

an hour in still water, what would be the speed per hour, using same amount of power, going with the current, current running four miles per hour? A. The boat will have its own speed added to the velocity of the current, and will make 8 miles per hour, as measured on the shore, and in the contrary direction can only hold her position against the current.

(8079) F. S. R. asks 1. Is the simple motor described in your issues of December 8 and 15 to be run with one or more dry batteries? A. The diagram of the electrical connection shows four cells, two series of two cells each, used to run the motor. Dry batteries will not answer. 2. I have used No. 27 sheet iron, 8 feet in armature and 32 feet in field magnet; does this affect its running? A. The difference is that you have used a thinner sheet iron, and will not have so much weight of iron in the field and armature; hence you will have less magnetism and less power. There is no reason why the motor should not run with lighter fields. It will not run so heavy a fan. 3. How does the current revolve the armature? A. If the current is sent through in one direction, the armature turns in one direction; if in the other, the direction of the rotation is changed. If the direction of rotation is not as you wish it, change the wires which lead into the armature so as to reverse the current in the armature, leaving the field unchanged. The same can be accomplished by changing the direction of the current through the fields.

(8080) P. A. S. asks: 1. By what process may clam shells be softened so that they may be flattened without breaking? A. Clam shells cannot be softened so they can be flattened. 2. How can celluloid be made plastic so that it may be flattened? A. Celluloid can be softened and moulded by pressing under heated oil. 3. Why does the dissolving of NH_4Cl in water (as in making batteries) produce a lowering of the temperature? A. The simple solution of any substance in water is accompanied by a cooling of the water. This can be shown with common salt or sugar. It is very evident with ammoniac chloride, and still more so with ice. It ought not to seem strange that this should be so, since heat is the means of dissolving the solid in all these cases. When no chemical action accompanies the mixing of a substance with water, the solution of it in water is always accompanied by an absorption of heat, a cooling of the water. Sodium sulphate dissolved in hydrochloric acid causes a fall of temperature far greater than the melting of ice can cause.

(8081) F. T. P. asks: 1. What is the temperature of liquid air? A. 312 deg. F. below zero. 2. How and by what kind of an instrument is it found? A. It is measured by a platinum thermometer. This depends upon the fact that the electrical resistance of pure metals is proportional to their temperature above absolute zero, and would have no resistance at absolute zero. See SCIENTIFIC AMERICAN for April 2 and April 23 1898, price ten cents each. 3. Where could I find a good article upon the subject of liquid air? A. We can send you ten good articles on the subject for ten cents each. Also a good book, Sloane's "Liquid Air," price \$2.50 by mail.

(8082) H. O. P. writes: Please inform me as to what an alum cell and bromide cell are, which are mentioned in your book, "Experimental Science," under subject of heat, page 189, twentieth edition, of what made and where they can be bought? A. An alum cell is a glass cell filled with alum water. The glass cell is shown on page 619 of "Experimental Science." A similar cell filled with carbon bisulphide in which iodine is dissolved till the solution is opaque to light is an iodine cell such as is used to show the transmission of heat without light. It is not a bromide cell, as you term it, but an iodine cell which is used for the purpose. They can be bought from dealers in physical apparatus, or made from two plates of glass and some thick rubber. Rubber tubing filled with fine sand may be used for the sides and bottom of the cell. Four screw clamps are required to hold the glasses together.

(8083) A. R. H. writes: I have collected a lot of bells of the form used for electric bells. I want to make a set of musical bells, and have all sizes. Could you let me know through your column or by letter how I could tune them? They are not very far or much out of tune as they are, but I do not know how to alter the pitch of the note one way or the other. A. To raise the pitch, turn the edge off in a lathe cautiously until the desired pitch is reached. To lower the pitch, make the edge thinner, removing metal from the inner or outer side at and near the edge.

(8084) E. N. C. writes as to an inexpensive battery for lighting one or two incandescent lights. A. You will find the plumbic bichromate battery described in SUPPLEMENT, No. 792, price ten cents, as convenient as any primary battery for lighting one or two small electric lamps.

(8085) J. T. asks: Has the problem of seeing to a distance by means of electricity ever been solved? If so, can you give me any information in regard to the latest work that has been accomplished in this direction? A. The sending of portraits or other pictures by electricity has been done for several years. We do not know any success in the direction of seeing to a distance by electricity.

(8086) F. D. P. asks: Can you inform me through your information department, in

a general way, of the most practical and economical way to establish a telephone line of short length? I wish to construct two lines, one about one-quarter mile, the other about two and one-quarter miles, in length. I have never had any experience in this line, and will be pleased to have all the particulars. A. You will need line wire of galvanized iron, if the line is in open country; or insulated, if the line is in a town where other lines are run along the streets. Transmitters, receivers, calls, and lightning arresters, batteries, insulators, etc., will complete the outfit. The list of these, with prices and quantities, will be furnished by the dealers to whom you may write for rates. We can furnish you Peole's "Practical Telephone Handbook," price \$1.50 by mail, which will give you instructions upon many points concerning the installation of the apparatus.

