the discovery of some result other than the hypothesis of attraction to account for the gravitation of one body toward another. This will indicate at once that the book is of the inconoclastic type, and shows that the author may be expected, in it, to remorselessly attack modern scientific conceptions. He seems to have covered the ground at great length and after the conclusion of his treatise favors us with about 100 pages of appendix.

DOMESTIC SCIENCE. A book for use in schools and for general reading. (Second and revised edition.) By James W. Talmage. Published by George Q. Cannon & Sons Co. 1892. Pp. 389.

We have gone through this little work emanating from far-off Salt Lake City, and have been most pleasantly impressed by the selection of topics and the judicious way in which they are arranged and treated by the author. He seems to have the talent of making a readable and consecutive work from materials which normally are considered of a somewhat disconnected nature. From what we have seen of it we feel strongly inclined to recommend it to the general reader.

THE COAL TAR COLORS. With especial reference to their injurious qualities and the restriction of their use: a sanitary and medico-legal investigation. By Theodore Weyl. Philadelphia: P. Blakiston, Son & Co. 1892. Pp. xii, 154. Price $1.50.

This interesting work touches upon a subject of growing importance. The toxicology of the coal tar colors has hitherto been rather neglected. The use of such colors not only in textile fabrics, but in food and elsewhere, makes it of unusual importance to understand what their effects upon the human system are. This work is done for us in Dr. Lethman's translation of Weyl's excellent treatise.

ELECTRICAL EXPERIMENTS. A manual of instructive amusement. By G. E. Bonney. London: Whittaker & Co., Paternoster Square, E. C. Pp. xvi, 252. Price 75 cents.

Much that is old, but for that reason none the less interesting, appears in this book. The usual topics of magnetism, induction coil experiments, static electricity and electrolysis are given, and the work will doubtless be of considerable interest to amateurs. Many of the cuts will be recognized as old friends, yet they are all pertinent to the subject.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

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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.

(4757) N. N. writes: I have an artesian well 612 feet deep, 5 inches diameter, and flows 190 gallons of water a minute. How much power can I get from it, and in what way can I test the pressure of it with a steam gauge? A. We should know the height that the flow of water can be utilized for power, as well as the quantity. You can reduce the area with a 2 or 3 inch hole in a pipe cap and find the height of the jet. You may also tap the side of the pipe for a gauge and close the top for the total pressure. Can you give the vertical height of the stream from the open pipe? With the water that is flowing, if you can get 20 feet fall, you can realize ¾ of a horse power.

(4758) R. V. De B. writes: It is proposed to feed a reservoir from a lake situated on a higher level. The lay of the land is such that a canal with a slight but continuous fall could be constructed from the lake to the reservoir, the water in the canal running at the rate of say one foot per second. Would there be any objection to the construction of an open canal, 3 feet deep, on account of the formation of ice in winter or from other causes? A. The question of climate should decide the matter of an open water ditch. In your climate slow-running water is liable to freeze from 2 to 3 feet thick during the coldest winters. If the reservoir is small, so that there is necessity for constant flow through the ditch, it will be at considerable risk to depend upon its supply during prolonged cold weather. If the cost is not a bar, we recommend cast iron pipe, or if within the range of size, glazed tile pipe is cheap and serviceable where there is no pressure.

(4759) E. R. F. asks: If the air contained in a cylinder 8 inches long and 1½ in diameter is compressed into ⅛ of that space, with the pressure of how many atmospheres would it rest on a square inch of surface? If the same quantity of compressed air should suddenly be released and escape from the cylinder through a tube ¼ of an inch in diameter, and in its passage through the tube encounter a bullet weighing ½ ounce, what force in pounds would it exert on the bullet, and how far and with what force or penetrating power would such a force drive it (the bullet)? A. The pressure as stated will be about 150 pounds per square inch, depending upon absorption of the heat of compression and leakage. The isothermal pressure = 103 pounds = 7 atmospheres. The adiabatic pressure = 235 pounds = 16 atmospheres. If the air were let into the air gun at the instant of compression, the pressure upon the bullet would be about 200 pounds per square inch and would eject the bullet with a velocity of about 500 feet per second, having a range of from 100 to 200 yards, according to smoothness and length of barrel and facility for giving free vent of the compressed air to the barrel. The force of impact would be that due to about 15 foot pounds.

(4760) W. K. M. asks: Has the process of tempering aluminum been discovered yet, and is it possible to use it in the open air without fear of its tarnishing? Also please state the comparative weight and tensile strength of steel, copper, and aluminum. A. The process of tempering aluminum has not been discovered, except by alloying with other metals. It does not readily tarnish in the open air. Aluminum, 26,000 pounds per square inch tensile strength, weight 168 pounds per cubic foot; copper, 30,000 to 33,000 pounds per square inch tensile strength, weight 552 pounds per cubic foot; steel, 70,000 to 90,000 pounds per square inch tensile strength, weight 490 pounds per cubic foot. See a valuable treatise on "Aluminum: its Manufacture, Properties, Alloys, and Working," by J. W. Richards, $5 mailed.

