Practical Electrics

20 Cents

Over 100 Illustrations

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THE ELECTRIC DOG

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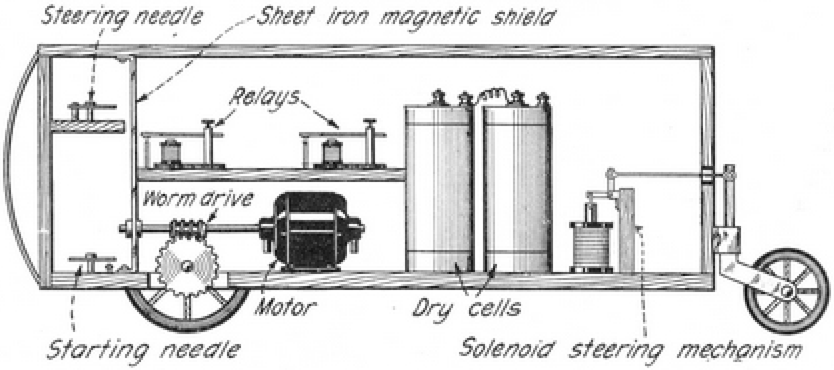
The Electric Dog

THIS electric dog follows a magnetic walking cane in any direction like an obedient servant. Simply hold the cane in front of the dog's nose, whereupon the dog starts running and will follow the cane straight ahead or to the right or left as desired.



Section of the electric dog. The steering needle and starting needle will be observed in the front with a sheet iron magnetic screen directly behind them. The steering solenoids are placed in a vertical position to eliminate friction.

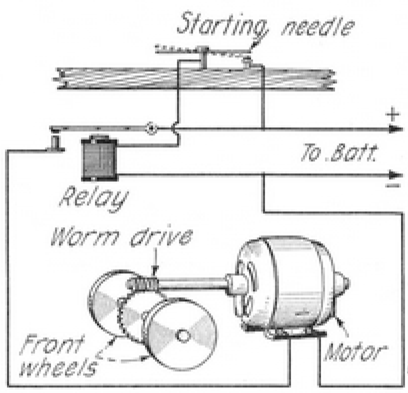
This is not magnetic attraction between the cane and the dog which acts as the propelling agent; the dog is self-propelled. There are within it an electric motor and a battery by means of which the dog is enabled to follow its master.

Within the cane is a long magnetized steel rod, which emanates magnetic lines of force for several feet out from the poles. In the dog's head are delicately balanced magnetic needles, like compass needles, which are deflected when within the magnetic field of the magnet in the cane. Therefore, bringing the cane near the dog deflects the magnetic needles, one of which closes a circuit allowing a feeble electric current to pass through a sensitive telegraph relay. The relay connects the battery to the propelling motor which runs and propels the dog. The dog then travels straight ahead.

Moving the cane to the right deflects another magnetic needle in the dog's head to the right, which also closes a sensitive relay circuit. This relay closes a circuit through a solenoid which pulls a plunger attached to the rear wheel and turns it in such a way as to cause the dog to turn to the right. The same operations take place when the cane is moved to the left of the dog's head; the dog turns to the left. Holding the cane between one to two feet from the dog's head will deflect the magnetic needles sufficiently.

The illustrations show clearly the construction of this simple yet mysterious dog. In Figure 1 is shown the motor starting circuit. The starting magnetic needle is located at the bottom of the dog's head (see Fig. 3), so that the front end will be deflected up when the cane is brought over it. This closes a circuit through an ordinary sensitive telegraph relay, which in turn closes the motor circuit. One set of four dry cells supply the electric energy required for all of the operations which take place in the dog. As the delicately balanced needles will only serve for very feeble currents, sensitive relays are essential. Of course the relays may be constructed out of telephone bell magnets. The battery operates a six-volt motor which drives the front wheels through a worm gear, thus giving sufficient speed reduction to run the dog slowly from the high speed motor.

Figure 2 shows a diagram of the steering mechanism. This operates similarly



The starting needle which operates the relay to carry the actuating current to the motor below.

to the starting circuit, except that one magnetic needle is deflected either to the right or to the left, and thus closes either one relay circuit or another. Although two telegraph relays may be employed, as shown in the illustration, a double acting relay can be made with telephone bell magnets to serve the same purpose. The steering relays close the solenoid circuits which pull their soft iron plungers and turn the rear wheel sidewise. This wheel is mounted so that the dog will run in a straight path when both solenoid circuits are open.

In Figure 3 is depicted the arrangement of the various parts. The magnetic needles, which are large size compass needles, are mounted in the front where they will be directly under the influence of the magnetic cane. Behind the needles is placed a sheet iron shield, which not only absorbs stray magnetic fields set up about the other electrical apparatus and prevents these fields from influencing the needles, but also attracts the needles themselves and holds them parallel to the body of the dog when they are not deflected by the magnetic cane. Otherwise the needles would have a tendency to point north, which would interfere with their controlling action. The motor, dry cells, relays and steering solenoids are mounted as shown.

