RECENTLY PATENTED INVENTIONS.

Engineering.

BRIDGE CONSTRUCTION.—Bernard M. Kash, Joplin, Mo. This inventor has provided a method of constructing supports for bridges, consisting of lowering into the water a pile made up of sections, driving the pile into the bed, lowering an anchor over the pile, locking it to an engagement with the bed and with the pile, and driving the anchor to a firm seat in its bed. This foundation may be erected in a quick, convenient and durable manner in deep water, and made capable of upholding a pier.

Railway Appliances.

TRAIN PIPE COUPLING.—Zachariah F. Lightner, Darby, Pa. This invention is intended to provide a coupling for air brake or other train pipes so that the connection may be made without the necessity of going between the cars. A coupling pipe is placed in the coupling head of one of the cars, and this coupling is arranged so as to engage in the coupling head of another car. The momentum of the approaching car causes a bumping of the heads, which are yieldingly mounted so that the parts are not broken, but still the connection between the pipes will be made. Connection between the train pipe and the coupling is made by means of hose.

ELEVATED RAILWAY BRAKE.—Watson L. Reynolds, Jersey City, N. J. The brake shoes, according to this invention, are arranged in pairs, pivotally supported from a common rock shaft and spaced apart to embrace a track rail, with means for rocking the shaft, the rocking of the brake shoe shaft serving to apply and release the brakes. A plate spring bears by its ends on the back of the shoe, affording an improved gripping action on the track rails.

CINDER AND DUST BLIND.—George W. Bohde, New York City. This is a readily applied device, inexpensive, and adapted to fold up in very small compass when desired, or to project outward to any necessary distance to form a perfect shield for the window. It comprises a longitudinally recessed post, a recessed stile, and slats pivoted in the recesses of the stile and post and adapted to lie in such recesses, there being a fastening device to hold the stile and post together.

BRAKE ROD FORK.—George W. Kelly, Marquette, Michigan. This improvement is especially adapted for use in connection with the brake rods of railway or street cars. The fork and stem are passed through body of the fork and headed between the tines. When the fork or jaw is to be used in connection with the top and bottom brake rods, the shank may be held in the fork by means of a rivet.

Mechanical.

WAGON TONGUE SUPPORT.—John F. Tiner, Sutherland Springs, Texas. This novel device consists of a transverse shaft around which a torsion spring is coiled; at either end of the spring is a ratchet wheel connected to the tongue of the wagon. The spring has a tendency to hold up the tongue through the medium of the chain and wheels. This invention does not interfere with the ordinary running gear and takes away considerable of the friction.

GATE.—Jacob E. Knapp, Brownsville, Oregon. The object of this invention is to provide a gate swinging from its center through the manipulation of levers. The gate is lifted vertically at the same time it swings open. After the person has passed through the other lever is depressed and the gate swings back to its normal position. The mechanism can be applied to either a single or double gate.

MOTOR FOR CLOCKS.—Sigismund B. Wortmann, of New York City. This invention is a motor of the gravity type, adapted for the propulsion of clock mechanism without employing the aid of springs, spring drums or like factors. Motion is imparted to the master gear by means of a weighted lever secured to the shaft of the master wheel.

WAGON JACK.—John F. McDaniel, Syracuse, Kan. The object of this invention is to provide a simple durable wagon jack capable of convenient manipulation. A feature of the invention is a locking device for the lifting lever, which will act automatically to hold the lifting bar of the jack in whatever position it may be placed, and further to provide a means whereby the locking device may be readily disengaged from the lift lever whenever required.

LAND ROLLER.—David A. Grant, Raleigh, Canada. This invention relates to an improvement in land rollers by which a number of rollers may be coupled together and used as one, the rollers having a common frame. The roller may be used on rough or undulating ground and is also provided with scrapers for the various rollers, the scraper of each set being capable of independent manipulation, the driver of the roller being able to bring all the scrapers into requisition or any one of them, as occasion may demand.

CHUCK FOR SCREW MACHINES.—Edwin E. Saum and Frederick E. Blackman, Stamford, Conn. This is a chuck more especially designed for use in connection with milling machines, to conveniently and rapidly mill pins, screws, etc. The construction is such that the articles to be operated on can be placed very close together, so as to make the cut formed by the cutter practically continuous. The device is very simple and durable in construction.

SPRING LOCKING NUT.—Charles P. Dorr, Ellsworth, Me. This nut has a thickened central body adapted to receive a bolt and reduced spring arms thereon extending laterally and returned on themselves, the returned members extending beyond the plane of one face of the nut. The spring arms are adapted to press against an object through which the bolt of the nut extends, so as to take up all slack and prevent the nut from getting loose.

LIFTING JACK.—Charles W. Ball, Commerce, Texas. This is a wagon jack of simple and durable construction, and one which permits of conveniently raising the rear or front axle without shifting the hoisting lever in the post.

Electrical.

PAPER HOLDER.—William P. Stibbs, Belleville, N. J. The object of this invention is to provide a paper holder adapted to receive papers or small parcels. When the holder is raised slightly and the paper or parcel is about to be inserted, an alarm is sounded by an electric bell connected with the holder. When the arm of the holder is raised sufficiently to allow of the insertion of the paper, the contact is broken and the alarm ceases. Thus the persons in the house are notified when the paper or package is inserted. When it is removed the same action takes place, the bell ringing just before the holder reaches the normal position.

