RECENTLY PATENTED INVENTIONS.

Railroad Appliances.

CAR COUPLING.—Edward P. Eastwick, Jr., New York City. This coupler is of the class having knuckle connecting links, and provides means whereby the strain on the drawhead caused by a buffing blow is made much less than usual, from the special construction of the knuckles and drawhead, and whereby the locking pin may be readily raised from the side of the car.

CAR TRUCK CONNECTION. — Aaron Twyman, Pullman, Ill. This invention provides for attaching a car body to a truck by parallel or jointed bars around the pivotal center of motion of the truck, leaving an open space at the center of or within the attachment which may be utilized for the convenient placing of a motor or grip, or other purpose, the king bolt and center plates being dispensed with.

CAR DOOR.—Henry Alsop, Chicago, Ill. This door is intended for stock and general freight cars, etc., and is formed with a bridge-like section or portion loosely or pivotally connected at its lower edge with the car, so that, when released, this section will be free to turn outward to and upon a platform or chute, forming a bridge for the passage of stock into or out of the car, or over which to roll hand trucks.

RAILWAY CAR. — Gerald P. Warren, San Antonio, Texas. In this car the ends or vestibule portions are constructed with their outer sides in movable sections, and bullet proof, with port holes, the arrangement being such that these portions can be quickly closed to make a fortified chamber wherein passengers will be protected against train robbers.

BELL CORD ATTACHMENT.—George A. La Fever, Selkirk, N. Y. It consists in a carriage mounted on a guiding bar supported in a horizontal position in the car above the bell cord, and provided with a device for clamping the cord and severing it in case of an unusual movement of the cord, preventing it from being drawn rapidly through the car and endangering passengers.

HOT AIR GENERATOR. — Emmet M. Crandall and Thomas H. Turner, St. Joseph, Mo. It is especially adapted for locomotives, to furnish hot air for heating the cars of a train, the generator being fitted in the smoke arch, and consisting of a ring-shaped hollow casing perforated by short pipes for the passage of heat and smoke, while the casing has an outwardly opening funnel for the entrance of air, and a pipe connected with the cars of the train.

Engineering.

MINING DRILL. — John P. Paynter, Pomona, Kansas. A frame carrying an engine is mounted to travel on a track, the engine operating a transverse cutter shaft, with a drill of novel construction, especially adapted for undercutting coal in small seams, cheapening the cost of mining, and relieving the miner from his most difficult work.

VACUUM ENGINE.—John R. Cameron, Pittsburg, Pa. This invention covers a novel construction, whereby a given body of air is rarefied by heat and allowed to escape as it expands, while the remaining body of air is then suddenly cooled to create a partial vacuum, the device giving continuous automatic action, affording means for operating a piston within a cylinder.

Mechanical.

LATHE. — Joseph K. Koons, Montgomery, Pa. This lathe is made with movable supports for the centers or work holders, whereby the work in the operation of the lathe will be moved as it is rotated toward and from the tool, making a convenient means for turning ovals and oval shafting, or for turning bodies having elliptical cross sections.

DRILLING AND CENTERING TOOL.—John E. Ketchem, Morrillton, Ark. This is a tool intended especially for watchmakers' use, and has a spring by which a steady feed pressure may be exerted on either the center marker or the drill, either of which may be conveniently applied to the machine, and the pressure can be regulated and adjusted to properly feed the tool in working in different materials.

SAW MILL FEED.—Alois Lang, Atlanta, Ga. This construction has a combination of disks secured edgewise to each other and upon shafts driven from the saw shaft wheel, a shifting lever engaging a wheel sliding upon a shaft, while there is a lever having a cam-shaped pivoted end for moving the wheel to and from the disks, with other novel features, designed to overcome certain objections in this class of mechanism.

Miscellaneous.

CUTTING HAIR. — Marcus Klein, Chicago, Ill. This invention relates to an apparatus combining a comb and a pair of scissors so connected and arranged together as to be adjusted for scissors of different sizes, and also for regulating the length of the hair cut.

ORNAMENTAL BOX.—Mendel Baskam, New York City. It is composed of united panels forming the side and end walls of the box, each being made of slotted tubes holding an inner plate, an outer glass plate, and an interposed ornament, the panels being secured to a bottom, making a cheap box with the ornamentation fully protected.

MUSIC BOXES.—Gustave J. Jaccard, New York City. This invention relates to mechanism for stopping and starting and governing music boxes, and consists principally of a duplex stop acting upon the countershaft, so that there will be less strain and less wear upon the vertical shafts which carry the stop arms.

OIL FEED FOR LAMPS. — Christian Sieghold, Salinas, Cal. The lamp is provided with a valve in its bottom, connected with a float contained by the body of the lamp and a pipe leading from the valve opening to an oil reservoir, making a simple and effectual device for uniformly supplying lamps with oil.

CARPET STRETCHER AND TACKER.—Austin F. Lamb, Stockbridge, Vt. It has a stationary bar and a sliding bar with forked and serrated end, a pivoted frame on the end of the sliding bar, a bar adjustably secured in the frame, and a tacker carried on the end of the latter bar, whereby carpets may be easily stretched and fastened down.

OIL TANK.—John C. Dilworth, Pittsburg, Pa. This invention relates to metallic oil tanks used by dealers, provided with a pump, and an opening through which waste oil is passed back into the oil chamber, and provides a strainer cup therefor, with filtering material, and a strainer pocket, with which it will be impossible for even the finest particles of dirt to enter the oil, while the strainer can be easily cleaned.

ALBUM CLASP. — Louis B. Prahar, Brooklyn, N. Y. A spring pawl is held within a pocket, which has a button extending outward, a plate being adapted to slide within the pocket, and having ratchet teeth engaging the pawl, with a stop for the plate, making a clasp designed to be ornamental as well as useful.

CHEWING GUM LOCKET.—Christopher W. Robertson, Somerville, Tenn. This is a locket having hinged sections and anti-corrosive linings, for holding, with safety and convenience, chewing gum, confections, or medicines, etc.