(4761) F. W. W. says: I have a few hives of bees which I keep for pleasure. Ever since I first had them, my extracted or strained honey has sugared or crystallized. This takes away its fine flavor, as some of the sugar will not melt on being heated to the boiling point of water. I have kept this honey in a warm room, and have also tried a cold one without attaining the desired result. The honey is extracted by removing the caps of the cells and whirling the combs in a honey extractor. My neighbor, who also has a number of hives, is troubled in the same manner. The honey was extracted in July. Do you know of any way of preventing this crystallizing without detracting from the value of the honey? A. There is a possibility that your bees have been feeding on sugar, which makes crystalline honey. Otherwise the centrifugal extractor may carry too much air through it, evaporating part of the moisture. Try moistening the air of the extracting room with steam while the work is being done. A boiling pan of water may answer the purpose.

(4762) C. G. C. asks: Will there be a gain (if so, how much?) in mixing hot air (furnace gases) with steam in working an ejector (pump) to lift cold water on high lifts to prevent condensation of steam? What proportion of hot air would be most useful? A. Hot air mixed with steam in an ejector is of but little or no value, and without pressure decreases its working power, and in any quantity nearly destroys its lifting power. The power of an ejector to lift and force water is in the property of steam to condense and disappear as a vapor at the instant of imparting its velocity to the water. Air mixed with the steam retains its gaseous volume in the receiving nozzle of the ejector and occupies the space that would otherwise be occupied by the water jet. Air alone is of little value in a water ejector. Will soon publish something on ejectors.

(4763) W. C. R. asks: How can I count the flaps of a small bird's (sparrow) wings, and how may I compute the area of a bird's wing which is somewhat irregular in form? A. You can only approximate the wing vibrations of small birds by eye comparison with a wing fitted to a vibrating mechanism with a variable power and registering index. The area may be computed by sectional divisions of a drawing to be made exactly of the size and shape of the wing.

(4764) Subscriber asks: Can wood carbon be used instead of battery carbon in an arc light? A. Wood carbon was the material used in producing the electric arc by Sir Humphry Davy, but it is not as good as the manufactured carbon made from powdered coke. The old authorities used to recommend saturating it with mercury to improve its conductivity. 2. Is there any way of changing heat direct into electricity? A. The nearest approach to the direct conversion of heat into electricity is found in the thermo-electric battery.

(4765) H. G. asks: What explosive powder when mixed with powdered magnesium will cause a powerful instantaneous flash, suitable for photographic purposes? A. Magnesium powder, 6 ounces; potassium chlorate, 12 ounces; antimony sulphide, 2 ounces; 75 to 150 grains of the powder should be used.

Magnesium	40 per cent.
Permanganate of potassium	40 "
Peroxide of barium	20 "

(4766) A. D. M.—A good cement for celluloid is made from 1 part shellac dissolved in 1 part of spirits of camphor, and 3 to 4 parts of 90 per cent alcohol. The cement should be applied warm, and the broken parts securely held together until the solvent has entirely evaporated.

(4767) G. M. R.—The designs for watch works are made on an enlarged scale, generally ten times the size, which makes the actual dimension expressed with a decimal point one digit to the left. There is no haphazard work in watch making or in the machinery for producing the parts.

(4768) E. R. S. asks: 1. What book is there on friction, suitable for a young student, yet giving practical calculations, such, for instance, as finding the horse power required to keep an axle or shaft turning at a required speed (the dimensions of the shaft and its weight being known)? A. We recommend Thurston's work on "Friction and Lost Work in Machinery," $3, mailed. Also our SUPPLEMENT, Nos. 572 to 576, for an admirable series of articles on friction. 2. If the resistance of the air is not taken into account, does the speed with which an axle or shaft will revolve in its bearings vary as the horse power applied? A. Friction varies with the speed, and relatively decreases in proportion to the increase of work in revolving machinery. 3. What book is there, showing how to calculate an electric motor to produce a certain horse power? A. Dynamo calculations are given in Sloane's "Arithmetic of Electricity," $1 by mail. Multiply the desired horse power by 746, divide by the potential difference at your disposal. This gives you the amperage. Then calculate on the lines of a dynamo of similar factors.

(4769) R.—No one has the right to make a patented article for his own use without consent of the patentee.