TELEPHONE INVENTIONS.—Eloy Noriega, Mexico, Mex. The first invention is a microphonic telephone transmitter, designed to be used in connection with heavy currents with especial view to working over long distances. It is constructed so that it will remain in adjustment and work uniformly under all conditions. The primary circuit is through carbon bars attached to the diaphragm, and through a series of loose carbon bars having ends reduced in diameter, entering cavities in the bars attached to the diaphragm. These bars are pressed by a spring through the medium of a body of absorbent elastic material. The carbon electrodes used in this instrument are made of a new compound of charcoal, coke, and boric acid—sometimes with the addition of graphite. The second invention is also a transmitter, in which the carbon electrodes are held in contact by the action of a magnet, thus securing a delicate adjustment of the carbons and a more effective action. In this instrument the diaphragm carries two perforated blocks in which are inserted carbon cylinders provided with soft iron armatures. A permanent magnet located near these armatures holds the carbon cylinders in electrical contract with the carbon blocks carried by the diaphragm.

AUTOMATIC TELEPHONE EXCHANGE SYSTEM.—John Serdinko, New Braunfels, Texas. Combined with a number of sending instruments adapted to send positive and negative impulses, a central registering device for each instrument, are a switch, a magnet and a vibrating lever, other novel features of arrangement enabling the instruments to be connected by a single wire, dispensing with the use of an operator at the central station. Automatic means are also provided for registering the messages sent by each subscriber, with an automatic switching device by means of which one subscriber may connect with any other.

SUPPORT FOR TROLLEY WIRE.—James E. Walker, Denver, Col. This support is formed of a longitudinally grooved casting furnished with a screw-threaded socket for attachment to the insulator, and a removable clamping piece attached to the main piece by means of screws, This support can be easily and quickly applied without the use of solder, thereby prolonging the life of the trolley wire, and it is smooth and noiseless.

Agricultural.

CULTIVATOR.—Andreas Mattijetz, Giddings, Texas. In this machine all the plow shanks are adjustable to or from the center line of the frame in order to adapt the cultivator for working different kinds of plants. The lateral adjustability of the plows upon the standards is also provided for, means being provided for maintaining both the standards and the plows in whatever position they may have been placed. The machine is very light, has an easy draught, and is especially adapted for the cultivation of stump fields.

Miscellaneous.

DUST PAN.—George B. Sarchet, Butte, Montana. The frame of this pan has a depressed circular seat, with an inlet leading to and from the seat, in which turns a receptacle having an opening in one side adapted to register with the inlet or the outlet. The construction is simple and durable, and such a dust pan is adapted to readily gather up and retain the sweepings in the pan until it is convenient to discharge them.

SHOW CASE.—Gustave J. Meyer, St. Louis, Mo. This case has sectional glass walls, with a glass door in each section, there being also horizontal partitions secured to the case walls between the sections to form compartments located one above the other. The case is preferably made in pyramidal form, the compartments increasing in size toward the top, and in its hollow base is a drawer.

SHOE FASTENING.—Henry Vachon, Golden, Canada. This is a lace fastening comprising hooks along the edges of the fly, a tongue separate at its edges from and covering the fly and provided on its under side with a central longitudinal series of parallel transverse hooks, each hook comprising oppositely facing parallel members, while the lacing is rove back and forth through the fly and tongue hooks. Each hook is formed of a single piece of wire and has a spring hook. The fastening is quickly made to secure the shoe to the foot, and gives a nice fit over the instep.

HOOK AND EYE.—John D. R. Lamson, Toledo, Ohio. The hook, according to this improvement, has its inturned end adapted to form a snap, and the eye has its end or bow made larger than its sides, the bow being slightly larger and the side slightly smaller in the direction of the plane of the bow than the opening into the hook, whereby the bow of the eye may be snapped into the hook, and its side may be slipped out when the side is turned to position to escape below the point of the hook.

WIRE FENCE.—Oscar C. and Pierse B. Moreland, Henderson, Ky. An economical tie or binder for the several strands of a fence is provided by these inventors, consisting of a single piece of wire having its opposite ends secured to a common strand of the fence by twisting, the portions near the ends being carried beyond the strands on opposite sides and passed rearwardly over, while the middle portion is passed in front of the common strand.

HOOF WEIGHT.—William Hamilton, Bedford, Iowa. This invention provides a toe or side weight which will adjust itself to the inclination of the hoof to which it is applied, and be self-locking, while it is of simple, durable, and inexpensive construction. In using this improvement a comparatively small portion only of the hoof need be removed, and there is no possibility of the weight leaving the hoof.

FORCEPS.—Michael McNalley, St. Louis, Mo. This is an improvement in implements utilized in veterinary practice for withdrawing teeth of animals, or cutting or trimming them. The two jaws of the forceps may be gradually and equally drawn together to produce a cutting action when required, or they may be quickly closed to effectively clamp the teeth. The implement is very light and easily handled.

LAMP CHIMNEY CLEANER.—Mary F. Hotham, Hillside, Pa. Secured to a handle are two or more U shaped fabric-retaining bars, which are secured at their upper ends by a movable collar. To these retaining bars, pieces of movable cleaning fabric are fastened and new pieces can be easily inserted when they are worn out by disengaging the collar and removing the bars.

CINDER SHOVEL.—Samuel J. Besthoff, New York City. This invention consists of a shovel having U shaped tines composed of wire or metal rods and is adapted to remove cinders from grates, etc. The shovel, by reason of its novel construction, receives the coal and cinders, allowing the dust and ashes to drop from the shovel, leaving the coal and ashes therein and in condition to be assorted if desired.

SIPHON MOTOR.—Frederic Wm. Reinhardt, Memphis, Tenn. This motor is adapted for furnishing small power. The motive power is derived from an overshot water wheel placed in an enlargement of the outlet leg of the siphon. As the water passes from the inlet leg through the outlet leg it causes the wheel to revolve and impart motion to a pump or other piece of machinery.