(8087) W. E. P. asks: Can you inform me how many convolutions there should be in the primary and the secondary of an induction coil designed to produce a quarter-inch jump spark, using a cell which gives about 6 amperes at 1 1/2 volts? Also sizes of wire suitable for primary and secondary coils. A. The primary of most induction coils is wound with two layers of wire. For a quarter-inch spark use No. 24 cotton-covered copper wire. For secondary use about 5-ounce No. 36 silk-covered copper wire. Full data, drawings and instructions for making all parts of coils from 1/4-inch spark to 6-inch spark are to be found in Benney's "Induction Coils," price \$1 by mail.

(8088) M. N. asks: 1. Are lightning-rods a protection, or not, to a building, provided, of course, they are properly put on? A. Lightning-rods are a protection to a building when properly put on. They protect the building in two ways: 1. If the building is struck, the rods furnish a means of conducting the electricity to the earth without damaging the building. 2. They act as a path for electricity from the earth up into the cloud to neutralize its electricity before the lightning strikes. This may prevent the lightning from striking the building at all. This is probably often the case. For this service the rod gets no credit. 2. If they are not a protection, how did Franklin's discovery benefit mankind? A. Franklin's great discovery was not the invention of lightning rods. It was that lightning and electricity from the machine are identical, one and the same thing. He invented the lightning-rod after he found out what lightning is.

(8089) A. H. asks: Please inform me if any of the SCIENTIFIC AMERICANS contain instructions for making a storage battery that will register 15 volts or more. Please mention numbers. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 1195, price ten cents. You will require 3 cells to obtain 15 volts of pressure. One cell can give but 2 volts. To obtain 15 volts, join 3 cells in series.

(8090) O. H. H. asks: Does ice melt faster in a cool, damp cellar or in a warm, dry room? Have had different opinions on the same, and would like to know the correct one. A. The melting of a substance is proportional to the difference of temperature between that substance and the place where it is. There is no connection between the melting of ice and the moisture of the place where it is; or, rather, the place where ice is kept will soon be saturated with moisture, since ice evaporates at all temperatures without becoming liquid. Ice will, for these reasons, melt better in a warm place than in a cool place.

(8091) A. L. L. writes: My two boys are anxious to understand electrical testing and electrical-testing instruments. They say commence at first principles, as it puzzles them to understand voltage. They can master amperage and resistance, but voltage and potential difference seem to puzzle them. Would you kindly advise as to what book or books they had better procure? A. Your boys may think of this: A man pumps water from a trough up to another twenty feet above the first. From the upper trough the water flows down into the trough from which it was raised through a pipe, turning a wheel on the way. If this little example in water power is understood, it will be possible for the boys to apply it to the action of a battery or dynamo current. The battery or dynamo pushes the difference of potential up on its plus side to a level higher than on its minus side. Then from the higher level the electricity flows down again, doing work on the way—lighting a lamp, or turning a motor. The current of water can do work in proportion to its quantity. So can the current of electricity. This is measured and called amperes. The water is prevented from doing work in proportion to the friction along the pipe and the difficulty in turning the wheel. So the current of electricity is prevented from doing its work by the difficulty it has in forcing its way along the wire. This is resistance, and is measured in ohms. The water gets power in proportion to the height to which it is pumped. So the electricity has power to do work in proportion to the height to which it is raised. This is its difference of potential, or, as it is sometimes called, its electromotive force, or voltage. These names may later be distinguished from each other, but at first a distinction is hardly necessary. Electromotive force is also thought of as pressure. This is like the pressure the water would have in a pipe up which it is being pumped. The higher the pipe, the greater the pressure at the bottom. So a dynamo may produce a pressure of 50 volts, or 100 volts, or

5,000 volts, and the current will flow down with more violence as the pressure in volts is made greater. We recommend Thompson's "Elementary Lessons in Electricity," \$1.40; Slinge & Brooker's "Electrical Engineering," \$3.50.

(8092) F. P. S. asks: Can you inform me why a buzzing sound is heard at a simple electro-magnet which is connected with a small, shunt-wound dynamo driven by a water-wheel, when the dynamo is running. A. The dynamo is probably furnishing an alternating current, and the sound heard is the musical note corresponding to the number of alternations per second of that current.

(8093) W. B. writes: I am in want of exact information as to what extent lightning-rods prevent buildings from being damaged by lightning. I want reliable information, other than from interested parties who have rods for sale. A. We have frequently expressed our opinion that lightning-rods are a great protection to buildings, both in preventing lightning from striking and in conducting the discharge to the earth when it occurs. SCIENTIFIC AMERICAN SUPPLEMENT, No. 998, price ten cents, contains a very valuable paper on the subject, from the pen of Prof. McArdle, of the Weather Bureau. His word ought to be considered as final.

