Business and Personal.

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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 This is for our information and not for publication.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.

(4370) T. R. asks: In a dynamo made of the field magnet of Parkhurst motor and drum armature 4½ inches long, 1½ inches diameter, would 250 feet of wire give 25 volts? By winding it with 6 layers of No. 21 wire 350 feet could be wound on; allowing 10 feet wire to a volt it would give 35 volts, and with low external resistance 10 amperes. This would give 350 watts and require about ⅓ horse power to run it. if my calculations are correct. Is there danger of getting too much wire on and requiring too much power to run it? Could not resistance be introduced and thus decrease the power required? How many ampere turns does this field magnet need to magnetize it fully? A. [T. R.'s query was referred to Lieut. Parkhurst, who has kindly furnished the reply, given below. Although an abstract of the reply would probably answer the purpose, we print it in full to show that it is not always an easy matter to furnish a reply to an apparently simple question.—ED.] Referring to your correspondent's query, I would say that I have worked out the winding with No. 21 wire for the dynamo in question, and I have not the time now for a complete solution of the question. But I can say at once that even granted that No. 21 wire can be wound so as to give 35 volts E. M. F., the carrying capacity of the wire entirely precludes the idea of ever taking out more than 4 amperes as a maximum current. Even this is beyond limit of ordinary safety, and anything more would probably heat the wire of the armature so much as to burn it up, or at least destroy the insulation completely. The most I can figure as possible to put upon the armature is 8 turns per layer per coil, with 12 coils, each 3 layers deep (and it would be a tight squeeze to get on 3 layers per coil on core 1⅛ inch diameter and not exceed 1½ inch for diameter of finished armature); this would give 288 turns of wire upon armature, and this would come somewhere between 300 and 350 feet of wire, the uncertain factor of waste length in the heads not being readily determined except by winding. Of this length of wire, whatever it might be, there would only be about 225 feet not connecting the heads, and of this there would only be about 75 per cent active, or about 170 feet of active wire, or about 85 feet active in each half of the armature. By driving it fast enough this might and probably would penetrate 35 volts E. M. F. The armature with 350 feet No. 21 wire would have a resistance of something over one ohm. The field winding would also, if series wound, have from ⅔ ohm to 1 ohm, so that the lowest resistance allowable in external circuit would be—

$$R_{ss}=\frac{35}{4}-\frac{8}{4}-\frac{27}{4}=6{\cdot}75 \text{ ohms.}$$

This comes from $C=\frac{E}{\Sigma R}$

$C=4 \quad E=35 \quad \Sigma R=R_{ss}+R_a+R_f \quad R_a=1+ \quad R_f=1$

$$\therefore 4=\frac{35}{R_{ss}+2}$$

This would only give 140 watts; and assuming that the dynamo is working at 70 per cent efficiency—as high a rate as can be assumed—this would call for about 200 watts as the actual work expended, or something over ¼ horse power. The armature is small in diameter and is pretty stiff. Mechanically, it probably can stand 6,000 revolutions per minute, and it would have to turn at something like that rate to generate 35 volts E. M. F. The area of magnet limb is only about 2 square inches. Allowing 40,000 lines of force per square inch, and not deducting for leakage, 80,000 lines of force for each magnet is all that can be counted on, or 160,000 lines of force for the field (with no leakage). To generate 35 volts E. M. F. 35×10^8 lines of force must be cut per minute, and since there are about 225 active turns of wire, and 160,000 lines of force, in the field, there will be $225\times160{,}000$ lines of force cut in each revolution, or the armature must rotate $\frac{35000000000}{36000000}$ per second or 97+ times per second, or 5820 revolutions per minute, to generate 35 volts E. M. F. This is only about 40 feet per minute for the outside wire of the armature, a speed not unusual, in fact general, in large machines. No. 16 wire for the field can carry 4 amperes of current safely. Allowing 25 per cent for insulation and slack winding, 34 turns should be got upon each magnet limb; 5 layers would therefore give 170 turns per limb, or 680 turns for the 4 limbs, and with 4 amperes we would have 680 ampere turns per limb, or 2720 ampere turns in all, which would probably be enough for the purpose. This would probably give rather higher resistance for the field winding than called for, but not enough to make very much difference. The above calculations are only roughly approximate, for as I said above, I have not time to go into the matter in all its detail. They may serve however to show that the machine in question could not under any very probable circumstances ever run up to more than ¼ horse power, and if it ran to much over ⅛ horse power, I would be rather surprised. C. D. PARKHURST, Lieut. 4th Arty.

