2. Also how to temper steel for permanent magnets, and the best steel to use? A. Steel for permanent magnets should be tempered about like taps and dies, that is, the temper should be drawn to a straw color. Chrome steel is said to be the best for permanent magnets.

(39) F. I. P. writes: I wish to stain or dye vulcanized paper or papier mache, such as billiard balls or car wheels are made of. I have tried aniline dissolved in water, boiling hot; but have not been able to penetrate the surface of the paper, which is very hard. I have also tried lampblack and asphaltum without success. Would like to stain it different colors, but black principally. A. It will be necessary for you to color or dye the fiber before pressing it into shape. For black: Soak the material for 12 hours in an alcoholic solution of aniline hydrochloride, then remove and immerse in a dilute solution of potassium bichromate. Do not leave it in the last solution too long, or else the fiber may become decomposed. For blue: Use the blue aniline for cotton. For red: Use the Turkey red, and apply in the usual manner.

(40) L.—A mixture of oxalic and citric acids is probably the best compound to use for the purpose of removing ink from parchment. Chlorine or the alkalies would be likely to injure animal tissues. The removal of printer's ink from paper is hardly possible. It is accomplished to a limited extent by means of ether or a solution of soap in water; hot benzol, naphtha, and the like are also used.

(41) A. R. asks: Can you give me a receipt to remove freckles from the face without injury to the skin? A. A commonly used preparation for this purpose is:

Sulpho-carbolate of zinc	2 parts.
Distilled glycerin	25 "
Rose water	25 "
Scented alcohol	5 "

To be applied twice daily for from half an hour to an hour, and then washed off with cold water. 2. What will remove warts painlessly? A. Touch the wart with a little nitrate of silver, or with nitric acid, or with aromatic vinegar. The silver salt will produce a black and the nitric acid a yellow stain, either of which will wear off in a short while. The vinegar scarcely discolors the skin. 3. Can a transmitter from a primary current without a secondary coil work with success? A. A transmitter without an induction coil may be used successfully on a short line. 4. Has it ever been tried? A. It is one of the earliest telephonic experiments.

(42) D. G. would like to know how to make a very good-smelling hair oil that will not be injurious to the hair. A. Castor oil ½ pint, 95 per cent alcohol ½ pint, tincture cantharides ½ ounce, oil of bergamot 2 drachms. Color a pale pink with alkanet root. Many of the hair oils consist simply of almond or olive oil scented with a few drops of otto of roses, oil of musk or neroli, etc.

(43) T. D. B. writes: I have made a pocket battery for running small incandescent lamp; it works well using for half an hour, and after that it will only redden the carbon; it consists of two hard rubber boxes each containing a carbon and zinc separated by a piece of hard rubber, and I use the following solution: Saturated solution of bichromate of potash with one-fifth weight sulphuric acid and ½ drachm bisulphate mercury to pound solution. I understand that those in the market can be used off and on throughout an evening. A. Keep your zinc well amalgamated, and add considerably more sulphuric acid. The kind of battery you describe is not very well adapted to continued use.

(44) E. W. R. asks a rule by which the horse power of different sizes of belts on various sizes of pulleys can be ascertained. A. For the width of belt for a given horse power, the formula is $\frac{4500 \times \text{H. P.}}{d \times V} = \text{W.}$

And for power transmitted by a given belt, $\frac{V \times W}{1{,}000} = \text{H. P.}$

V=velocity of belt, d=diameter of pulley, W=width of belt. 4,500 and 1,000 are coefficients.

(45) G. L. writes: Is it more economical to use a 100 horse power engine running at its utmost capacity, or a 150 horse engine, same power needed in each case? To supply steam for such engine, which is the most economical—to use two boilers which have to be filled very hard, or to put in a third boiler, of the same size as the other two, and use all three? A. The moderate use of engines and boilers is considered economical. The saving of fuel where there is ample boiler power is very apparent. The heated gases going up the chimney with heavy firing is a sure indication of waste. We recommend the larger engine and 3 boilers, lightly fired, with moderate pressure.

(46) C. H. B. asks a process that will etch steel, such as cutters perform in transferring pictures and monograms upon razors and knives. A. Cover all the parts not required to be etched with beeswax, or cover the whole with beeswax, and then make your lines through to the steel; then dip in dilute nitric acid.