WATCH BALANCE.—George H. Smith, Lancaster, Ohio. This improvement provides an attachment for balance wheels whereby the rate of vibration will be changed without shifting the screws in the balance. The balance has longitudinally slotted arms in which are placed sliding weights, screws passing through the slots and through holes in the weights to shift the weights along the slots. The changing of the rate of the watch may thus be effected by moving the weights, doing away with the usual method of adjustment by changing the screws in the rim.

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Notes & Queries

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

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(5577) J. C. A. asks: 1. What makes the draught in a chimney, and why has a tall one more draught than a short one? A. The difference in the weight or specific gravity of the hot air inside and the cold air outside makes the chimney draw. This is readily illustrated in observing the upward flow of hot air currents around a stovepipe or the ascent of fire balloons. The higher chimney, having the greater volume of heated air and gases, has the stronger draught. 2. A says that a sounding lead will not sink beyond a certain depth, owing to the compression of the water. B says it will sink to the bottom, whatever the depth. Which is right? A. B is correct. Everything that will sink at moderate depths will go to the bottom of the deepest oceans.

(5578) J. E. P. asks for a receipt for case-hardening that will harden about one thirty-second of an inch thick for bicycle bearings. A. Pack the articles to be case-hardened in an iron box or piece of iron pipe with hoof shavings that have been charred and pulverized. Heat at a low red for half an hour or more, then raise to a cherry red and plunge the articles in water.

(5579) L. L. G. and R. S. H. ask: Why is not length a speed factor in steam vessels as well as in sailing vessels? Take for instance the Feiseen and the new cruiser Columbia, both built for speed. Take also the yachts Queen Mab and Valkyrie, built also for speed. As it is possible for the Feiseen to develop as much speed as the Columbia, why is it not possible for the Queen Mab to develop as much as the Valkyrie? A. Length is a speed factor, as it enables greater power to be carried in proportion to the midship area in steam vessels and more sail in sailing vessels, as illustrated in the larger four masted clippers and schooners. In both classes of vessels the conditions of relative dimensions and power are hampered by the required duty other than speed, and with racing yachts length is regulated by yachting rules. The models are now so nearly perfect that for matched boats the difference in speed may be entirely due to excentricities of the wind.

(5580) R. F. C. writes: 1. Is there any means by which I can produce a thin stream of electric light between two points about one-half inch apart, the light to be steady (not like the spark of an induction coil) with an intense heating power; it is the heat that I wish to use. Also is it impossible for me to use it if it is produced in a vacuum? A. You can do this with the arc. The Bernardos system of welding utilizes the arc as a heating appliance. For this see our SUPPLEMENT, No. 840. We have others on electric welding by other processes. 2. Does the arc light produce an intense heat? A. It produces about the most intense heat that can be produced by man. 3. I built a small direct current, 20 lamp, 16 candle power, 52 volt dynamo, which we have used some time; several days ago one of the leaves of

copper that the brushes are composed of dropped down and touched the bed of the machine, there was an intense flash of fire and all the lights went out. What was the cause? Was the machine short-circuited or not? A. It is undoubtedly a case of short-circuiting. The piece of copper must have connected the two terminals in some way. Possibly its brush was connected to the other terminal; possibly the field is in contact with a bare spot of its winding.

(5581) E. C. B. says: I have a damaged mirror and want to cover up several blotches. Can you give me directions for doing it? A. Remove the silvering from the glass around the scratch, so that the clear space will be about a quarter of an inch wide. Thoroughly clean the clear space with a clean cloth and alcohol. Near the edge of a broken piece of looking glass mark out a piece of silvering a little larger than the clear space on the mirror to be repaired. Now place a very minute drop of mercury on the center of the patch and allow it to remain for a few minutes, clear away the silvering around the patch, and slide the latter from the glass. Place it over the clear spot on the mirror, and gently press it down with a tuft of cotton. This is a difficult operation, and we would advise a little practice before trying it on a large mirror.

(5582) J. B. J. asks: Is vaccination hereditary, so as to render it unnecessary for a descendant of a person who has been vaccinated to be vaccinated? When did vaccination first originate? Does vaccination undermine the physical condition or reduce the average length of life of mankind? A. Vaccination is not hereditary, nor is it safe for the person vaccinated for a longer period than seven years. It seems to have no effect upon human vitality either to shorten or lengthen life. It was discovered by Dr. Jenner more than 100 years ago. See an interesting account of its discovery and early history in SCIENTIFIC AMERICAN SUPPLEMENT, No. 709.

(5583) A. V. E. B. writes: In the recent international race the English claim that a boat built to race for the America cup, in so far as it has a transatlantic voyage to make, cannot be a mere racing machine. Would you please state if, in your judgment, this is a factor worth considering in deciding about the relative merits of the racing boats of the two countries or of the two kinds of boats—keel and centerboard? Do you consider it necessary, as naval architects on the other side hold, that in designing a boat to contest for the cup any departures should be made that would materially interfere with fast sailing? A. It is well known by naval architects and expert builders of racing yachts that all the American contestants in the international races have been as good sea boats as their adversaries, and not merely racing machines. If ever the cup goes back to England, it will find the centerboard racers equal to the voyage for a contest on the English seas.

(5584) A. K. writes: I wish to light a one candle power incandescent lamp at intervals which will not aggregate more than twenty minutes per day. Can you name an inexpensive non-freezable battery for operating same, one that will remain charged for a considerable length of time? A. We advise you to use a dry battery. One or two cells should suffice.