(4371) N. W. B. asks: 1. An electric motor that takes 110 volts 3 amperes current to run at its full capacity is run as a dynamo; will it have the same output? A. Nearly. 2. How much wire will it take to make an induction coil to get one thousand volts, No. 32 wire, worked by 2 cells Bunsen battery? A. Consult SUPPLEMENT, No. 160, for this information. 3. In winding an induction coil does it make any difference if the wire is not wound in even layers near the primary coil? A. The wire should be wound as compactly as possible. 4. Is it essential that you should be good at mathematics to be a good electrician? A. Yes. 5. In asking you questions in regard to patents, if they are worth patenting or not, do you charge anything for the desired information? If so, how much? A. We give our opinion free of charge. 6. I was testing an electric bell iron frame. If I took hold of the bell with one hand, and the screw that makes the connections with the other one, I received a shock. What was the cause of it? Had about 4 volts, 2 cells plunging battery. A. The shock was due to the induced or extra current generated during the discharge of the bell magnet. 7. Which is the cheapest—to buy an induction coil, say 1,000 volts, or to make one? A. It is probably cheaper to purchase. 8. In making induction coils with more than one electrode, how do you do it—by winding as many wires on it as you want electrodes? A. The binding posts are connected with the winding at different points, so as to include different lengths of the secondary wire. 9. If you choke an electric motor, is there any danger of burning the armature out—100 volts 3 amperes? A. Yes, there is danger of burning out the armature unless the wire is of sufficient size to carry the current.

(4372) E. B. A. asks: 1. What is formula of the solution in the porous cup in the Bunsen cell? A. Make a saturated solution of bichromate potash and water. To this slowly add one-fifth its weight of commercial sulphuric acid. 2. What is the internal resistance of the Daniell cell? A. About 3 ohms. 3. Is there any local action in either of the above cells when not in use? How strong a current will each of these cells give? Is the number of SUPPLEMENT named giving the directions to make an induction coil for medical purposes? A. There is very little local action in a Daniell battery, more in the Bunsen battery. The Daniell battery has an electromotive force of 1·07 volts, and the Bunsen about 2 volts. The current from either is determined by the resistance. The electromotive force divided by the resistance equals the current. $\frac{E}{R}=C$. Induction coil is described in SUPPLEMENT, No. 569.

(4373) C. W. O. asks: 1. How can I get mercury from the stuff on looking glasses? A. Scrape off and boil with a little hydrochloric acid and water. If the mirror is coated with amalgam, this will remove the tin. 2. If I make a Trouve battery such as is described in Notes and Queries No. 3395 (September 26, 1891), with plates 3 inches in diameter, how many such pairs will be required to give 90 watts through zero external resistance? A. We have no exact figures, but a very large number would be needed. The battery is not adapted for high power currents. 3. Is copper 1-100 inch thick, thick enough? A. Yes. 4. Which wears out—zinc or copper? A. The zinc. 5. What is the resistance of motor described in SUPPLEMENT, No. 641? A. About 3 ohms. 6. What number of feet of copper wire will it take to give a resistance of 1 ohm of each size given? 12, 13, 14, 15, 25, 26, 27, 28, 29, 31, 33, 34, 35, A. W. G. A. 615, 488, 386, 306, 30, 24, 19, 15, 12, 7·5, 4·7, 3·74, 2·97.

(4374) W. W. asks: Which is the more economical for heating purposes, hot water or steam? Why and to what extent? Will boilers deteriorate more when idle, when full of water or when empty? Please name some good work on drawing machinery in perspective. A. Hot water circulation for heating buildings and dwellings is the most economical in fuel when the plans favor its proper arrangement. The economy consists in the grading of the fire in moderate weather so that all the pipe circulation may have any desired temperature below that of steam-heated pipes, while for heating by steam a constant and full fire must be kept up at all times or no steam is generated. This applies to low pressure heating. Boilers should always be laid up for summer, full of water that has been boiled by filling the boiler and drawing the fire. Empty boilers rust. We recommend "Drawing for Machinists and Engineers," by Davidson, $2; "Practical Perspective," by Davidson, $1.50; and "Orthographical and Isometrical Projection," by Davidson, $1, mailed.

