, unless the law of Newton is untrue, that action and reaction are equal. The production of a flash of lightning is not yet accounted for by any theory, and we shall have to wait for more knowledge than we have to explain this phenomenon.

(10356) C. R. McM. writes: I desire to maintain a heat of about 105 degs. to 110 degs. in a box containing about 8 cubic feet of air. Can I do it by sending a current from a small battery through wires? How many cells and what kind? How much wire and what kind? A. We cannot advise the heating of air by electricity if expense is an object. It will cost many times as much as an oil lamp, and be as difficult of regulation as that. It can be done, however, by a coil of No. 14 or No. 16 iron wire with three or four cells of battery. The bichromate cell will give the heat quickest. The Edison-Lelande cell also may be used. It will work slower and last longer. A bichromate cell will need to be renewed every day. The length of wire should be perhaps fifty feet. We cannot give definite figures, since there are so many circumstances to affect the result. If you get too much heat reduce the battery, if too little add more cells.

NEW BOOKS, ETC.

CONSUMPTION AND CIVILIZATION. By Dr. John Bessner Huber, New York. Philadelphia: J. B. Lippincott Company. Profusely illustrated. 536 pages; large 8vo. Cloth, $3 net.

In this book of over 500 pages Dr. Huber has produced a masterly and exhaustive treatise on the subject of Consumption. Every phase of the disease—including cause, prevention, and cure—is described in such an interesting and instructive manner that it cannot fail to prove attractive to physicians, invalids, and all persons who are interested in the prevention and cure of this disease, which is the cause of one-seventh of all deaths which occur in this and many other countries. Over 130 fine engravings are used to illustrate sanitariums, cottage and tent life, and many other subjects. Invalids and others will find much in this book which will assist them in the work of restoring their health.

PRODUCER GAS. By J. Emerson Dowson and A. T. Larter. London: Longmans, Green & Co., 1906. 8vo.; pp. 295. Cloth. Price, $3.

Within the last three decades the subject of producer gas and its application has come to take a most important position in engineering science. The authors of this book have been closely associated with the development of producer gas during all these years, and are exceptionally well qualified to produce a work of this kind. The subject is treated briefly and concisely, and the illustrations excellently supplement the text. The recognized position of producer gas in practical work to-day is such that it promises to be extended very widely in the near future. This being the case, mere rule of thumb is no longer applicable, and the subject must be considered theoretically as well as practically. While there are numerous books on the theory and practice of the gas engine, there is probably no complete work available at present on producer gas alone, and for this reason the volume in question is an acceptable addition to the literature of the subject.

THE CHEMISTRY OF HAT MANUFACTURING. By Watson Smith, F.C.S. London: Scott, Greenwood & Son, 1906. 12mo.; pp. 124. Cloth. Price, $3.

Mr. Shonk has very ably revised and placed before the public Mr. Watson Smith's interesting series of lectures on the Chemistry of Hat Manufacturing. These lectures were delivered before the Manufacturers' Association in the years 1887 and 1888, and notwithstanding that a considerable period has elapsed since their inception, they have had such influence in the remarkable progress of the British hat industry that their republication at the present time was desirable. The book should be of great value to those interested in work of this character, on account of its thorough and excellent treatment of the subject.

THE SCIENCE YEAR BOOK. By Major B. F. S. Baden-Powell. London: King, Sell & Olding, Ltd., 1907. Price, $2.

This year there are but few changes in the Science Year Book, and few were necessary, as those familiar with this excellent work will understand. Of course, the usual revision, necessary because of changes in conditions during the past twelve months, has been made, and the summaries of science have been combined in one general article—an arrangement which is probably more convenient than the prior one of separate headings. Those requiring a diary of large size, combined with a scientific summary, almanac, etc., should not fail to obtain a copy of the present volume.

MODERN PRACTICAL CARPENTRY. By George W. Ellis. New York: Industrial Publication Company, 1906. 4to.; pp. 390. Cloth. Price, $5.

