(3812) "Unscientific American" says: Will you please state in your paper the difference between a copper flue, copper pipe, copper tube? A. The only difference is in their use, each kmd being made for a special line of trade. Copper flues are made of sizes and thickness for boiler flues and designated by their outside diameter. Copper pipe is made to the outside gauge of iron pipe and thick enough to take iron pipe threads and designated by the nominal inside diameter. Copper tubes and tubing embrace a great variety of sizes and thicknesses usual in trade and generally designated by their outside diameter.

(3813) G. A. R. writes: A man has been working at electrotyping during the past three years; he handles considerable plumbago, bluestone, and iron rust, the bluestone being a solution in water. His hands are black and have been so for years. Can you give me a receipt for something that will clean them? A. Possibly some modification of a tattoo removing process might be applicable. Such is described in our SUPPLEMENT, Nos. 695 and 722. There is always danger to be apprehended in severe treatment applied to such large areas of skin surface.

(3814) G. B. M. asks what rule to use to wind a dynamo to obtain a certain number of volts and amperes. How to wind a motor to obtain the best results from a given number of volts and amperes, as six volts twelve amperes, twelve volts six amperes. Is four volts eight amperes as useful for power, as, eight volts four amperes? How many amperes can be safely carried through No. 14, 16, 18, 20 respectively? A. As the length of wire on the armature is mainly concerned controlling in the generation of the current, the first question to be settled in planning a dynamo is the voltage of the current to be generated. In the best dynamos two feet of active wire are allowed per volt. Having determined the amount of wire required for the armature to produce the specified voltage, the next question to be determined is that of the current. The wire selected must be of sufficient size to carry the current without being unduly heated. The next step is to plan the armature, which must be of sufficient length and diameter to hold the wire. It is desirable to limit the depth of the winding so that the iron core of the armature shall not be too far from the polar extremities of the field magnet. The winding should be divided up into as many coils as convenient. After having constructed the armature with a suitable commutator, the iron part of the field magnet should be made in such a manner as to inclose the armature, leaving air spaces between the poles equal to about one-third the diameter of the armature. The field magnet should be constructed so as to permit of using interchangeable coils. For a shunt machine the field magnet should have about fourteen times the resistance of the armature. The amperage of a machine is determined by dividing the E.M.F. by the resistance. It will therefore be seen that if a large current is required, the resistance of the machine must be very low. In designing a motor, the same general rules should be followed, and the total resistance of the machine required to secure a certain power from a given current is determined by Ohm's law, the basis of the calculation being that it requires 746 watts for a horse power, a watt being a volt multiplied into an ampere. It is impossible within the limits of an ordinary reply in Notes and Queries to furnish you with the full information desired. We therefore refer you to Sloane's "Arithmetic of Electricity," $1; Hering's "Dynamo Electric Machines," price $2.50; Hering's "Magnet Winding," price $1.25; and "The Electromagnet," by Silvanus P. Thompson, price $6, all of which we can send you by mail. Nos. 14, 16, 18, and 20 copper wire would carry respectively 6·4, 4, 2·5 and 1·6 amperes.

(3815) M. H. C. asks: 1. Is the current from a primary cell proportional to the surface of the elements exposed to the solution? A. Nearly. 2. In a carbon zinc cell, why is the exposed surface of the carbon so in excess to that of the zinc? A. Depolarization of a battery depends to a large extent upon the carbon surface. If it is large in proportion to the size of the zinc, it is more effective than it is when smaller. 3. Are electric street trailers ever lighted by an incandescent system connected with the circuit of the motor? A. It is common to light electric street cars by the current derived from the power system. We do not know that the light has ever been applied to the trailer. 4. What causes the armature (of a dynamo) to require more power in turning than a fly wheel of the same weight? A. The turning of any conductor in a magnetic field is always at the expense of considerable energy.