TOBACCO PIPE AND CANE. — George H. Coursen, Baltimore, Md. This invention provides a pipe that will be of the usual shape, either ornamental or plain, but forming the upper portion of a walking cane, from which it is detachable, the bowl constituting the handle of the cane and the stem a portion of the stick.

TOBACCO PIPE.—George F. Golquitt, Purcell, Indian Ter. This invention consists of a pipe provided with a storage chamber having an opening leading into the bowl, and with a valve for closing said opening, the design being to prevent the nicotine and other unhealthy substances from entering the smoker's system.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & 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.

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

(192) T. K., New South Wales, asks information for grinding and setting a hollow ground razor. A. Razors that have been in use until the edge is rounded by strapping can be brought to a flat bevel on the edge by placing them on a perfectly flat hone or other fine-grained stone, with a little thin oil, as lard oil or fine machine oil, letting the back always rest upon the stone, and with small circular motions of the hand without pressure grinding down the bevel until the stone marks meet on both sides in a thin feather edge. The regular razor hone as imported through your cutlery trade from England is the best. The finest washed flour emery laid on a flat piece of wood with glue and pressed down with a flat piece of iron or plate glass, or a strip of flour of emery paper glued to a strip of wood and pressed upon a flat iron or piece of glass, will answer the purpose. In using the emery stick always draw the razor backward from the cutting edge to prevent catching and hacking the edge against any uneven particles of emery. For a strap use a strip of fine, even calf skin, glued to a piece of wood, on which rub a little paste made of oxide of iron (rouge) mixed with olive oil. Draw backward and keep the heel or back of the razor in contact, so as not to round the edge. Oxide of tin or putty powder mixed with oil also makes a good razor strap paste. The skin of a horse's tail is very highly recommended for razor straps.

(193) G. P. asks how chimney stacks (factory, etc.) are built so as to gradually taper toward the top (and how everything is kept plumb). Also how the gradual lessening of the bricks is managed. A. The insides of nearly all tall chimneys are parallel and vertical. They are carried up by plumb bob and long plumb line for correction in the usual way of mason's practice. The outside batter is carried up in detail by a plumb bob set for the angle, which is verified by actual measurement of the diameter every section of a few feet. The batter is brought in by cutting a brick on each second, third, or fourth outside course, the joints usually allowing for considerable drawing in of the batter for several courses. The same practice is also used for thinning the wall, with rule measurement for regulating the thickness all around. The boss mason or architect usually furnishes the computation for batter diameters by sections. If there is any doubt as to the vertical lines of the chimney during the progress of the work, a plumb line is let down the center and measures taken at top and bottom in each direction of its sides.

(194) E. D. F. writes: Can you give instructions through your valuable paper for painting photographic pictures on convex glass, also on plane glass? Also, how can the original photo. be preserved? A. Soak the pictures in water and attach with starch paste to a concave glass such as can be bought at the art stores. After they are dry, rub down with pumice stone until nearly transparent, hold against the light, and paint them. Soak with castor oil when they are dry; pour off excess of oil and place a second glass against the back, and bind edges securely with paper or cloth, using gum tragacanth. Or you may flow dammar varnish on the glass, and after soaking the picture stick it to the glass while the varnish is still tacky. When all is perfectly dry the paper can be almost completely rubbed off with a wet finger, leaving the picture. Paint, and flow a second time with dammar varnish. In both cases attach the picture to the convex surface. Practice on flat glass with valueless pictures first. The original photograph is destroyed.

C. J. C. is referred to latter process, in answer to his query.

(195) J. W. asks (1) the difference between the working of a high pressure and low pressure engine. A. The main difference between a high pressure and a low pressure engine is that the latter works with a partial vacuum on the preceding side of the piston, made by condensing the steam and thus adding about 13 pounds to its effective work for every square inch of the cylinder area. We recommend you to read the "Practical Steam Engineer's Guide," by Edwards, $2.50, which we can mail for the price. It contains a full description of all kinds of steam engines. 2. The largest engine in the United States. A. The largest single cylinder engine is near Bethlehem, Pa., at the Lehigh zinc mines, used for pumping.

(196) G. C. H.—We have no further information in regard to clover hullers than that contained in articles quoted. Prof. Sweet, of Cornell, now in Syracuse, N. Y., designed the straight line engine. It takes its name from its outward appearance. Automatic engines are so called because the ordinary governor valve is dispensed with, and the governor so arranged as to act directly upon the motion of the slide valves. The slide valve moves upon a flat surface, while a rocking valve (Corliss and similar) makes a partial revolution in a cylindrical steam chamber. The variation in prices of engines mostly corresponds with peculiarities and complexity in construction, also in finish. Some engines of the same size cylinders vary very much in the weight and value of the material. Your 1½ inch belt at 200 feet per minute represents 3 horse power.

(197) B. F. C. asks: How is a piano case polished or finished or smoothed before it is put together, or rather how is it prepared to varnish? Is it not done with emery belts or belts of some kind? A. The polish finishing of piano cases requires experience to assure success. The cases are first smoothed with a planing machine or hand planes, and then are scraped and smoothly sandpapered. They are then stained, and a "filler"—a rosewood paste for instance—is carefully rubbed in, to completely fill the pores of the wood. A rubbing coat of varnish is then applied, this coat really being four or five coats applied four or five days apart. When thoroughly dry this rubbing coat is rubbed down perfectly smooth with ground pumice and felt rubbers and water. Then a flowing or finishing coat of varnish is skillfully applied, and when dry it is fine-rubbed and rottenstoned, using water and the palms of the hands in this operation, which removes all scratches and leaves a bright polish, which is completely finished by rubbing off with oil. In finer classes of work a "scraping" coat is applied after the filler is rubbed into the pores, and when dry this scraping coat (which is really four or five coats of varnish applied four or five days apart) is carefully scraped off by steel plate scrapers, a delicate operation, then the rubbing coat above named is applied, and later the flowing coat and oil finish. The original smoothing is not done by emery belts, but by machine or hand smoothing planes, scraping and sandpapering. It requires about three months' time to polish a piano case, and the work should be intrusted to skillful, experienced hands.