(8094) J. T. V. writes: 1. In reading "Experimental Science," on page 350 I find the author makes the following statement: "In the search for perpetual motion, vain efforts have been made to discover a substance which could be interposed between the magnet and its armature, and removed without the expense of power, and which would intercept the lines of force, so as to allow the armature to be alternately drawn forward and released, but no such substance has ever been discovered." On page 481 there is shown a magneto-electric machine, deriving its power from a series of magnets. Inferring from the passage quoted that a permanent magnet continues to attract its armature indefinitely, will you kindly explain the effect the revolving armature has on the magnets of this magneto-electric machine, that renders them incapable of imparting motion, as I understand it does in time? A. The statement quoted from "Experimental Science" is quite true. There is no substance which can intercept lines of magnetic force which is not also attracted by the magnetic field. The magneto-electric machine derives its power from the fact that a coil of wire revolving in a field of force, so as to include a varying number of lines of force as it revolves, will have an electric current generated in it proportionate to the force required to revolve it; that is, proportionate to the number of lines of force which it cuts. This power is not lost by its exercise, but can be used indefinitely to produce an electric current. 2. Does the temperature affect the passage of the electric current through steel or copper wire? A. Yes; every conductor has its resistance changed by a change of temperature. Carbon has less resistance when hot than when cold. Metals have more resistance hot than cold. The change of resistance for one degree is called the temperature coefficient. 3. Will you also please advise the number of shots it is calculated can be fired from the new 16-inch gun described in a recent issue of the SCIENTIFIC AMERICAN? A. The life of the 16-inch gun depends upon the intensity of the explosives. As to the number of shots that can be fired before the gun gives out, it probably cannot bear more than 100 shots at long range.

(8095) H. E. McC. asks: Will you please inform me if I may solder the wires to commutator segments? A. Armature wires are usually soldered to the commutator bars.

(8096) E. L. M. asks: I would like to inquire if the furnace of SUPPLEMENT 1182 can be used for melting lead, Babbitt and such metals and kept at a steady heat? A. An electrical furnace cannot be used for melting metals at a low temperature. Its heat is so intense that the metals would be burned.

(8097) J. Z. asks: On a short telegraph line of about 300 yards, which instruments would you advise me to use—two five-ohm, or two twenty-ohm, instruments; or would it be just as good to use one of each, and why? A. Almost any sounder will work 300 yards. We do not know any reason for preferring one of these to the other.