(3816) G. F. A. asks: 1. How long does it take to make the vacuum in the incandeseent electric lamps? A. From one to several hours. 2. Does the air pump which is used for this purpose cost a great deal more than a good piston air pump? A. A Geisler or Sprengel air pump costs about $50. 3. Is there any difference between an air pump and a vacuum pump? A. No. 4. What is the ratio of relative brightness used in classifying the stars into their different magnitudes? A. The accepted light ratio of star magnitudes is 2·512 and 0·3981—*i. e.*, a star of the first magnitude is 2·512 times greater than a star of the second magnitude, and a star of the second magnitude is 0·3981 the light ratio of one of the first magnitude, and so on through the series.

(3817) M. R. asks: 1. Can refuse arc light carbons be used in place of square carbons in a battery, and does a rod with the same amount of surface exposed as a square carbon give the same intensity of current? Also tell me how to fasten same to a brass connection post. A. Electric light carbons may be used in a battery, but if they are coppered, the copper must be removed. This can be done by dipping them in nitric acid. After this treatment the carbons should be thoroughly washed and dried, and about one inch of one end of each rod should be heated and soaked with paraffin. These ends can now be electroplated with copper and soldered to the wire connections, or they may be soldered together side by side or fastened together by means of lead cast around their upper ends. The round rod is an excellent form for the purpose. 2. Tell me how to make a white ink to write on a dark background. A. For white ink use barytes or Chinese white and a little gum water. 3. Tell me in what number of the SCIENTIFIC AMERICAN or SUPPLEMENT I can find directions for making a common plunge battery with glass or wooden cells. A. You will find a large plunging battery described in SUPPLEMENT, No. 792. 4. Please tell me what elements were discovered since 1886 and who are the discoverers? A. None have been definitely discovered and identified as elements. The work of Crookes, Von Welsbach, De Boisbaudran and others in the direction of identifying new elements have had no very definite result in the period named. Norwegium, holmium, thulium and many doubtful oxides from the minerals samarskite, gadolinite, etc., cannot be allowed to figure as authentic discoveries of elements. There are still left about twenty blanks in Mendelejeff's table to be filled possibly by newly discovered elements.

(3818) M. E. W. writes: I am thinking of being an electrician. What is the salary of an electrician? What is his work? Does he have to go to college or can he not study as an apprentice? What would be the best studies to take while at school? A. The salaries of electricians vary from $4 to $40 a week. The work required of him is according to his ability. Some parties who only run electric lines call themselves electricians. Others are able to go into the most intricate calculations. If you expect to be an electrician and not an electrical engineer, you can probably gain the necessary knowledge by studying as an apprentice. At school you should study mathematics, physics and chemistry, and if there is a course in electricity, obviously you should take that.

(3819) E. F. B. asks what the surface maasure would be to 1,000 feet elevation, also what the elevation would be to 79 miles surface measure for vision. A. In round numbers the possible range of vision for an observer 1,000 feet elevation for an object on the surface of the earth, and allowing for refraction, is 48 miles. For 79 miles range the necessary elevation, allowing for refraction, is 2,680 feet. Not allowing for refraction, for 1,000 feet elevation we have a range of 44½ miles, and for 79 miles a necessary elevation of 3,180 feet. All this applies to objects on the surface, and is of course subject to limitations of eyesight, clearness of atmosphere, power of telescope, etc.

(3820) F. C. G.—To remove fruit stains from table linen moisten with dilute sulphuric acid and then rub with aqueous solution of sulphite or hyposulphite of soda in water.

(3821) Index.—In regard to the solidification of potatoes the process is not patented and is said to be as follows: Make a solution of 4 parts of sulphuric acid in 50 parts of water. Treat peeled potatoes with this solution for thirty-six hours. Dry the mass between blotting paper and subject to great pressure. By using very strong pressure, billiard balls have been made closely resembling ivory. The material can be carved and doubtless could be used for the larger types. We have had no practical experience with this receipt or the substance described.

(3822) W. B. S. asks for the voltage and resistance of a Fuller battery, and how many cells would be required to light a two candle incandescent lamp, a three candle and four candle. A. The voltage is about 1·90 when in good condition. The resistance will depend on size; ⅛ ohm would be a fair average. Allow one cell to a candle power.