(198) J. S. asks: 1. Will you describe the method usually employed of manufacturing plaster of Paris? A. It is made by grinding and heating gypsum. 2. Can it be made in any other way than by burning gypsum? A. It is made by no other method. 3. What books describe "burning lime" or "burning alum," or making plaster of Paris? A. Spons' Encyclopedia, which we can supply for 75 cents in parts, contains treatises on plaster of Paris and lime. The burning of alum is described in the United States Pharmacopœia, which you can consult in any drug store.

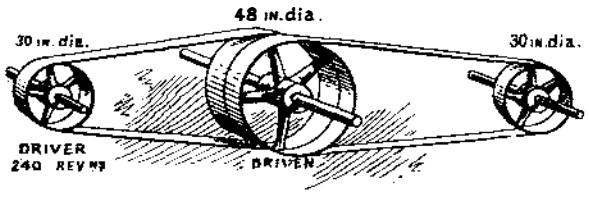
(199) W. A. S. writes: I am in want of an electro-magnet which will lift, say 4 pounds, a distance of about ⅝ inch. Can you give me any information as to where I can get a description of such a magnet, giving the dimensions of the different parts? I would also like to know if a Leclanche battery of two cells would operate such a magnet in good shape. A. Your battery is rather weak. The larger the magnet core for the same number of ampere turns, the more powerful will your magnet be. A ¾ bar of iron wound with No. 18 wire until 1 inch to 1¼ inch thick should give good results.

(200) J. W. K. asks for a cement to fasten rubber to iron. A. Soak pulverized shellac in ten times its bulk of strong aqua ammonia for three weeks, when it will become a transparent mass. Spread upon both surfaces to be cemented, and press together and allow to dry. First clean the iron by immersion in hydrochloric acid 1 part, water 4 parts, for two or three hours, and wash free from acid in hot water.

(201) M. E. S. asks: 1. Will the fluctuating motion of a windmill answer well to drive the eight light dynamo of SUPPLEMENT, No. 600? A. It will not. 2. What sized storage battery will be required

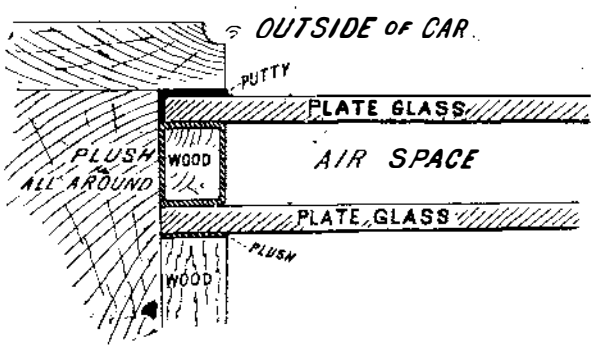
to operate the eight 16 candle power lights for six hours when there is no wind to drive dynamo, or how much battery per light per hour? A. Twenty-five cells will be required for fifty volt lamps. 3. How much wastage to storage battery when not in use, charged and uncharged? A. It should be kept charged, when there will not be much loss. If uncharged, it deteriorates.

(202) G. W. C. asks whether there is any lost power in belting as per sketch over the ordinary friction, or if there is any power gained by so belting.



A. As you have failed to note particularly in regard to distances between the centers of transmission, we must assume several conditions to satisfy a general answer. If the central pulleys and shaft do no work, or are only means of transfer, there is nothing gained by their use for distances of less than 40 feet between extreme points or shafts. There is a little friction from the bending of the belts, the journals, and also a slight loss of contact on the extreme driving and receiving pulleys. The sag of the belt made by dispensing with the transfer pulleys enables a more perfect economy by increased belt lap with decreased tension, for lap and tension are equivalent factors in this problem. Within reasonable limits, the more lap, the less tension is a maxim, and the sag of a moderately long belt is the best means of regulating the tension to the required work. For long distances, say 80 to 100 feet, the intermediate or transfer pulleys become in most cases a necessity, although long belts running upon idlers are admissible, and are part of the regular scheme in wire rope transmission where the weight and momentum of the rope gives it uniformity of motion. The only objection to the use of very long belts arises from their elasticity and vibration. In many kinds of machines the work or motion sets up a synchronous vibration in the belt that becomes destructive. In such cases a very light idler may obviate the difficulty. We can only say in answer to your direct question, that in no case is there a gain in power over the absolute power of the driving pulley. The only gain is in a saving of otherwise lost power by steadiness of transmission in long distances.

(203) A. T. S. writes: In several of our railway office cars, observation room end windows are glazed with double glass in order to keep out the cold while running. A space of ½ inch is left between the outer and inner glass, and both panes set as tight as possible to prevent dust between them, but now, as cold weather sets in, the inside of the outer pane sweats, obstructing the view. Do you know of any way to keep the space between the two glasses dry and clean? A. As the half inch space contains an objectionable amount of moisture when condensed by cold, we suggest, as the less air between the glasses, the less moisture will be condensed upon the outer glass, that the glasses be set with only a one-eighth inch space between them, and that the inside glass be set in a hinged frame to allow of opening and wiping moisture from the outside glass. Another method, requiring more care, is to make an opening under the present air space and insert a sheet iron box (narrow and the length of the space), with a lid or door to close the space air tight. When the weather induces frost or condensation on the glass, put quicklime in the box. Its affinity for water will make the inclosed air dry enough to prevent condensation during any ordinary inspection trip. The old lime can be dehydrated in an iron pipe or pan in any common fire; one or two quarts of lime should be sufficient for an observation window. Chloride of calcium is used for the same purpose in some northern countries.