(4375) J. G. S. asks: Will hay or straw when packed in large quantities and in a damp condition cause spontaneous combustion? A. Yes; heating and spontaneous combustion is one of the liabilities in massing large quantities of hay or straw in such a way that the air will feed the oxidation following the heat of fermentation. This does not apply to ensilage, which must be done in tanks or ground recesses that are airtight at the bottom and sides, so as to hold the carbonic acid gas generated by fermentation, which in turn remains in the tanks by its weight and which drives any air that may be left in the mass out at the top.

(4376) C. L. D. asks: 1. Could a yacht of 140 horse power, burning 3¼ pounds of coal per horse power per hour, be run any more economically by electricity? A. No. 2. How much room would be needed for the storage batteries necessary to supply the above amount of horse power for four days? A. It requires about 8 cells for a horse power, and for a continuous run one charge will last about 6 or 8 hours, working at full capacity. The cells will average about one-half of a cubic foot each. 3. Has coal ever been turned directly into electricity in a battery? A. The nearest approach to this is a thermo-electric or pyro-electric battery.

(4377) A. H. N. writes: 1. I have use for a number of permanent bar magnets. I have a coil of about No. 16 magnet wire; said coil is 5 inches long, 6 layers carefully wound in glue on a dry hardwood spool the shell of which is ⅛ thick, the end flanges or collars ¼ thick. Would it improve this coil as a magnetizer to wind on a pound or so of very fine wire? A. The fine wire would not improve a coil for this purpose, but more coarse wire would undoubtedly render it more efficient with a suitable current. 2. Would it answer for an induction coil, and by removing vibrator and core, and changing connections direct to terminals of primary coil, be suitable for making strong permanent magnets 6 or 8 inches long by ⅜ to ¾ size of hole? A. Six layers of wire is more than is necessary for the primary wire of an induction coil. However, if you were to construct your coil in the manner suggested, you could magnetize with it, but not as successfully as you could with a coil having a larger number of convolutions of No. 16 wire. 3. Is an induction coil and a coil for making permanent magnets practical as a combination? A. No.

(4378) E. N. asks how to make hydro- quinone developer. A.

No. 1.

Hydroquinone	6 gr.
Sodium sulphite c. p.	24 "
Water	1 oz.

No. 2.

Carbonate soda	60 gr.
Water	1 oz.

For a developer take of

No. 1	1 oz.
No. 2	2 "
Water	1 "

Use less of No. 2 if it works too fast. 2. How can I give prints a black tone? A.

No. 1.

Powdered borax	100 gr.
Water	10 oz.

No. 2.

Chloride of gold	1 gr.
Water	10 oz.

Mix equal parts. 1 grain of gold will tone a sheet of paper 18×22 inches.

(4379) T. B. H. asks: Does a curved ball really change its course in the air or is it only a deception of the eye? A. Yes; there is no doubt as to a curve or deflection being made from the line of projection by the peculiar twirl given to the ball as it leaves the hand. See a full discussion of the subject, with illustrations, in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 402, 410, 423, on base ball science.

(4380) W. B. asks for a good formula for coating paper with a chloride gelatine emulsion for photographic printing, to take the place of albumen paper. A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 276, for full directions. 2. Please name a good treatise on the manufacture of gun cotton or pyroxilin. A. See "Modern Explosives" by Eissler. Price $4.20.

(4381) Subscriber, Vernon, Texas.—The insect is one of the plant lice. It belongs to the genus Callipterus.

(4382) M. M. says: I was much inter- ested in the question by L. W. A., why the injector works. When the injector (or inspirator) is in operation under high pressure of steam, and the overflow valve is opened, allowing part of water to enter boiler and part to return to well, why don't the water rush out with great force, as there is an opening to interior of boiler through check valve? In balancing a cylinder, how can I tell whether both ends are balanced alike? Is there any rotary steam engine in successful operation, and where? What is the greatest difficulty to overcome to make a rotary compete with a reciprocating steam engine? A. There is a slight contraction in the stream as it passes between the delivery nozzle and the receiving nozzle, and when they are exactly proportioned and adjusted to prevent scattering and overflow, except when starting; the stream not only enters the receiving nozzle intact, but carries a little air with it. The check valve shuts off all flow from the boiler and only opens when the impact from the jet becomes greater than the boiler pressure. In balancing revolving cylinders place one journal in a box held by easy springs, or in an easy-sliding box, or suspended box, and revolve the cylinder or drum by an attachment on the shaft at the solid box end. By revolving at about its proposed speed, the journal in the elastic box will wabble and a piece of chalk held against the end of the cylinder will mark the light side. When one end is balanced, reverse the cylinder and balance the other, and if fine work is required, repeat the operation. We know of very few rotary engines in use, and those not on a large scale. They suit many special wants, but have not yet been brought to match the economy and ease of repair and care of the best reciprocating engines.