(3823) W. E. S. says: Three men are to lift a timber 18 feet long, weighing 200 pounds, and each to sustain one-third the weight. One to lift from the end and the two others to support their end by means of a cross bar. How far from the end must the two men place the cross bar to bear two-thirds the weight? A. The cross bar should be placed 4½ feet from the end of the timber for three men to carry it with even load.

(3824) J. K. asks how to solder metal to glass. A. We give you the following from the "Scientific American Cyclopedia of Receipts, Notes and Queries:" "Cover the glass with a thin layer of platinum, by brushing a neutral chloride of platinum mixed with essential oil of camomile. The oil is slowly evaporated by heat, and when the vapor ceases to be given off, the temperature of the glass is raised to a red heat. This reduces the platinum salt to a metallic state. The platinum thus attached to the glass is electroplated with copper. The article to be attached can be secured by electro soldering, or by means of soft solder applied in the usual way to the coppered glass."

(3825) J. L. says: 1. Lately I was vulcanizing India rubber in a Hay's vulcanizer. The safety point is about 320° temperature, but it got up to about 390. I immediately shut off the gas and opened the window, when somebody said that it would be dangerous to do so. Now, would the act of raising that window have any effect upon the vulcanizer or the contents? A. We can see no danger in opening the window under the circumstances stated, and only a cooling effect. 2. What is the cause of the bursting of an emery wheel? A. The bursting of emery wheels may be from defects, as a flaw or a crack unnoticed on the outside, or from too great speed. 3. Do you think that a small drill could be operated by springs, they (springs) furnishing the power. Could you give any hints as to how it could be done? A. Spring motors are practicable for small drills. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 46, 47, 48, 50, 473, for illustrated descriptions of spring motors.

(3826) L. A., Jr., asks: 1. What is the best dressing for leather belts to prevent slipping? Rubber belts the same? A. Rub a little beeswax on the inside of leather or rubber belts, to make them stick. This does not injure the material. 2. How much heat may be obtained by placing 1,000 ft. of one inch steam pipes, charged with 80 lb. steam pressure, in the basement of a 16 ft. square kiln? A. You should be able to obtain from 150° to 200°, according to construction and closeness of the room. 3. Is not mutton tallow and cut rubber mixed a good leather boot waterproofing? What can you recommend? A. You will find your mixture to stiff and difficult to mix. Try 1 oz. beeswax, ½ oz. suet, 2 oz. olive oil.

(3827) E. A. D. asks: What is the so-called "photographic process" of printing? For instance: I heard a bookseller remark to a purchaser: "This book is not as clearly printed as the original, for it was printed by the photographic process." A. The bookseller probably meant that the book was made from copied printing plates produced by the photographic process. Of each printed page of the book to be copied, a photo-negative is made. A photo print from the negative is made on sheet zinc. This is etched with acid, which eats out all the parts of the plate except the printed letters and lines, thus producing a printing plate without the need of setting types. Books are copied in this way.

(3828) G. H. asks: 1. How can meerschaum be colored artificially? A. Fill the pipe and smoke down about one-third, or to the height you wish to color, leaving the remainder of the tobacco in the pipe undisturbed for several weeks, or until the desired color is obtained. When smoking, put fresh tobacco on top and smoke to the same level. 2. Have there ever been "professional fasters" in any other country than America? A. As human nature is pretty nearly the same the world over, we think you will find cranks of the class named in every country under the sun. 3. Where does the water exert the greatest pressure against the sides of a moving vessel (steam boat)—at the bow or at the stern? A. At the bow.

(3829) A. McB. asks: 1. What proportion should the resistance of the field magnets be to that of the armature of a motor in order to secure the best results? A. In the shunt machine the resistance of the field magnet should be about fourteen times that of the armature. 2. Is the resistance of a drum armature one-half or one-quarter of the original resistance of the wire? A. One-quarter. 3. Are there any other numbers of the SCIENTIFIC AMERICAN or SUPPLEMENT that have anything in them about photo-engraving, besides SUPPLEMENT, No. 612? If so, give me numbers please? A. You will find photography and photo-lithography described in SUPPLEMENT, Nos. 656, 603, 642, 501, and 749.