(204) J. S. writes: I made a motor like one described in March No. dated 17, and it runs to perfection: have five large batteries 12 inches square, 30 one-half inch carbon pencils, and porous cup with zinc in it, that is, each has that amount, but find it pretty expensive to keep running, so now I want to make an eight light dynamo and run it by a windmill and charge a storage battery to run motor, and also light my dwelling at same time. I would like to know how many storage batteries I am to get. There will be only four lights used most of the time, once in a while six or eight lights. A. Three or four storage battery standard cells would run your motor. To charge the battery it must be connected in series. For cells address some of our advertisers in electrical supplies. To run lamps you will need more battery, as you will require cells equal in number to one half the voltage of the lamp. Thus for a single fifty-volt lamp you would need twenty-five cells.

(205) F. M. E. writes: I wish you would give a list of the products of petroleum compared with products of coal tar, as it seems difficult to get the information any other way. A. The products of coal tar are so numerous that any account of them would fill a book. The products of petroleum are much less interesting, falling largely into the olefine and paraffine series. The benzole and allied series given in such quantity by coal tar are wonderfully prolific in their substitution products. We recommend Crewe's "Petroleum," $4.50, and Lunge's "Coal Tar and Ammonia," $12.

(206) J. L. S. asks how to succeed in casting small iron door bells. I have trouble in getting the right ring by the ordinary casting process and common metal. A. For small bells of cast iron it is necessary to have a very fluid iron that will run sharp on the edges and also be solid. This may be done by using good charcoal iron with fine-grained scrap for the cupola. When ready to tap, place in the ladle one ounce of tin that has been granulated by melting and pouring in water or through a sieve, for a tap of 50 pounds of iron. This may be varied a little to suit the requirements of tone or temper. By placing the finely disintegrated tin in the ladle, it becomes thoroughly mixed in drawing the iron upon it. The required tone of the bells depends upon the thickness and shape of the patterns, and is necessarily a matter of trial. Aluminum is also much used for making cast iron flow freely and solid. Address the Cowles Electric Co., Lockport, N. Y., who will send you their circular on this subject. If you find that the ring is not sharp enough, try a harder grade iron, say No. 3 or 4 pig. With the harder iron the bells will be brittle.

(207) A. B. asks information in regard to the utilization of tin scrap. A. Scrap tin is used in New York and vicinity by chemical manufacturers, who separate the tin and iron by chemical processes. The solution of tin is made into tin salts used in dyeing, and the iron scrap, if large enough, is rolled into tag iron, or made into rouge or the red oxide of iron, used for polishing or paint. The scrap tin is also used with pig or scrap iron in an ordinary cupola for casting sash weights or other iron articles not required to be cut with tools, as it is hard. Scrap tin is of very little value, and will hardly pay for its own transportation any considerable distance.

(208) S. T. C. asks how to keep boilers from rusting that are kept for reserve, only fired once or twice a year, three or four days at a time. A. You may keep them empty, provided you can withdraw the water perfectly, leaving openings above and below so that they shall be perfectly dried. Otherwise leave them full of water that has been boiled. A little caustic soda or potash may be added with advantage.

(209) Paul writes: 1. I contemplate lighting my residence with incandescent lamps, using storage batteries to supply the current. I have a dynamo whose capacity is said to be 70 volts and 15 amperes. The batteries are said to be 100 ampere hours and 2 volts each. I use a gas engine in my barn to cut up feed, etc., and have more power than I need. I want to burn about 20 lamps of 16 candle power during the whole day, say 10 hours. I have been told that if I use the storage batteries as regulators, charging them at one end and discharging them into the lamps at the other end, a smaller number of batteries will suffice. If that is the case, how many batteries of the above capacity will be necessary? How many horse power will it need to light the lamps as stated above, and how many if lighted direct from the dynamo? A. Your dynamo will supply 1,050 watts, enough for about 350 candle power or about 20 incandescent lamps. A storage battery is sometimes used as an auxiliary to a dynamo. It is then placed in a shunt directly across from lead to lead between the dynamo and lamps. Then any surplus of current charges it, and if there is a deficiency, it is supposed to be made up by the battery giving a current. It will take about 1½ H. P. (electrical) to light the lamps (or $\frac{1250}{746}$ H. P.) The practical power required will, for the dynamo, be not far from 2 H. P., and for the storage batteries twenty-five per cent more. 2. Is there a rule for determining the number of watts per candle power for incandescent and arc lamps? A. Allow from 3 to 4 watts to the candle power. 3. What would be the most economical voltage for lamps of 16 candle power lighted by storage batteries? A. For storage battery work, lamps of low voltage are required; in general terms, the lower the better. Thus for every 2 volts a cell is required, so that for 50 volt lamps 25 cells would be needed. The economy refers to the number of cells required, not to running expense, except as regards deterioration of battery plates from too rapid discharge.

(210) J. H. B. writes: There is a process, known to some sign painters on glass, of making a letter upon glass with half of the letter gold and the balance silver. A. Size one-half of the letter and gild it, then size the remaining portion, if necessary sizing part of the gold leaf, and apply silver leaf.

(211) C. G. W. writes: Will you please give description and how to use Nippoldt's telephone bridge, made by Hartmann & Braun, Bockenheim-Frankfurt a. M., which consists of galvanometer, resistance coils and bridge? Or give through SCIENTIFIC AMERICAN name of book which tells how to use this instrument. A. We would suggest Practical Electricity, by W. E. Ayrton. This gives many methods of bridge work, though it does not mention the particular bridge you speak of. We can send it free by mail for $2.50.

(212) P. P. S. writes: What combination of chemicals will produce fire without an explosion by applying water? A. Metallic sodium, potassium, and phosphide of calcium ignite when water is applied to them. All these must be handled with great care, as they are dangerous.

(213) J. J. W. writes: 1. How much water in pounds at 60° Fah. must be taken to saturate 100 cubic feet dry air at 160° Fah., and have no water left? A. 1·52 pounds; it will increase the volume of the air to about 137 cubic feet. 2. What will be the temperature of the saturated air formed from hot dry air at 160° and water at 60°? A. About 125° Fah. 3. Will the resultant saturated air be heavier or lighter than the dry air at 160°? A. It will be heavier, owing to the reduction in temperature. At the same temperature, wet air is lighter than dry air.