(5585) T. J. P. asks in what manner a gold chain that has been dropped into the fire and burned black can be restored to its original color. A. Heat in dilute nitric acid until the desired color is reached. Possibly immersion in ammonia water will answer.

(5586) W. H. R. asks for a preparation which can be applied to tan shoes to render them waterproof without changing the color. A. Beeswax, 1 part; oil of turpentine, 4 parts. Apply with a cloth and polish with Canton flannel.

(5587) H. R. T. asks: When was the triple propeller first attached to vessels? A. Triple screws have been in use in a few naval vessels of France, Germany, and Italy, for several years. See articles on triple screws and the trial of the Columbia in SCIENTIFIC AMERICAN SUPPLEMENT, No. 935, 10 cents mailed.

(5588) S. B. W. asks: What per cent of the energy in the steam engine or other running power is changed into electricity by the most improved dynamo? A. Ninety per cent of the indicated power of the engine is claimed to be the energy of the electric current in horse power. And if again transformed into effective power by a motor, the resulting effect is claimed to be 81 per cent.

(5589) V. S. W. says: We have recently built a small standpipe, 10 feet by 60 feet, for water supply and fire protection. We use each week day about 15 feet of water and replace it with water from our deep well, which has a temperature about 50° Fah. Shall we be troubled by its freezing, and is it liable to be damaged by ice? It is entirely exposed to the weather. Pipe connections are all from the bottom. A. The standpipe should have a close roof to keep the surface of the water from freezing over and accumulating ice, otherwise no protection is needed except the pipe connections.

(5590) I. I. asks how curling stones are dished out and made true and polished. Also if such work is done in the United States. I understand they must all be sent to Scotland. A. Curling stones are blocked out by chiseling in the ordinary method of stone cutting, then finished and polished in a stone turning lathe. Any granite worker having a lathe can make them.

(5591) W. J. writes: 1. I have a glass cylinder, which I wish to make into a friction machine, but cannot find out how to drill the holes in the ends. How can I do this in good shape? A. These can be drilled with a file held in a carpenter's brace. Break off the end, so as to give a sort of drill point. Lubricate with turpentine and camphor. Or cement a cork where the hole is to be, and drill the hole with a copper tube, centered by the cork, and fed with oil and emery. Turn with a brace. 2. Can you tell me how much the castings for Perretts' small dynamo will cost me? A. If you make your own model, they should cost from 5 to 10 cents a pound.

(5592) A. N.—Theoretically there is no difference between the power of a crank and an eccentric of equal throw. Practically the eccentric is subject to greater friction than a crank pin and hence less efficient.

(5593) T. T.—The brass wire cloth can be cleaned by scrubbing with a brush, using a solution of 2 ounces oxalic acid to 1 quart water, and powder of Bath brick or pulverized pumice stone with the solution.

(5594) F. D. H. asks for a method of computing the length of a degree of longitude at any point on the earth's surface, for instance on the Tropic of Cancer or the Arctic Circle. A. Multiply the length of a degree at the equator by the cosine of the required latitude; thus, cosine of the latitude of the tropics 23° 27′ is 0·91741 and 60 × 0·91741 = 55·0446, or 55 miles $235\frac{48.5}{100.0}$ feet.

(5595) R. B. S. asks rule for casting lead sponge used in those storage batteries described in SCIENTIFIC AMERICAN, No. 21, November 18, 1893. A. Keep stirring the lead until it is on the point of solidifying; then cast it in blocks and saw up into plates.

(5596) A. R. T. asks: 1. What size should the plates of a storage battery (two cells) described in the SCIENTIFIC AMERICAN some months ago, and how many to run small motor, one-sixteenth horse power, continually for about four hours, storage cells to be charged by six cells of gravity battery? A. Provide at least two square feet of positive plate in each cell. Arrange size of plate and number to suit yourself. 2. How often would gravity battery have to be recharged if cells were connected to the storage cells all the time except when using? A. About one-tenth ampere current would be taken, which would set free about two grains of metallic copper per hour, so that the batteries would run many days, except for local action. 3. What acid can the plates be placed in to roughen them sufficiently for the application of the red lead? A. Nitric acid diluted 1 acid to 5 water.

(5597) O. C. R. asks: What chemical solution could be used to write on a "blue print" with a perfect white line? Caustic soda will dissolve the blue, but the yellow tint of the iron remains in the mark. I was given a solution which produces a perfect white line. It is neither acid nor alkaline. The flame test produces the violet color of potash, and silver nitrate solution forms a white precipitate, which is soluble in dilute nitric acid. Can you give me any information as to what this solution may be? A. Probably binoxalate of potassium dissolved in water to the strength of 1 ounce of the salt to 4 of water.

(5598) A. L. W. says: 1. The film that I use in my camera bothers me badly, on account of its tendency to curl up very tightly when I wish to print. Please give formula to prevent this curling, and also a cement or glue that will stick the film to glass. A. There is no good remedy for curling. One is to soak the films in a mixture of one-eighth glycerine and seven-eighths water after washing, for a few minutes. After drying the films should be packed flat between stiff cardboards. We think ordinary fresh glue, such as Le Page's or Chase's, will answer to fasten film at its edges to glass. 2. What is the value of the silver on a single-plated teaspoon? A. Perhaps three cents. Depends on how thick the single coating is.