Table listing various mechanical and electrical items with prices. Items include: Balance sheet or book for banks, W. W. Barrett; Baling press, D. A. Killman; Band cutter, A. feeder, American, A. Van Houweling; Barrel head, D. McGee; Barrel lowering device, J. C. Purucker; Basket, R. B. Fuller; Bathing apparatus, electric, O. Schneider; Batteries with charging circuits, apparatus for controlling connections of storage, N. M. Suren; Batteries with charging lines, apparatus for connecting storage, N. H. Suren; Battery charging system, secondary, M. Waddell; Battery system for signaling circuits, storage, N. M. Suren; Bicycle, A. S. Dickinson; Bicycle, C. L. Travis; Binder, loose sheet, J. B. Irving; Binder, temporary, C. H. Rosenberg; Blast furnace, J. Kennedy; Blotter, roller, G. E. Barshar; Boat lowering gear, D. Roche; Boiler incrustation, preventing, T. H. Jones; Book, manifold order, F. L. Smith; Book rack, J. Roseboom; Boot or shoe spring tread device, G. E. Swan; Border cutting and wall paper trimming machine, A. Allen; Boring drill, J. Nitschmann; Bottle finishing machine, W. P. Parsons; Box covering machine, H. B. Blackington; Boxes, packages, barrels, etc., machine for stacking or unstacking, G. M. French; Brake apparatus pressure regulator, J. G. McCarthy; Brake shoe, J. R. Cardwell; Bread raiser, E. B. Knipple; Broom, S. J. Edmiston; Brush, blacking, E. P. Le Compte; Brush holder, scrubbing, Donnelly & Brady; Bucket, bait, G. Ayers; Burial casket, E. A. Post; Butter cutter, H. Lingo; Butter making, C. M. Taylor, Jr.; Cabinet, R. J. Buchanan; Cable fixture tip, E. T. Burrows; Cake cutter, F. Grosvold; Calipers, nose, C. M. Haynes; Camera, multiplying photographic, J. F. Standford; Can, E. M. Hallbauer (reissue); Can, See Shipping and storage can; Car coupling, A. Dunn; Car, dump, T. R. McKnight; Car drafting rigging, railway, W. H. Miner; Car fender, A. G. Carlson; Car seat head rest, T. B. Beach; Car side bearing, Susemihl & Torrey; Cars, gravity rocker side bearing for railway, J. J. Hennessy; Carbon and paper holder, W. B. Boshing; Cartridge case loading machine, J. P. de Braam; Ceiling structure, B. Maibach; Centrifugal separator, P. H. Adams; Chair bellows, rocking, C. U. Krieg, Sr.; Chairs, sanitary head rest for barbers' or other, H. Marshall; Chopping machine, L. E. Hawes; Chuck, rock drill, Docharty & Wagner; Chucks, tool for extracting bushings of drill, Docharty & Wagner; Cigar lighter, electric, C. A. Bernhardt; Cigar rolling table and wrapper cutter, I. Liberman; Cigar wrapper cutting machine, J. D. Lacroix; Cleat for metallic shingles, C. W. Conner; Clevis, blow spring, W. S. McParren; Clock, alarm, O. Bartel; Cloth cutting or like machine, England & Roberts; Clutch, J. Carlson; Cock, gage, Miller & Hart; Collar and cuff dampening apparatus, F. H. Harriman; Collars, etc., machine for folding, C. H. Knapp; Combination lock, C. E. Hopkins; Compass, ship's, H. Bruns; Composition of matter, Bennet & Beman; Compression lubricator, W. Michalk; Concentrating apparatus, A. K. Cross; Concentrator, S. W. Traylor; Conductors from non-conductors, mechanism for separator of, Blaker, Morscher; Conduit joint mold box or form, Therien & Gregory; Cooler for bottled wine, etc., J. T. Ashe; Copper matte, desulfurizing, G. C. Carlson; Cord cutter, S. H. Wiesedepppe; Crate, J. P. Bae; Creamery apparatus, J. Payne; Crucible and crucible furnace, A. Reynolds; Crusher, W. Lingo; Cultivator, W. L. Beall; Curler, hair, W. Connolly; Curtain fixture, A. Harris; Curtain pole, J. P. Muehlebach; Curtain pole and pole support, combined, H. C. Stout; Cutter head, H. C. Hosier; Delivery apparatus, coin controlled, Stuart & Beechfield; Demagnetizer, O. S. Walker; Dental press for compressing dental disks, J. P. Gomes; Disinfecting appliance, T. N. Thomson; Display and sale cabinet, Putnam & Warriman; Door hanger, F. A. Engelbright; Door lock, C. J. Letzing; Douche bench, W. T. Greer; Dough, separable apparatus for warming and raising, R. E. Pedigo; Dredge, L. A. Dey; Dyeing machine, J. Steenberghe; Ear, device for treating diseases of the, M. Polich; Easel, desk, L. L. Ingraham; Eraseur, M. Jaencke; Electric separator, F. Ribbo; Electric lighting systems, junction box for, M. Waddell; Electric motor controlling device, A. G. Carlson; Electric switch, C. J. Doran; Electric switch, J. J. Jones Jr.; Electric switch, J. H. Spangler; Electric switch, P. H. F. Spies; Electric traction system, Thompson & Walker; Electrical machine attachment, static, G. Werber; Electrical separation of conductors from non-conductors, Blake & Merscher; Electromagnetic separator, G. H. Waring; Elevator, See Warehouse elevator; Elevator, electric attachment, B. Fleck; Embalmers' use, vein dilator for, W. L. Miller; Engine, H. MacLaury; Engine lubricator support, G. U. Merrill; Engine reversing apparatus, steam, Van der Noorda & Hoem; Engine vaporizer, explosive, R. P. Hansen; Engine vaporizing device, explosive, C. E. Dawson; Engine cylinder with liquid packing for explosion or internal combustion, L. Bayer; Engines, incandescent ignitor for gas, C. J. Macomber; Excavating apparatus, M. Covell; Expense register, traveler's, H. R. Richardson; Explosion engine, C. E. Dawson; Exposure indicator, F. Wager-Smith; Fastener feeding mechanism, P. R. Glass; Fastening, metallic, L. A. Casgrain; Fastenings, machine for inserting metallic, L. A. Casgrain; Fastenings, machine for making and inserting metallic, L. A. Casgrain; Fastenings, making metallic, L. A. Casgrain; Fence machine, slat and wire, W. F. Seargeant.

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[See note at end of list about copies of these patents.]

Table listing various mechanical and electrical items with prices. Items include: Account case, merchant's short, H. H. Chapman; Advertisement pillar, C. Casanova; Advertising device, J. P. Marshall; Advertising device, Westermann & Darling; Alarm mechanism, T. H. Bowles; Amalgamator, T. H. Hicks; Anchor, J. H. Shaw; Arch skewback, W. B. Hughes; Automobile, J. Break; Backwater floor and stable drain, J. F. Cotter; Bag, E. D. Bean.

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