(4770) O. M. W. writes: I have built a small electric machine, windings and pattern after the 8 light dynamo described in the SCIENTIFIC AMERICAN, except size; armature 3¼ inches long, 2 3-16 inches in diameter; magnet waists oval, 1×2 inches; 4 inches long, magnet coils 18 wire gauge; armature No. 20; 16 commutator bars; each armature coil six turns per layer, two layers deep. As a motor it seems to be a success, but as a dynamo a complete failure; can only get a current of seven-tenths ampere up to 1800 revolutions, above that speed less. What is the trouble? What sized wire and what manner of winding can I get the largest amperage as a dynamo, using very soft cast iron magnet or very soft forged iron magnets? Magnets and armature size as above. A. The iron used in a field magnet should always be as soft as possible. If the iron in your magnet is hard, it accounts for your failure. With No. 18 wire on the field magnet you should use your machine as a series wound machine. If you find the resistance is too great with the two arms of the magnet in series, you can put these in parallel. If you desire to use the machine as a shunt wound machine, the resistance of the field magnet is not great enough. Probably the winding of the field magnet for a shunt machine should be of No. 22, or possibly No. 24 wire.

(4771) W. H. D. writes: I want to know about the resistance necessary for a ⅛ horse power motor when running it with fan on a 500 volt T. H. street railway circuit, with amperage bearing as high as 240. You will do me a kind favor by letting me know through your valuable paper how many ohms resistance it will take. A. An electrical horse power is 746 watts. A watt is an ampere multiplied into a volt. The current in amperes equals the electromotive force divided by the resistance. You have an electromotive force of 500 volts; for ⅛ horse power you require 93 watts. You will therefore need about 5 amperes of current, and a consequence your machine will need to have a resistance of 100 ohms.

(4772) W. A. S. writes: I have been trying to smelt tin cans, tin clippings, and all kinds of rough iron scrap, in a common straight cupola such as all foundries use, and have been unable to get any iron. There is a great quantity of slag, which is very thick and tough, and in a short time fills the tuyere holes and won't let any wind through. We have not used anything for flux. A. You cannot run down wrought iron scrap in a cupola. It should be piled in masses of 100 pounds or more, heated in a reverberatory furnace and welded with a power hammer. The tin scrap may be used in small quantities with cast iron in the cupola.

(4773) C. E. B. asks how big a space he needs for the gas in a gas engine with a cylinder 1½ inches in diameter and a stroke of 2½ inches, also how big space he requires for the compression of the air. A. A compression gas engine uses about 1 part of gas to 7 or 8 of air. We think you will find it extremely difficult to operate an engine of the size given. The space for the gas and air varies with the system upon which you propose to run a motor. If you are running it without washing out the cylinder with air before each explosion, you will need a space twice as large as that required for the combustible mixture. If, however, you wash the cylinder out, the space for gas and air need be only large enough to contain the combustible mixture when compressed.

(4774) M. T. B.—Your proposed improvement in telescopes would have no value, as the defects of each telescope and mirror would be multiplied; furthermore, each reflection and each refraction of the light absorbs an appreciable quantity, so that your telescope would lack in illumination as well as defining power.

(4775) W. M. C.—(1) First select a clean perfectly fitting cork for each bottle. Then melt your salve and pour it into the bottles from a vessel provided with a spout, taking care in doing so not to allow any of the grease to touch the inside surface of the neck. (2) There is nothing dangerous in the use of the inhalations recommended to you for the asthma. (3) You will find a valuable article on the "Etiology and Cure of Asthma" in SCIENTIFIC AMERICAN SUPPLEMENT, No. 589. Price 10 cents.

(4776) E. F. S. writes: I was in a store the other day, and saw a clerk take a cotton string about six or eight inches long (common wrapping twine) and stick it to a glass showcase on the inside with a piece of wet paper across the middle and let both ends hang down alike, but opposite each other, from the round side of the showcase. Then he rubbed the back of his hand on the outside of the glass, and the strings began to move backward and forward until the one nearest the hand hit the glass and stuck to it; the other end stood out the other way, and became rigid. Some said that it was electricity, and some magnetism. Please tell us what it was. A. The results which you describe are probably due to frictional electricity generated by rubbing the glass with the hand.

(4777) A. A. asks what size wire to wind the four cores of a small shunt wound dynamo, the cores of which are 4 inches by 2 inches by ⅞ inch. I wish to wind these with such wire as will, when wound to about 5-16 inch thick all over, permit about 1 ampere of current only to pass through the coils. The armature is 2 inches by 4 inches, wound with No. 20 wire, with which I expect to get 4 amperes and 50 volts. A. You will need about 1,000 feet of No. 27 wire for your field magnet.

(4778) T. B. writes: I have a magnet that I wish to wind to obtain best results. The size of the cores is 2 inches long and 5-16 inch in diameter. What size and quantity of wire shall I wind on bobbins? A. Wind each core of your magnet until the thickness of your wire equals the thickness of the core. If you intend to use the magnet for local work, No. 24 magnet wire would be the best size for the winding.

(4779) G. A. G. asks: How far will the electricity now in use on the electric street railways jump