(5599) T. R. E. asks: 1. How is a Leyden jar made, and what is it good for? A. It usually is a glass jar covered for about three-fourths of its height, inside and out, with tin foil. For special purposes, other constructions are used. It is used to store electricity of very high tension, so as to give shocks and sudden discharges, and is used in much experimental work. 2. I hear of an Ideal storage battery that will run a phonograph over one hundred hours. I wish to run a lamp one hour at a time, three times a week. A. Allow two volts for each couple in the battery, and buy a lamp of the voltage thus obtained. 3. How many candle power lamp shall I get? A. For two couples you can use a one candle power lamp, for three couples a two candle power lamp. 4. Can I charge the storage with ten cells of telegraph battery which I have, as I live a long way from an electric light plant? A. The ten cell telegraph battery will charge three couples. 5. How shall I connect them? The posts are marked P. N. A. Arrange in series and connect the copper plate terminal of the telegraph battery to the terminal of the red colored plate (marked P.) and the other terminal of the telegraph battery to the gray plate terminals (marked N.) Go by the color of the plates rather than by the letters.

(5600) H. E. W. B. asks: 1. How can I mix sodium with chloride of gold for gilding solutions? A. We presume you refer to the double chloride. It is made by dissolving 58·5 parts sodium chloride and 302·7 parts gold chloride in water. By evaporation the double salt is obtained. 2. What effect has alum when mixed with saltpeter, common salt, and muriatic acid for coloring gold? A. It is hard to give a chemical reason. Alum is very acid in tendency, the acid having rather slight affinity for the base, and in a certain sense it represents an acid in its action. 3. What flux should I use when gold is brittle, so as to make it roll good? Also is there any way to prevent blowholes in casting gold? A. Melt with borax and sodium or potassium nitrate. Possibly annealing is all that is required. 4. Is bisulphide of tin the same as tin bronze? A. Tin bisulphide is often used as a bronze powder, under the name of mosaic gold. Bronze powder is often made by secret processes. 5. How is the vacuum made in the incandescent lamp? Also how can I carbonize silk for lamp? A. The vacuum is made by air pump. Carbonize filaments by embedding in charcoal dust, placing in an iron case and heating to redness. For pumps see our SUPPLEMENT, Nos. 224, 569, 629, 630, 631, 771. 6. Can more than two messages be sent over the same wire at once? If so, how is it done? A. Yes. The apparatus is described in the books such as Prescott's "Electric Telegraph," 2 vols., price $7; Maver's "American Telegraph," price $5; Thorn and Jones' "Telegraphic Connections," price $1.50. 7. How should pneumatic tires be kept through the winter so as to keep them from honeycombing? A. No special treatment is required. They should not honeycomb if they are of good quality.

(5601) M. McN. asks: What is the relative strength of cast steel forged or cast steel castings? Does the addition of aluminum to castings make the steel harder or not? Can the steel be cast as thin as iron? A. The strongest cast steel forgings, as usually made, have a tensile breaking strength of from 125 to 150 thousand pounds per square inch. Castings of steel have a very variable range of tensile strength, according to shape and size, from 40 to 60 thousand pounds per square inch. The addition of a small percentage of aluminum to low carbon steel for hammer working makes a tougher and stronger metal, which may vary in tensile strength from 140 to 175 thousand pounds per square inch. With steel castings, a small percentage of aluminum largely increases their strength and solidity, with possibilities of over 80 thousand pounds per square inch.

(5602) R. F., Decatur, Ill., writes: Our city has put in a filtering plant at the water works, locating it on a hill, some 75 feet above the pumping station. We have a pumping engine to take the water from the river to the filter, from which it runs into a reservoir of nearly same height, and from there through about 500 feet of 16 inch pipe down to another engine at same station, by which it is pumped directly into the city mains, under an ordinary pressure of about 75 to 80 pounds per square inch, but which is brought up to nearly 100 pounds when needed for extinguishing fire. The pipe which brings the water down from reservoir (suction pipe, we will call it) was connected directly to the main pump and under ordinary service stood all right, but when fire pressure was put on this pipe broke by "water hammer." It is an ordinary cast iron pipe, 16 inches diameter and seven-sixteenths inch thick. A controversy has arisen between some of our local ameteur engineers as to the best way out of the difficulty. One party, which we will call A, says this hammer is irresistible and cannot be overcome, except by letting the water out into a well or cistern at the bottom of the hill, to be pumped from there into the mains, or else by putting the main pump on the hill by the reservoir. The first of these all admit would be a great waste of power, to be tolerated only as a temporary makeshift, and the other has some objectionable features. Another party, whom we will call B, holds that neither of these plans is necessary. That as the water in the suction pipe has a free passage through the pump into the mains at all times (excepting the slight obstruction caused by the necessity of raising the valves), the pressure in the suction pipe can never be more than very slightly greater than that in the main pipes, and all that is necessary to overcome the liability of breakage is to make this suction pipe strong enough to safely stand the highest pressure that is ever put on the main pipes. He holds that this ramming action is really an advantage, as tending to give a steadier flow of water into the mains by continuing the flow while the pump is changing strokes. He holds also that as a water hammer without an outlet is conceded to be almost irresistible, the fact that this pipe stood while the pump was working against ordinary pressure proves conclusively that there is an outlet, which he claims is sufficient to substantiate his theory that the suction pipe is simply too weak to stand the pressure which the water in it has to act against in the mains. Who is right? If neither, please set us right. How thick must a 16 inch cast iron pipe be to stand 100 pounds pressure with a good margin of safety? A. The statements of all parties are correct as far as they go, barring the accidents from a water hammer, which is so uncertain in its effect that its transmission through the pump to the force main is a dangerous expedient. A 16 inch pipe to be safe at 100 pounds pressure should be ¾ inch thick. Such a pipe for your suction would be very expensive, as the normal pressure in the suction pipe is only 33 pounds per square inch. We advise large air chambers on both suction and force mains, as near the pump as possible, with an independent air pump to keep them charged with air at all times. There can be no water hammer under this arrangement. The main pump could be made the source of power for the air pump by a side rod and bell crank lever, which can operate a small air piston, single acting, of sufficient capacity to supply the amount of air absorbed by the water in the air chambers. The air pipes should be connected at the bottom of the air chambers with a check valve in the high pressure air pipe and a stop valve in the low pressure side leading to the suction air chamber, so as to control the air in either direction.