(47) R. S. asks the process of giving a tempered blue color to the steel plate and malleable iron castings of a roller skate. Is it done by painting, japanning, or heating? A. In order to obtain an even blue, the work must have an even finish, and be made perfectly clean. Arrange a cast iron pot in a fire so as to heat it to the temperature of melted lead, or just below a red heat. Make a flat bottom basket of wire or wire cloth to sit in the iron box, on which place the work to be blued, as many pieces as you may find you can manage, always putting in pieces of about the same thickness and size, so that they will heat evenly. Make a bail to the basket, so that it can be easily handled. When the desired color is obtained, dip quickly in hot water to stop the progress of the bluing, for an instant only, so that enough heat may be retained to dry the articles. A cover to the iron box may sometimes be used to advantage to hasten the heating. Another way, much used, is to varnish the work with ultramarine varnish, which may be obtained from the varnish makers.

(48) J. D. O. writes: 1. I would like to know the manner of applying gas and air in gas engines. I understand that gas and air are introduced into a vacuum and ignited, which causes an explosion, and so gives motion to the engine. A. There are two methods of using gas in gas engines. One is to draw the gas into the cylinder with a suitable proportion of air by the forward stroke of the piston, and then explode it under atmospheric pressure. The other method is to introduce the mixture of gas and air into the cylinder under compression, or to compress it in the cylinder, and explode it while in the compressed state. 2. How is the gas introduced? A. The common method is to allow the power piston to draw the gas and air into the cylinder by its forward motion. 3. How is the air introduced? A. The air is generally introduced by being simply drawn in through an open valve along with the gas. 4. Relative quantities of each? A. One volume of gas to eight or ten of air in non-compression engines, and one of gas to ten to fourteen of air in compression engines. 5. Process of ignition? A. There are several methods of igniting the gas. The most common method is by employment of gas jet, which in non-compressing engines is drawn directly into the explosive mixture contained by the cylinder. But in compressing engines it is drawn first into a chamber containing the combustible mixture, at atmospheric pressure, which is closed to the external air and then opened toward the cylinder, so as to communicate flame to the contents of the cylinder. 6. What size vacuum for one horse power? A. We do not understand what you mean by vacuum. 7. Does the patent on gas engines cover the manner of using gas and air only, or does it cover the combination of gas and air as a motive power? A. There are methods of using gas and air in gas engines which are not patented. There are other methods which are patented. The broad idea of generating power by the explosion of gas in a cylinder is not patented, and is public property.

(49) E. A. A.—You will find a description of the Bell telephone in SUPPLEMENT, No. 142. If an ordinary acoustic telephone would answer your purpose, you can readily make one by connecting with the ends of a light wire cable line, cigar boxes, which will answer very well as transmitters and receivers.

(50) C. P. W. asks: 1. Will you explain the point of saturation in permanent magnets? A. The point of saturation in a permanent magnet is reached when the magnet becomes incapable of permanently retaining as much magnetism as the strongest helix or electro magnet can impart to it. 2. How powerful in proportion to their own weight can they be made? Can they support more than their own weight? If so, how much? A. They have been made to lift 15 times their own weight, and small magnets have been made which would lift 25 times their own weight. 3. What is the longest distance they will attract, say chrome steel? A. As the attracting power of a magnet is inversely as the square of the distance, of course its power rapidly diminishes with the distance, so that the strongest magnot does not have any considerable power except in the immediate vicinity of its poles. 4. What kind of steel will make the best and strongest magnets? A. Chrome steel is said to be the best.

(51) T. R. G.—The office of the large wire in an induction coil is to produce intense magnetism in the core of the coil. There is no very well established relation between the primary and secondary coil, except that the primary coil should be capable of producing a magnetic field which will extend to the exterior of the secondary coil. You will find full description of induction coil in SUPPLEMENT, No. 160.

(52) N. J. W. writes: I have made a small dynamo after SUPPLEMENT, No. 161, that magnetizes electro magnets powerfully, and makes quite a light between a carbon and platinum point, but will not run one 3 candle power incandescent lamp. Has any one succeeded in making it run a 3 candle power incandescent lamp? A. You ought to be able to operate a three candle power incandescent lamp of lower resistance with the current from your dynamo. 2. In making a new armature having 4 coils, shall I use the same size wire, or would finer wire be better? A. In making your new armature, by employing finer wire, say No. 24, you will be able to produce a current of higher tension, which will work through greater resistance than the current from your present machine.