(214) F. C. T. asks (1) for a preparation that will take the place of oil for tapping cast iron and wrought iron. A. Use strong soap water. 2. Also the names of some good mechanical books. A. We recommend Spon's "Mechanic's Own Book," $2.50; "Engineer's and Mechanic's Pocket Book," by Haswell, $4; "507 Mechanical Movements," $1.00, which we can mail at above prices.

(215) E. E. S. asks: How can I bleach bromo-gelatine negatives to have them remain permanently white? A. Soak plate in water 15 minutes, then immerse in a solution of bichloride of mercury, strength 20 grains to the ounce, for five or ten minutes.

(216) A. J. D. asks how the so-called ivory type on glass is made? A. See full directions in No. 8, vol. 52, page 120, of the SCIENTIFIC AMERICAN.

(217) H. E. B. asks: 1. If a force of ten pounds is necessary to slide a piece of steel off another piece of steel, both pieces being unmagnetized, how much greater force will it take if the pieces of steel are magnetized, and unlike poles placed upon one another, or in other words, how much does magnetism increase the coefficient of friction? Of course your answer will have to be largely in the nature of a guess, as it will depend largely upon the quality of steel, strength of current, etc. A. The moving block of steel would weigh about 50 lb., and might easily develop 100 lb. resistance to sliding. It would be very largely affected by the condition of the surfaces as well as by the magnetic force. 2. How much water would waste from a boiler in an hour, if a hole $\frac{1}{16}$ of an inch was drilled in the boiler below the water line, with a steam pressure of 100 lb.? Also, how much would waste from a hole $\frac{1}{32}$ of an inch? A. The streams will emerge with a velocity of 95 feet per second. Multiplying this by the area gives as the quantity per second 0·29165 cubic inch and 1·16660 cubic inch, or per hour 1,050 and 4,200 cubic inches respectively. 3. In a neighboring city are several small water motors run by the water from the city water works. The motors are run by the simple impact of water against the outside of the wheel. About what per cent of the power of the water is utilized by the motors? A. They should utilize from 50 to 75 per cent. 4. Supposing that instead of the wheel running by the direct action of a jet of water, the wheel was made hollow, and from arms radiating from the wheel jets of water were made to discharge at right angles to the arms, all in one direction, and causing the wheel to run by reaction. Would not the wheel develop just as much power as the present style of motors described in my third question? A. Such motors are on the principle of Barker's mill, and have been made to give very good results in practice. 5. Does the turbine water wheel run by action or reaction? A. Reaction. 6. What are screw plates? Can they be used to cut threads on bolts, the same as dies? A. A screw plate is practically a collection of dies. They are used for the identical purposes as dies, generally on the lighter classes of work.

(218) B. writes: Will you inform me how to make jelly from non-gelatinous fruits, such as lemons? A. Two cupfuls of sugar, one of lemon juice, one quart boiling water, one cupful cold water, one box gelatine. Soak the gelatine in the cold water for two hours. Pour the boiling water on it, add the sugar and lemon juice, strain, mould, and harden. Other receipts are given in the cook books for various fruits.

(219) A. F. G. asks: What part of a boiler, when steam is up, sustains the greater pressure? My friend maintains the part containing the steam is under the greater strain, while I hold to the opinion that there is as much strain on the bottom as there is upon the top. A. All parts of a boiler are under the same strain from the pressure of the steam alone. The lower part has a slight additional strain, due to the hydrostatic pressure or weight of the water. This may amount to from 1 to 2 pounds per square inch in ordinary cylinder boilers.

(220) H. A. S. asks how the horizontal pressure exercised by a current in midstream is ascertained, for example: When a 24′ × 10′ surface is presented to a stream (say the Hudson) in its center, and at right angles to its course, what is the horizontal pressure, by a two knot stream, on the 240 square feet thus presented to the current? A. The formula for the resistance of plane surfaces at right angles to the flow of water is the weight of water per cubic foot multiplied by the surface of resistance in square feet, and this product multiplied by the square of the velocity of the stream in feet per second, and the last product divided by twice gravity, or twice the velocity that a body attains at the end of one second in falling without resistance, as in your case:

$$\frac{62{\cdot}5 \times 240 \times 3{\cdot}2^2}{64{\cdot}33} = 2{,}387 \text{ lb. pressure, or nearly 10 lb.}$$

per square foot. For tables and formula illustrating the motions of bodies in fluids and resistance of planes under various angles, see Haswell's "Mechanic's and Engineer's Pocket Book," which we can furnish to you for $4.

(221) L. H. L. writes: 1. Please give full directions for making a stereotype, using form of printer's type in chase as the intaglio, and using the paste described in query No. 5, SCIENTIFIC AMERICAN, December 15, 1888, for matrix. A. The paste is thinly spread on successive layers of tissue paper, enough to make mould of sufficient substance, the compound sheets thus formed being kept level by flat metal plates; these sheets are of a substance to admit readily beating them into the surface of the type with a brush, although they are likewise forced in by a press. Then the form with the sheet upon it is placed upon a steam table till the water is all drawn off, and the sheet, then readily removed from the type, constitutes a perfect mould to cast from. 2. Would *papier mache* be preferable to the above paste? If so, how can I make it, or where can I get it? A. *Papier mache* will not do for the purpose; it is not sufficiently fine and strong. 3. Will old type metal do for stereotype? A. Yes. 4. Give formula of cement used in forming letter sheets, note heads, etc., into tablets. A. Glue is made into very thin solution, after ten minutes' soaking in cold water. For every fifty pounds of dry glue nine pounds of glycerine are added to the mixture. It is colored with cochineal or with aniline dissolved in alcohol.

(222) W. L. P. writes: 1. Can a small wire be heated to a red heat between points in a battery circuit? A. Yes. 2. What is best battery to use, and how many cells? A. Use two cells of Grenet or simple plunge battery. 3. What is the best metal for wire? A. Use No. 30 to 35 platinum wire.