(5603) C. H. C. C. asks how to produce the black bronze on brass and iron. A. The black bronze on brass may be made by immersion in a solution of 10 ounces muriate of arsenic, 2 pints permuriate of iron, 1 pint water. For black bronze on iron by immersion or brush:

Bismuth chloride	1 part.
Mercury bichloride	2 "
Copper chloride	1 "
Hydrochloric acid	6 "
Alcohol	5 "
Water	50 "

By weight.

Let the liquid dry on the article and immerse in boiling water for a half hour and dry.

(5604) J. G. B. asks: Will you be kind enough to tell me how to rid our premises of these bugs. I know of other houses and whole blocks of buildings so infested that people are at their wits' ends to know how to rid themselves of them as we are. Borax will do to put on pantry shelves, etc., but I need something to cover the whole kitchen and pantry and dining room floor at night when they come out, and to keep it there; the remedy would be about as bad as the disease. They really are a very great nuisance. Answer by Professor Riley: The insects sent were specimens of the common Croton bug or German cockroach (*Phyllodromia germanica*). The main difficulty in ridding houses of this pest is due to the fact that people do not seem to be willing to take enough trouble. They wish something which they can scatter about once and be relieved for all time, but, unfortunately, there is nothing which will accomplish the result in this easy way. There is nothing better in my experience than to thoroughly and persistently use California buhach, a home-grown pyrethrum powder. This should be puffed from a small bellows into all cracks or holes and crevices in the infested room just after nightfall and the room should then be closed and left until the following morning. In the morning the servant should go over the room with a broom and sweep up every specimen found upon the floor and burn them. This process should be repeated for two or three nights in succession, and at the end of that time the trouble will be mainly past. The insects breed rapidly and migrate from one house to another, so that the operation will probably have to be repeated again after some months.

(5605) J. H. M. writes: 1. I wish to run three or four 16 candle power incandescent lamps, for about two hours each evening. What kind of resistance lamps would be the best, and how many and what style of storage batteries would be the most efficient and yet be cheaply and easily made by an amateur? How many gravity batteries would be necessary to charge the storage batteries, charging for 10 to 15 hours daily? A. Special low resistance lamps are made for this purpose. By all means buy your battery. For charging you may allow from ten gravity cells upward for each cell of storage. 2. I have a Dr. Gassner dry battery that is played out. Is there anything that I can put in it to make it work? A. Sometimes water will get a little more out of an exhausted dry battery. 3. What is the diameter of a core used in an induction coil 6 inches long? A. About ¾ inch. 4. Would double cotton-covered wire used for secondary coil be as good as double silk-covered wire? A. It would probably be a little greater in diameter and hence not quite as good. 5. How much No. 36 wire would be necessary for a coil of the above size? A. No quantity can be prescribed. See our SUPPLEMENT, No. 160, for the construction of an induction coil.

(5606) J. M. L., Jr., asks: 1. How may I make a good but inexpensive lacquer for nickel, silver, and copper after plating? A. Use alcoholic solution of shellac or seed lac. The great point is to apply it properly to the absolutely clean metal previously warmed. A finger touch will impair the success of the operation. 2. It is said that the plating solutions will soak through earthenware after awhile. Could you give a preparation to prevent this? A. Try melting in paraffine, the wood being absolutely dry. 3. About how manny gallons of nickel solution could I run with a current of 15 amperes and 5 or 6 volts? A. There is no question of quantity of solution. Allow at starting 0·1 ampere at 5 volts per square inch of cathode, and then reduce to 0·02, ampere at 3 volts per square inch.

(5607) E. B. T. asks: 1. What is the chemical reaction of the caustic potash battery? A. The zinc oxidizes and dissolves in the caustic potash solution. 2. Can it be recharged by reversing the current through it? A. Yes, but it hardly pays. If it was a Lalande-Chaperon combination, you would probably fail in oxidizing the copper depolarizer. 3. Have you ever published an article on running a dynamo by windmill power? If so, in what number? A. See the SCIENTIFIC AMERICAN, vol. 63, No. 25. 4. Also the automatic regulation of a dynamo for an unsteady source of power. A. You must regulate your power. 5. What are the requisites of a loud-speaking telephone of the bell type? A. The Edison loud-speaking telephone depends on a distinct principle, the change of coefficient of friction by electrolysis.

(5608) L. C. T. asks: I have six or eight ounces of No. 36 bare copper wire, the insulation having been burned off by an overcharge. I wish to use it on an induction coil. Would the burning of the insulation affect the quality of the wire in any way? Can you tell me how to construct a coil, using the bare wire for the secondary coil? A. If your wire is not divided, it can be used. Test it first with a battery and galvanometer. For induction coils we refer you to our SUPPLEMENT, Nos. 160, 229, 569. 2. How could I manufacture ice on a small scale with the least apparatus possible? A. This cannot be done economically. Small ice-making machines are sold for the purpose. Address Queen & Co., Philadelphia, Pa. 3. In charging storage batteries by wind power, the windmill would not always be running at the same speed; would this make any difference in charging? A. You must have an arrangement for disconnecting the battery when the mill runs too slow. Binders for the SCIENTIFIC AMERICAN or SUPPLEMENT are $1.50 each prepaid by mail.