(53) E. R. S.—It would be impossible to give offhand the information you desire concerning the construction of the dynamo. The development of a dynamo of a new size or form requires a great deal of calculation, as well as much experiment. You had better consult some competent electrical engineer for the information you desire.—For a cement for fastening rubber to iron, melt together equal parts of pitch, gutta percha, and shellac. Apply the cement to the iron while the iron is warm.

(54) J. S. C. writes: If a barrel of oil (crude or refined) was say 30 feet from a stove, and there was ¼ or ½ inch pipe running from the barrel into the stove, and if I would turn on the oil (in a spray) and light it, would it burn only at the end of the pipe (in the stove), or would the fire follow the pipe to the barrel and cause it to explode? A. If the spray were kept up under considerable pressure, the fire could not run back into the barrel. You can avoid danger of explosion by extending your spray pipe to the bottom of the barrel, so that it will always be covered with oil.

(55) H. H.—Dynamite, as is the case with other explosives, expands with equal force in all directions.

(56) G. S.—The solder you refer to as being applied so easily is probably what is called bismuth solder, and is made of two parts of tin and one part each of lead and bismuth, by weight. It makes a very easy flowing solder.

(57) E. N.—The steam from the top or outlet of your coil boiler should not pass directly to engine, but to a chamber, so that the water will be separated from the steam, and settle to the bottom of the coil through a direct pipe connection. An old locomotive boiler, tested hydrostatically to 140 pounds, should not be trusted with more than 75 pounds steam pressure.

(58) Z. L. asks for the proportions of metals used in bronze castings. A. Red bronze: copper, 87; zinc, 13—yellow bronze: copper, 67; zinc, 31; tin, 2—statuary bronze: copper, 91; zinc, 5; tin, 2; lead, 2.

(59) G. W. L.—The Babcock fire extinguisher is charged with a solution of bicarbonate of soda in water and sulphuric acid in a lead bottle, which, when required, is turned over by a crank, spilling the acid into the charge of soda water. Carbonic acid gas is instantly generated, by which a pressure is obtained sufficient for throwing the whole contents of the apparatus with much force through a nozzle for fire purposes. Use of sulphuric acid 5 parts, bicarbonate of soda 6 parts, by weight. Other combinations are used, such as carbonate of ammonia, potash, etc. Iron can be used for the alkaline reservoirs. There are about 20 patents for fire extinguishers, mostly on the mechanical details.

(60) E. C. B. asks: Will coal oil saponify by uniting with any alkali, and is it ever used in the manufacture of soap? A. Yes, petroleum soap is in the New York markets.

(61) A. A.—For giving to cast zinc a genuine brass color, use for your dipping bath, for each quart of water, one-fifth ounce sulphate of copper, one-fifth ounce protochloride of tin. You may vary the shades by varying the proportions of the salts.

(62) G. W.—The following are dipping baths suitable for bird cages: nitric acid, 2 parts; sulphuric acid, 4 parts—or, sulphuric acid, 6 parts; nitric acid, 1 part; muriatic acid, 1 part; all by measure.

(63) R. M. H. asks the power necessary to overcome the resistance of a large horse street car on a *level* track, loaded with 50 persons. Also, to move the same loaded car up an incline represented by an angle of 10 degrees? A. For car on a level track, about 60 lb.; on an ascent of 10 degrees, 1,300 lb. To obtain an initial momentum will probably require far more, according to how near a perfect balance it is on which the car is resting, involving inequalities in axles, wheels, track, etc.

(64) P. M. L.—Pin points are supposed to be finished with a fine emery wheel revolving in the machine that makes the pin. You may put the points on pin tongues in a small way by twirling the points between the thumb and finger, upon a fine emery wheel running at high speed.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

E. M.—No. 1 is a fine grained so-called micaceous hematite or specular iron ore. It has no value as a paint in this city. The color is not considered good. No. 2 is simply a large grain or crystal of the specular iron ore. The ore, if free from sulphur and phosphorus, might be valuable for the iron. An analysis would be necessary to determine this.

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