(223) P. E. M. asks. 1. What kind of metal contracts the most by cold and expands the most by heat? A. Of common metals, solid at ordinary temperatures, zinc. 2. How many cells of the Law battery will it take to run up strong the motors that you described in SUPPLEMENT, No. 641? A. The Law battery will not answer. Use ten to fifteen cells of a simple plunge battery. 3. Has a nut lock been invented that will prevent the nuts from coming off by the vibration of the train on the track, and leave the fish plates loose and the track loose? A. Yes; there are many patents on them.

(224) A. A. (Transvaal, South Africa) asks the value of crocodile, giraffe, hippopotamus, and sea cow skins, saying they have plenty of them in that locality. A. These skins only come to this country in very small lots or singly, so it would not be possible to name standard market value. Alligator skins, the product of our Southern coast, which we suppose quite similar to those of the crocodile, bring from 50 cents to $1 apiece, as taken off. Small giraffe skins from young animals are much of the nature of deer skins, and would probably command about same price per pound if in good condition. The hippopotamus would have no appreciable value for any regular use. There is a little leather made from skins of sea lions, for use in buffing wheels, but the skin is difficult to tan, and its value very uncertain, dependent upon size and condition. You should write to some of our hide dealers, stating number, size, and weight of skins you can supply.

(225) W. F. H. writes: Will you kindly let me know what mixture you would use to make 5 gals. of electropoion fluid for a carbon battery? A. Mix 1 gal. oil of vitriol and 3 gals. water carefully, and allow to cool. In a separate vessel dissolve 6 lb. bichromate of potash in 2 gals. boiling water. Mix both solutions carefully while the latter is still hot. This will make a little over 5 gals.

(226) Turner asks: What is electricity, or how is electricity produced in a Grove battery? A. Neither of these queries admits of an answer. Human knowledge has not gone far enough to solve the enigma. In a Grove battery chemical energy disappears, and its equivalent of electric energy is produced.

(227) G. M. G. writes: Will you let me know the mixture used for making mercury adhere to glass and metals? A. Place a piece of tin foil on a smooth surface, pour mercury over it, slide a piece of glass with its advancing edge just under the surface, then press and place on edge to drain. The same process will answer for smooth steel; most other metals will be attacked and injured by the mercury. Above all, do not let it touch gold jewelry, etc., as it will at once amalgamate with the gold and make it very brittle.

(228) I. R. B. writes: Will you please give me a receipt for a good stove polish in the form of a powder? A. Use good quality plumbago, applied with a stiff brush.

(229) J. W. H. asks: What is the simplest method to remove tobacco stains from fine blue kersey cloth, so that it will not injure the cloth, yet remove the stains permanently? A. Try lemon juice; oxalic acid followed by ammonia; weak muriatic acid followed by ammonia. Follow by sponging with soap and water.

(230) M. K. asks if there is any difference between Baume's hydrometer and that of Twaddell? If so, what is the difference, and how to calculate it? For example, suppose Baume's hydrometer showed 4°, what would that represent on Twaddell's? A. You will find the specific gravity scale of the Baume scale in works on chemistry. You can compute a Twaddell scale by multiplying the scale number by 5, add 1,000, and divide by 1,000. Thus: 1° = 1,005; 2° = 1,010; 3° = 1,015; 4° = 1,020; 5° = 1,025; which is within a fraction of 4° Baume = 1,027.

(231) F. E. asks: In a cannon of 6 inch bore, powder produces a pressure of, say, 30,000 lb. per square inch; what is the bursting strain the tube is subjected to at each point around the circumference, and by what rule is it calculated? If the cannon be made of material having an elastic limit in tensile strength of, say, 60,000 lb. per square inch, how thick must the walls of the tube be to stand this pressure of 30,000 lb. per square inch? The bore of cannon taken as 6 inches. A. The bursting strain around one lineal inch of the circumference of the bore is equal to 30,000 lb. × by the diameter = 180.000 lb. This product divided by 60,000 lb. tensile strain = 3 inches of metal, and this multiplied by 7 as a factor of safety makes 21 inches of metal, to which add the diameter of the bore, making the breech end of the gun 27 inches in diameter.

(232) H. R. K. asks for some article to use on leather belting to prevent slipping. Resin is not good, as it cakes and ruins a belt in a short time. Also, would like to have you name a good work on practical engineering, engines and boilers, exclusively. A. Use a piece of beeswax rubbed on the inside of the belt or on the pulleys as a temporary remedy in cases of emergency, though with proper size belts and pulleys, properly put in, there should not ordinarily be any slipping. We recommend you the "Practical Steam Engineer's Guide," by Edwards, $2.50.

(233) E. C. asks: Can you tell me the best preparation for cleaning copper boilers on outside so as to remove all tarnish? A. An excellent preparation, and the one most in use, is a solution of

oxalic acid in 6 parts water. It is a powerful poison, and requires care in its use. Slightly wet a cloth with the solution and rub the boiler. Wash clean with hot water.

(234) C. F. P. writes: I am about to erect a tobacco sweat house, 15 by 16, which must be completely steam tight. Can you tell me how many one-inch steam pipes it would require to heat this room, 15 by 16, 7 feet high, to a uniform heat of 90° day and night? I also need a moisture of 95°, which must be absolutely there day and night; would you recommend the heating by hot water or steam circulation? Is there any steam tight paper manufactured, which will stand moisture and heat any length of time? What will it cost me to get a hygrometer? A. You will require 75 feet of 1 inch pipe for your sweat room. If you have steam upon the premises, it is recommended. If not, a small greenhouse hot water stove is recommended. A galvanized water evaporator can be hung on the heating pipes for moisture. For ascertaining the amount of moisture in the room, we recommend a Mason hygrometer as the most reliable means, cost $2.50 to $3. They can be purchased through the optical trade. There is no paper lining that would stand the moisture and heat, unless thoroughly saturated with coal tar, which would impart a disagreeable odor to the tobacco. Many sweat rooms in New York are only lined with matched ceiling boards that have been well oiled with linseed oil and then painted with mineral paint (no lead). Some are only oiled.