(5609) P. L. A. writes: To make artificial ice right in the ice house when the weather is cold enough, would it do to use a hose from the hydrant, and make a sprinkler in the ice house, so that when the water is turned on, all surfaces will receive an even thickness for freezing? Then when the desired thickness for a cake has been obtained, and this thickness having frozen solid, what should be used to separate the first layer of ice from the second? Would it be well to use waterproof building paper which has not been tarred? We have a large ice house which we will fill in something like this way if it is possible to do so. The weather is generally cold enough for a long period to allow the water to freeze solid before being bothered with a thaw. A. The filling of the ice house in the manner described is feasible on a small scale where the winter cold is nearly continuous. The only inconvenience will be in cutting out the ice in summer, as in freezing the walls of the ice house become solid, which prevents drainage from the hollow central cutting. Means would have to be provided to clear the surface water. We apprehend that the paper will not favor the cleavage of the ice; the water will soak the paper and by freezing make its separation uncertain.

(5610) E. O. B. asks (1) how to make the best composition with which to fill honey-combed shaped lead plates for a storage battery. A. Use red lead for the positive and litharge for the negative plates. Mix to a paste with dilute sulphuric acid. 2. How to make a solution for the same? A. Use dilute sulphuric acid, 1·170 sp. gr. 3. How to ascertain the maximum charging current for the same? A. Charge at 5·3 amperes per square foot of positive plate. 4. How to know when the battery is fully charged? A. Charge until the cell boils. *i. e.*, evolves gas copiously. The acid should rise to 1·20 sp. gr.

(5611) O. C. asks: 1. What book or publication gives the most complete description of the best methods of making permanent steel magnets, kind of steel, best temper, shape and proportions to get the greatest attractive force, current to use in charging them, etc.? A. Silvanus Thompson's work on electromagnets, $1 by mail, contains some information applicable to your subject. For magnetizing use as strong a current and as many turns in the magnetizing coil as will give maximum ampere turns. Use tool steel drawn to a straw color. See also our SUPPLEMENT, No. 318. 2. Can you give a rule by which I can calculate the weight of 1 cubic inch of water

under different pressures? I find it stated that 1 cubic inch of water at 70° Fah. under the ordinary atmospheric pressure weighs 0·578 ounce. What is the weight of same when under a pressure of 75 pounds as indicated by a Crosby water gauge? A. Water is very slightly compressible. For one atmosphere of pressure (14·7 pounds), it is compressed 0·00005 of it original volume. For 75 pounds above the atmosphere therefore it would increase in weight about 0·00025, giving 0·57814 ounce instead of 0·578 ounce. The above rule is approximately correct.

(5612) E. G. R. asks: 1. Will the No. 2 water motor described in SCIENTIFIC AMERICAN of October 14, page 244, run the hand power dynamo described in "Experimental Science"? A. Yes, if there is sufficient head of water. 2. How large a lamp would the above dynamo run when the field magnets are separately excited with six or eight Bunsen cells? A. Three to five six-candle power lamps, without any cells; with the cells twice as many, especially if you use a drum armature. 3. When field magnets are separately excited as above, would the dynamo charge two storage cells? A. Yes. 4. What horse power has the No. 2 water motor? A. Address the manufacturers for particulars.

(5613) F. E. K. asks: 1. Can a plastered wall in a house be blackened so as to be used as a crayon board? If so, how can I prepare a paint to be used to paint it? A. For a wall blackboard: to 1 pint shellac varnish add 6 drachms lampblack, 1 drachm of ultramarine blue, 3 ounces ground pumice stone, 2 ounces rottenstone ground. If not thin enough to spread easily with a brush, add enough alcohol; two or three coats will be needed for a plastered wall. 2. How far is New York City from the deep ocean, and the length of Broadway in the same city? A. About 12 miles in a direct line. Broadway is about 5 miles long. 3. What is the size and weight of the Capstone on Washington monument? A. The capstone of the Washington monument weighs 3,300 pounds. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 476, for an interesting account of its setting. 4. What is the size of the smallest boat that has crossed the Atlantic Ocean? A. About 18 feet in length.

(5614) H. L. B. asks: 1. What is the safe carrying capacity in amperes of a copper wire, No. 14 gauge, B. and S. and how is the carrying capacity of any wire to be found? A. 6·4 amperes. See Sloane's "Arithmetic of Electricity." Allow 2,000 amperes per square inch of section. 2. Is there any book published giving directions for concealed incandescent wiring? A. We can supply Badt or Davis on "Electric Wiring," $1 each by mail. 3. Is there any instrument on the market for recording the height of water in a tank located some distance from the station supplying it? Could not a common low pressure water gauge be used? A. A pressure gauge could be connected to do this.

(5615) A. E. N. writes: In the SCIENTIFIC AMERICAN SUPPLEMENTS already received from you I find a Wimshurst electric machine (glass friction) advised for the generation of ozone by electricity. But having better opportunities to use other sources of electricity, I should like to know: 1. Whether a galvanic battery or a magneto-electric machine could be substituted for the Wimshurst? A. No. 2. What is the strength of a Wimshurst electric machine (taking as a standard the Daniell cell=about 1 volt) compared to other electric machines, viz., 1, Daniell battery; 2, Davis & Kidder magneto-electric machine; 3, Gaiffe's pocket electro-medical machine? A. It may run up into millions of volts. The electro-medical machines probably do not run higher than two or three hundred volts.