This is probably one of the most ambitious books which has ever been written about carpentry. The ground is covered in as thorough a manner as is possible within the limits of one book, and the text is accompanied by nearly eleven hundred excellent engravings, which clearly illustrate the subject matter discussed. The book is intended for the use of workmen, builders, architects, and engineers, and describes methods of constructing and erecting roofs, floors, partitions, scaffolding, shoring, centering, stands, stages, coffer dams, foundations, bridges, gates, tunnels, excavations, and gives various structural details. It furthermore includes the necessary calculations in carpentry, and simple methods for finding the bevels in roofs and the similar problems encountered. The treatise upon timber, notes on the woods used in carpentry, and the tables and a glossary of terms and phrases connected with carpentry will be found extremely valuable. The chapter on the uses of the steel square is exceptionally good.

INVENTORS AT WORK. By George Iles. New York: Doubleday, Page & Co., 1906. pp. 503. Price, $2.75 by mail.

"Inventors at Work" is one of the most interesting and meritorious books of this character which it has been our pleasure to review for a long time. Mr. Iles has been most successful in his compilation of important inventions and the work of the foremost inventors, who have been of service in the advancement of civilization. The book is well illustrated, and is arranged in subdivisions covering various classes of inventions and innovations in different industries. It should prove of the greatest interest to the layman as well as the scientist and the inventor.

A GRAIN CHART. By R. G. Becker. Pittsburg. Price, $2.

This chart exhibits in an interesting and forceful manner various statistics concerning the grain production of the world, which will be found of value by all those interested in the subject. It includes the production of grains, including wheat, barley, rye, oats, and corn in the United States up to 1906; the wheat crop by States, the world's wheat crop, average yields per acre in the United States, Russia, Germany, Austria-Hungary, France, and the United Kingdom, and various other interesting statistics.

REINFORCED CONCRETE. By Albert W. Buel, C.E., and Charles S. Hill. New York: The Engineering News Publishing Company, 1906. 8vo.; pp. 499. Cloth. Price, $5.

The American practice and the prevailing conditions governing the subject in question are followed in this treatise, which is intended primarily for designing and constructing engineers. The first edition of this excellent book has made it familiar to many interested in this phase of engineering industry, and it needs little recommendation in this column. The second edition includes, in the appendices, tests of beams and columns made by Prof. Talbot, of the University of Illinois, and by the United States government at the Watertown Arsenal. Much of this valuable matter has not as yet been widely circulated, and its addition to the contents of the book will unquestionably enhance the value to its readers. The authors of this work are among the leading exponents of the American practice.

ALTERNATING CURRENT MOTORS. By A. S. McAllister, Ph.D. New York: McGraw Publishing Company, 1906. 8vo.; pp. 278. Cloth. Price, $3.

Dr. McAllister's excellent work on the alternating current motor is not intended for the beginner in electrical science. It has been assumed that the reader is familiar with the fundamental facts of electricity and magnetism, and that he has some knowledge of the lower branches of mathematics. The author deals freely with graphical diagrams and the examination of facts upon which they are based. The mathematical treatment of the subject is limited as far as possible throughout. The diagrammatical illustrations are very good.

GOLD MINING MACHINERY. By W. H. Tinney. New York: D. Van Nostrand Company, 1906. 8vo.; pp. 308. Cloth. Price, $5.

As the title indicates, this work deals exclusively with the principal features of the machines employed in gold mining; their sizes, capacities, speeds, and the rules and formulæ governing their use. The descriptions are brief and concise, but still sufficient to describe fully the machinery in question. The notes on methods of erection and other matters will be of practical assistance to mining and mechanical engineers. This work will be found a practical handbook for use by practical men.

TEXT-BOOK ON THE STRENGTH OF MATERIALS. By S. E. Slocum, B.E., and E. L. Hancock, M.S. Boston: Ginn & Co. 8vo.; pp. 314. Cloth. Price, $2.25.

While this book is thoroughly representative of the best modern theory and practice, it is sufficiently elementary in nature to be available for student use in technical and engineering schools. The text has been so prepared that the student's knowledge of the subject shall be accurate as well as practical, thus reducing the liabilities of errors from an incomplete conception of the foundations upon which the subject is based. Each important point is illustrated by practical applications. Graphical methods are used for calculating centers of gravity and moment of inertia, and the moment of inertia is defined as the shape factor in the mechanics of materials. Other important features are the use of the core section, application of the principle of least work, comparison of column formulas, with graphical illustrations of their relation, and accurate formulas for the torsion of shafts of various cross sections.

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