(4383) J. S. McD. asks the best method of keeping, during summer months, the pipes and radiators of a hot water heating apparatus. Is it better to keep the pipes and radiators full of water, or should they be kept empty when not in use? Please give me the best plan to preserve pipes, radiators and heater or furnace when not in use. A. A hot water heating apparatus should be laid up for the summer full of water, the same that has been circulating, as such water contains no air, and the boiler and pipes will not rust in water from which all the air has been discharged. If the water has been long in use, and it is desirable to clean out by drawing off, the new water should be heated and a hot circulation made before laying up for the season. The fire chamber and flues should be thoroughly cleaned, and the draught entirely closed to prevent sweating by changes of weather during the summer. Empty boilers and pipes rust very fast, as the inside cannot be made thoroughly dry.

(4384) A. W. T. asks (1) how ordinary tack hammers are magnetized, so they will pick up tacks? A. By passing them through an excited helix; the hammers being made of hard iron, or case-hardened, retain the magnetism. 2. What kind of metal is most easily magnetized? A. Very soft wrought iron is most easily magnetized, but it does not retain its magnetism. You can permanently magnetize hardened steel or case-hardened cast iron. 3. I can magnetize the blades of my pocket knife with a horse shoe magnet, but I have a steel tack hammer that I cannot magnetize with the magnet. Why is it? A. Possibly your steel tack hammer is too soft, or it may be too hard, or possibly your magnet is too small to charge the hammer to any perceptible degree.

(4385) T. H. B. writes: 1. In regard to storage battery described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 845, can it be formed with a gravity battery? A. Yes, by giving it plenty of time, say one month. 2. If so, how many cells of gravity battery (6 x 8) should be used for each cell of storage battery? A. 4 or 8 cells. 3. How should the gravity cells be connected—in series or parallel? A. They should be connected so as to give an E.M.F. of 2¼ volts. 4. How long should the current be allowed to flow before reversal? A. 8 or 10 hours.

(4386) W. H. asks: Can you inform me in what part of the country bird's eye maple grows? A. The "bird's eye" and "curled" maple are accidental growths of the sugar maple, *Acer saccharinum*. It is native through all the Northern States and West to Eastern Minnesota Nebraska and Kansas, and southerly along the Allegheny Mountains to Northern Alabama and Western Florida. It is slightly reduced in size toward the limits of growth; it reaches its greatest development in the States bordering the great lakes.

(4387) J. A. B. says: In making a siphon, I suck the air out. What starts it flowing, and what keeps it flowing? Again, I take the tube and fill it with water and start it flowing. What starts it, and what keeps it flowing? A. The principle of the action of a siphon is due to the fluid leverage of unequal columns of water which are sustained in the bent tube by the pressure of the atmosphere. In whatever way you deprive the siphon of its air the water follows, and when full will run by gravity toward the lowest level with the velocity due to the difference in level less the friction of the pipe. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 793, on siphons, illustrated.

(4388) A. H. S. asks: In what propor- tion should the ingredients of a tar and gravel roof be mixed? A. Use as little tar as will allow the gravel to be spread with the trowel when hot. Cannot give the parts, as gravel differs in kind and fineness. Use tar that is nearly hard when cold. The gravel should be made hot before mixing with the hot tar. The surface should be sanded as soon as the mixture is spread.

(4389) C. N. asks: Can a circle be de- scribed so as to make any three given points the termini of the radii from a common center? A. Yes; draw a line between each of the three points, exactly bisect each, and draw a line at right angles from each bisection. The point of meeting of the lines will be the common center of a circle passing through the three points.

(4390) A. M. asks: Where is the proper position for the steam dome on a horizontal boiler? Does it make any material difference where it is placed in regard to danger of explosion? A. The number of sheet sections in a boiler generally determines the position of the dome. The center of the boiler is the