(5616) W. F. R. writes: 1. Have you any literature relating to the manufacture of copper oxide plates as used in Edison Lalande battery? A. We have no literature on this. We could supply you with the patents at 25 cents each. 2. Can you inform me as to the best and cheapest method of preparing copper oxide (black)? A. Ignite copper borings to redness in the air. 3. Do you think it would be possible for me to make a box of blacklead for heating above plates? If so, how should I proceed to prepare such a crucible? A. Use a mixture of clay and plumbago made into a paste with water.

(5617) T. G. S.—The photograph sent by you shows a fresh water lizard, probably *Triton tigrinus*, Green. It is an aquatic species not rare, and well known. The horns you mention are branchial appendages which grow out and are shed. See N. Y. Natural History Survey, Zoology, Fishes and Reptiles, page 83; in illustrations, plate 15, Fig. 32.

(5618) C. C. N. writes: How many storage batteries of a given size would it take to run a 40 horse power motor? How long would it take to charge them with a 10 horse power dynamo, and also a 2 horse power dynamo? How long would it take to discharge them? Also, is the power being used up when not running? A. You may allow 425 cells to run the motor 10 hours. It will take four and a quarter times and twenty-five times the period of running to charge with the 10 horse power and 2 horse power dynamos respectively. It will very slowly lose its charge when not working.

(5619) A. R. K. asks: 1. What do electricians call a multiplier, and in what capacity is it used? A. A galvanometer is sometimes called a multiplier. 2. Is there a multiplier, so called, that can increase the efficiency of a dynamo from 75 to 100 per cent? A. No. This would be in the line of perpetual motion. There is room, however, for inventions in increasing the efficiency of dynamos.

(5620) H. S. S. asks for (1) a recipe for a tin electroplating solution for plating on copper. A. We quote the following from the "Scientific American Cyclopedia of Receipts, Notes, and Queries:" "Deposition of Tin by Simple Immersion or Dipping.—For this purpose a saturated solution of cream of tartar is made with boiling water; in this solution small brass or copper articles, such as brass pins for example, are placed between sheets of grain tin and the liquid is boiled until the desired result is obtained—a beautifully white coating of tin upon the brass or copper surfaces. Ordinary brass pins are coated in this way. A little chloride of tin may be added to the bath to facilitate the whitening. The articles are afterward washed in clean water and brightened by being shaken in a leathern bag with bran." 2. Please describe the machine Nikola Tesla uses to produce high alternating currents. What is its armature made like? A. We refer you to SCIENTIFIC AMERICAN, Nos. 9, 11, and 13, vol. 66; also SUPPLEMENT, Nos. 792, 902, 831, 692, 847, 855. 3. What is the highest number alternations in a magneto-dynamo, such as is used for shocking purposes? A. From a few hundred up to two thousand or more a minute. There is no "highest number." 4. Suppose an electric battery be made by making a lead tray 6 × 6 and 4 inches deep. In the bottom is put sulphate of copper 1 inch deep, and over that 1 inch sawdust. A zinc plate on the sawdust as positive pole; binding screw on tray and one on zinc. Solution used, water. What voltage and amperage would it give? Would it give continuous current? How long would such a battery last (if used every day of twenty-four hours) before becoming exhausted? A. About one volt. The continuous current will be, perhaps, half an ampere. Its period of running would depend on the resistance of the outer circuit. 5. Will a bichromate battery, with porous cup filled with bichromate potash and outside vessel filled with a solution of common salt, continue in action for a greater number of hours than the ordinary one-solution bichromate battery? A. It might run longer, but would give a far less total of electric energy.

(5621) A. H. writes: 1. One of my zincs of a Daniell gravity cell has been almost destroyed, while the other two are not affected in the least. There has been no solution in the jars for about one month, and during this time the zincs were covered with a copper-like substance, which had formed while the battery was in action. How was it that one zinc was destroyed and the other two were not affected? A. It seems probable that the destroyed zinc was more attacked than the others before you laid up the battery. Corrosion would be slow, if the zinc was not in the solution. 2. How much wire on the field magnets of the hand power dynamo, No. 161, and also how many feet on the armature, as near as you can judge? A. Five pounds wire for magnets, 100 feet for armature; if drum wound, about 200 feet. 3. Do not the brushes have to touch one commutator segment before it leaves the other? A. No. 4. Can a Porter's motor, No. 1, be used as a dynamo? A. You will not get much result, we think. We have no figures as to its voltage and amperage.

(5622) N. T. asks: Of the various kinds of batteries, such as storage cell and plunge, which is the strongest? A. Storage batteries are far the strongest. How to make them is told in SUPPLEMENT, No. 845. Other batteries, 157, 158, 159, and 792. Also see storage batteries in SUPPLEMENT, No. 838. These we can supply for 10 cents each.

(5623) E. A. E. writes: I would like to build an induction coil that will produce a 4 or 5 inch spark. Can I follow directions as given in SUPPLEMENT, No. 160, and are there any changes I can make that will be a benefit to it? What is the object of the insulation of resin and wax between the two sections of the secondary coil? Also, have you any books or papers from which I can get information on this subject? A. You will find it quite difficult to make a successful 5 inch spark induction coil. The object of the disk is to separate portions of the secondary which differ greatly in relative potential. For a large coil, 6 or 8 such disks should be used. For other coils, see our SUPPLEMENT, Nos. 229 and 569, and SCIENTIFIC AMERICAN, No. 14, vol. 66, all of which we can supply for 30 cents. Also, "Induction Coils—How Made and How Used," price 50 cents; also Bonney's "Induction Coils," price $1 mailed.

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Rail brace and fastener, combined, W. R. Gerhart ... 510,419
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Rocker shield, F. A. Keyes ... 510,799
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