(3830) A. D. B. writes: In the gas engine, the charge is taken in before compressing fills the same space in which it expands. What I wish to find out is this: Would I derive any more power from the same amount of gas (compressed just the same as in the first illustration) if allowed to expand to say one-half greater volume than in the first case. That is to say, if I increase the length of stroke one-half, leaving the volume of gas the same with the same compression, how much, if any, would I gain in power? And how far could I carry that principle in practice? A. If the gas engine utilizes the pressure exerted by the expanding gases to such an extent as to reduce the pressure at the point of exhaust to such a degree that it would be no longer available in driving the piston, it is obvious that an increase of stroke would not increase the efficiency of the engine; but if, on the other hand, the exhaust takes place while the pressure is still great in the cylinder, an increase in the stroke would be beneficial.

(3831) D. McN. asks how to waterproof cloth without using rubber? A. Soak the clothing in a weak solution of alum; afterward immerse it in strong soapsuds; then rinse it in clear water and dry.

(3832) H. B. D. asks: How can I ebonize a piece of white holly for inlaid work? A. Steep the wood in strong liquor of logwood or galls; let it dry and wash it over with a solution of iron sulphate. Wash with clean water and repeat if the color is not dark enough.

(3833) A. M. asks: 1. How can I give to steel the right degree of hardness for permanent magnets? A. Heat the magnets to a low red; plunge them in water and draw the temper to a straw color. 2. How are the Burnley dry cells made? A. To secure the details of this battery, you should purchase a copy of the patent in which it is described. 3. What size of platinum wire will become red hot with current from three cells of battery? A. It depends upon the amount of current generated by the battery. Usually very fine wire, either No. 34 or No. 36, is used. 4. How can I make a galvanic battery in which there will be no chemical action except when the circuit is closed? A. There is very little action in the Leclanche battery when the circuit is open. You will find this battery described in SUPPLEMENT, No. 157.

(3834) C. M. M. asks: 1. Whether hydrogen gas has been introduced for purpose of domestic heating? A. It has not, owing to the expense of generating it. The nearest approach is the Dabereiner lamp, introduced early in the century to do what matches do now. 2. If no such apparatus is known in the trade, what kind of gas has been found most practicable for use in private houses out of town? A. Gasoline gas, made by passing air over the surface of gasoline.

(3835) G. R. F. asks what to use, as of a kind of varnish, to put on a rubber hose used for gas, to prevent the smell of gas which comes from it, I think, through the pores of the said rubber hose? A. Try shellac varnish applied to the interior. A good hose should be practically gas tight. A solution of shellac in strong ammonia water is one of the regular varnishes for india rubber goods.

(3836) F. Z. C. writes: I have tried to recharge a porous cup of Leclanche battery in the following way, but cannot get a current, although set up the same as a new cup. Bits of carbon from electric light lamp and powdered black oxide of manganese nearly equal parts. Where is the trouble? Is it because I did not use the granulated manganese? Please locate fault. A. We can see no reason why you did not succeed with your battery. Possibly you failed to wet the carbon and manganese mixture in the porous cell before trying to start the battery. You may have sealed the porous cell so that the air cannot escape to permit the solution to enter. There should always be one or two air holes in the sealing at the top of the cell.

(3837) E. N. asks: Can you inform me how to make an emulsion of cod liver oil? A. Take 8 oz. cod liver oil; 2 oz. gum arabic in powder; 3 oz. water. Rub up the oil and gum, and then add the water. Of this concentrated emulsion take 13 oz.; oil of wintergreen, 24 drops; simple sirup, 1 fl. oz.; water 3 fl. oz. Triturate the concentrated emulsion and oil of wintergreen together, and then add the water and then the sirup. Other formulas are given in the "Scientific American Cyclopedia of Receipts."

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