(235) C. B. asks: I would like to know if the dynamo described in No. 600 could be made in half size by using exactly half the dimensions everywhere. Also if there would be any difference in the wire? A. To make a dynamo of one-half the capacity of the one referred to, reduce every dimension twenty-five per cent. If you make it one-half size linear measurement, the machine will have approximately one-fourth the power.

(236) H. M. C. writes: Please give definition and value of following terms: 1. Electro-motive force? A. The force directly producing an electric current. What it is, is unknown. 2. Ohm? A. The resistance offered to a current of electricity by a conductor through which a unit of electromotive force (one volt) will produce a current of one ampere. A cylindrical column of mercury one meter long and one millimeter in diameter has a resistance of 1·2247 ohms. 3. Megohm? A. One million ohms. 4. Microfarad? A. One millionth of a farad. A condenser of one microfarad capacity, charged at a potential of one volt, will contain one microcoulomb of electricity, enough to mantain a current of one ampere for $\frac{1}{1000000}$ second. 5. Volt? A. The unit of electromotive force. A gravity battery gives about 1·07 volt. 6. Ampere? A. The current produced by one volt through a resistance of one ohm. 7. Series? A. One succeeding the other. 8. Parallel? A. One by the side of the other, so as to be in action simultaneously. 9. Multiple? A. Several at once. 10. Multiple arc? A. Several voltaic arcs arranged in parallel between two conductors. This is the proper meaning, but it is applied to incandescent lamps, and means several disposed in parallel as just described. 11. Ampere hour? A. A current of one ampere maintained for one hour. 12. Compound wound? A. In a dynamo, having separately arranged windings on the electro-magnets.

(237) F. W. asks if men and women have been scalped and have recovered from it? A. Yes; there have been such cases, though they have occurred but rarely. One of the veterans in our office well remembers having seen, when a boy, an entirely recovered and healthy man who had been a subject of an Indian scalping knife. Possibly such survival has been due in some instances to the fact that the Indians, in hurriedly performing the work, removed only a portion and not the whole of the scalp. An instance was also reported, some years since, of an operative in an Eastern factory being scalped, from her hair having caught in the machinery, and of her recovery from the effects of the accident.

(238) H. L. W. asks (1) for a process of making soft water for the purpose of manufacturing liquid blueing with oxalic acid, without distilling. A. If the lime is present as bicarbonate, it can be precipitated by boiling. If it is present as sulphate, it should not cause you much trouble. 2. How to make a cheap electrophorus powerful enough to ignite gas or gasoline. A. Cast a cake of resin six inches in diameter and one inch thick. Provide for it a wooden box lined with tin foil. A tin disk four inches in diameter is provided with a central glass handle. To excite it, stroke the resin with a cat-skin, put the disk upon it as nearly central as possible, touch the disk with the finger, and then remove the finger. The disk, lifted by the glass handle, brought near a gas fixture, will give a spark.

Enquiries to be Answered.

The following enquiries have been sent in by some of our subscribers, and doubtless others of our readers will take pleasure in answering them. The *number* of the enquiry should head the reply.

(239) W. H. M. asks: Please describe the method of firing red hot shot. We know it has been done, but it seems impossible to gain any personal information.

(240) F. C. L. asks: Can you inform me about how deep the water is in Niagara river, from one to two hundred feet back of the great falls? Is the rock in river bottom here comparatively level? Also state the rapidity of current at this point. Does the city of Buffalo offer $100,000 premium to the party furnishing the most feasible scheme to utilize the power of the falls?

(241) H. C. W. asks whether it is easier for a fireman to keep steam on an 80 h. p. boiler to run a 50 h. p. engine (14 × 20, 180 revolutions) or a 75 h. p. engine doing the same amount of work as the 50 h. p. engine, it requiring 80 lb. of steam to run the 50 h. p. engine, and do the work. We fire with the refuse from rotary veneer machines and poplar bark, and sawdust from a heading saw. We find it pretty hard work to keep 80 lb. of steam on our 80 h. p. boiler to run 50 h. p. engine. Would we find it any better to put in a larger engine? Would we find it any more work to keep steam?

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(35) Circular Saw, Connections, etc., for same.—Your saw, 36 inches, should travel 1,000 revolutions per minute. You cannot obtain this speed without using a belt or multiple gearing. Better use a belt. If you have a fly wheel 5 feet in diameter on your engine shaft, you will need a pulley 1 foot in diameter on your saw arbor, providing your engine travels 200 revolutions per minute, which it should, with a boiler pressure of 150 pounds. It would then indicate 27·6 horse power if the stroke is 8 inches. This arrangement will allow of your cutting 5,000 feet of lumber per day, if your boiler is of sufficient size. But I do not think it is. Your description is too meager to permit of an estimate being made of its power. You should give number and size of tubes and size of fire box.—S. H. PRATT, M. E.

(56) I. S.—With the velocity of the air in the pipe at 14 miles per hour, with pressure of 100 lb. less the friction and other losses, we compute that you may realize 8,000 horse power, and for 200 lb. pressure nearly double, or say 15,000 horse power.

(58) W. H. C.—White porcelain clay or kaolin is a silicate of alumina, known by its soft, greasy feel and absorbent nature when touched to the tongue. Address L. A. Solomon & Bro., 216 Pearl Street, New York, importers of clays, for prices.

(59) F. H. G.—For coal, the grate should be 24 inches from the boiler; and for the small power you intend to use, you may make the grate surface only 3 ft. wide, if the grates are 4 ft. long. This can be done by false sides upon the grate, of fire brick; or an independent wall from the ash pit on each side.

(60) H. B.—For computing the indicated horse power of an engine: Multiply the area of the cylinder ($D^2 \times 0{\cdot}7854$) by the mean engine pressure, taken from tables, for mean pressure due to cut-off, and this product by the travel of the piston in feet per minute, and divide by 33,000. The mean engine pressure for ¼ cut-off = 0·637 of boiler pressure; for ⅜ cut-off = 0·766; for ½ cut-off = 0·86. For computing the distance of the weight on the safety valve lever: Multiply the area of the safety valve ($D^2 \times 0{\cdot}7854$) by the required pressure for blowing off. Divide this product by the weight of the ball. Multiply the quotient by the length of the fulcrum in inches and decimals; the product will be the distance in inches and decimals from the fulcrum to the center of the ball. Thus for a 3 in. safety valve, 100 lb. pressure, 60 lb. ball, fulcrum 2 in.: 3^2 in. = 9 in. × 0·7854 = 7·06 × 100 lb. = 706 lb., and 706 ÷ 60 = 11·76 × 2 in. = 23·52 in., 23½ in. from the fulcrum to the center of ball.

(73) 1. Resistance of accumulator and lamp.—Watts = 250 per unit of time. Amperes × volts = number of watts. 2. Resistance of lamp, 183·3 ohms. 3. The resistance of carbon is about 6-10 as much at a white heat as cold. 4. You cannot unless you allow one or more of the arc lamps to go out, without reducing greatly their brightness. 5. The batteries should be connected in series with the lights. —C. A. C.

(74) E. A. B.—Bromide Prints.—See SCIENTIFIC AMERICAN SUPPLEMENT, No. 330, practical hints on the making of bromide and gelatine prints.

(75) L. M. C.—For your thermostatic bar, cut a strip of sheet iron and a strip of sheet zinc 1 inch wide and long enough to reach across the incubator box. Rivet or solder the ends together, and wind twine tightly around for the whole length to hold the pieces close together, or if convenient, the strips can be soldered together. Fasten one end to the inside of the incubator. The other end will swing with the variation in temperature, to regulate a damper or the heat in any way that you may devise.

(77) Recovery of Silver from Waste.—The waste papers are thoroughly washed in water and this added to any first washings of silver prints. Sodium chloride (salt) is added till precipitation is complete, decant the solution, wash the precipitate with water, and again decant. The remaining precipitate is dried and then ready to reduce to metallic state. The silver chloride is mixed with about an equal portion of a mixture of sodium and potassium carbonates and fused in a clay crucible. A few minutes after fusion pour the contents of the crucible into some clay dish and allow to cool, when the silver button is easily separated from the mass. The cotton filters should be burned and the ashes treated with nitric acid. Dilute and precipitate with salt and proceed as above.—E. W., Jr.

(77) Recovering Silver Waste.—1. Burn the material, and treat ashes with nitric acid and water, 50 per cent solution. Then filter and evaporate, leaving silver nitrate. 2. Know of no method for reproducing negatives directly. You may make a positive on glass first, and then copy another negative from it. —C. A. C.

(78) Red gas flame.—Suspend in the flame a fine wire gauze basket containing strontium nitrate.—C. A. C.

(82) Raising a weight.—The power required would be the same in each case.—C. A. C.

(83) Who invented the telephone?—The telephone was invented by Philip Reis in 1861. Bell's patent is dated 1876.—C. A. C.

(84) Lapidaries' wheels.—The wheel used by lapidaries is a flat copper disk, charged on the edge with powdered emery, or a steel disk charged with diamond dust. It is used in the same manner as a circular saw.—C. A. C.

(86) M. C. H.—Matches.—Clear white pine is used for matches. We can mail an excellent work on the fabrication of matches by Dussauce, for $3, its price.—Address Paul Pryibil, 463 West 40th St., New York, for splitting machines.

(87) F. S. W.—Hot Water Heating Apparatus.—The hydrogen which you ignited at the air cock is not explosive; it requires to be mixed with a proper proportion of air to become so. There may be a possibility of vegetable matter in the water of your hot water apparatus disengaging a small portion of gas, which may accumulate in a radiator. In steam boilers, the flow of steam carries any gases of decomposition with it, and also all air that might make an explosive mixture.

(90) T. G. A.—Granite ware is glazed with porcelain enamel in the same manner as other kinds of enamel ware. The difference being in glazing both inside and outside, and in the color and quality of the glaze. Any colors can be utilized that are available for chinaware. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 248, 314, enamels and enameling.

(91) W. H. B.—Wire Netting for Drying. —Nothing that you can put on the wire netting in the frames will resist disintegration by the glue. Regalvanizing is the only remedy.

(94) 2. Battery for Heating Wires.—I think you will find the Grenet or simple bichromate of potash battery the best for heating wires. One cell, with a zinc plate 2¼ in. × 1½ in. between two carbon plates of the same size, heats ½ in. of No. 30 platinum wire to a white heat in two or three seconds. For greater length of platinum wire, connect more cells in series. With greater battery power, you can probably obtain white heat in a second. The battery fluid soon becomes exhausted with this work.—L. B.

(94) Telephone call bell.—1. The bell would be rung over the wire by the magneto call bell, but the resistance of the wire is too great to operate by a battery. 2. You do not mention the length of wire to be heated.—C. A. C.

(95) Movements of the ocean.—Two. The tidal movement caused by the attractions of the sun and moon, and the ocean currents, as the Gulf stream, caused by the rotation of the earth and the unequal heating of the waters at the equator and the poles.—C. A. C.

(96) Horse power of waterfall.—1. Over the 25 foot fall, 1·527 H. P. 2. Over the 50 foot fall, 3·054 H. P.—C. A. C.

(97) Leather belt.—Always turn the grain or hair side of the belt to the pulley.—C. A. C.

☞ Books or other publications referred to above can, in most cases, be promptly obtained through the SCIENTIFIC AMERICAN office, Munn & Co., 361 Broadway, New York.

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Gate, Elliott & Farrar ... 395,885
Gate, H. S. Harris ... 395,827
Gate, T. J. Howard ... 395,976
Gate, C. J. Moore ... 396,046
Generator. See Hot air generator. Steam generator.
Glass. See Binocular glass.