The body of the dog may be constructed out of light wooden boards and painted in gaudy colors as is depicted more vividly on the front cover. It may be tested out before installing the magnetic needles to make certain that the battery is powerful enough to run the motor and propel the dog. A good six-volt battery motor will be sufficient if easy running, well lubricated driving mechanism of the correct size is employed. Rubber tired wheels should be used.

The magnetic needles are then mounted as shown and should be thoroughly cleaned where they make contacts. It may be necessary to shunt small ¼ mfd. fixed condensers across the contacts so that the heat developed by the small arcs when the circuits are broken will not cause the needles to stick.

Although the permanent magnet inside of the cane is suitable, the actions of the dog may be made more mysterious by using a long electromagnet inside of the cane with secret contacts, whereby it is magnetized from batteries carried in the coat pocket. In this case the magnetic field is not only more powerful, so that the cane may be held farther away from the dog for satisfactory operation, but the arrangement prevents the dog from following the cane when held by strangers who are not equipped with the

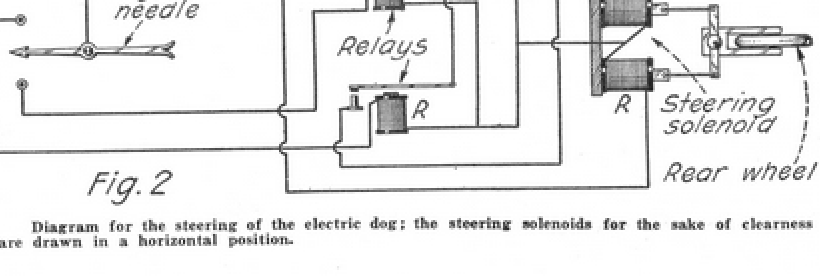


Fig. 2

Diagram for the steering of the electric dog; the steering solenoids for the sake of clearness are drawn in a horizontal position.

necessary batteries to magnetize the cane. The dog will only follow its master. A hollow bamboo cane may be used to conceal the magnet.

Of course this magnetic needle remote control system may be applied to many other contrivances besides the magnetic dog. Imagine an elaborate table lamp which lights only when a small magnet is lying at one side of it. Electric fans, bells, and other devices may be operated in the same way.

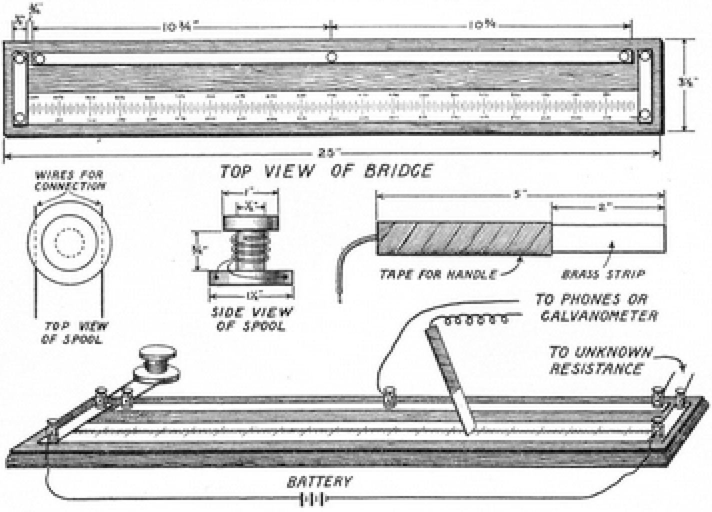
Wheatstone Slide Wire Bridge

By A. P. Peck

An amateur often has to measure the resistance of a piece of apparatus, or a pair of phones, and may not have the necessary facilities for doing so at hand.

With a little time and patience, and with no great outlay of money, he can, by following the directions given herewith, construct a simple Wheatstone slide-wire bridge which will enable him to do this work.

The first requisite is a base which may be of hard wood 25 inches long by 3½ inches wide by ¾ of an inch thick. This, for appearance's sake, should be stained and varnished. Next obtain about 31 inches of brass strip ½ inch wide by 1/16 inch thick. Cut a strip 21½ inches long from this, and drill a hole at each end, and one directly in the center. Cut two other strips 2¼ inches long, and drill a hole in each end of each strip.



Different views of the Slide Wire Bridge, often called the Meter Bridge because it was originally made one meter long. Independent of its convenience, it is a very elegant solution of the Wheatstone Bridge problem.

Next secure a strip of Bristol board 1 inch wide by 22½ inches long, and divide it into 200 parts. Beginning from the left-hand end, mark the first point zero, the tenth point 50, the twentieth point 100, the thirtieth point 150, etc., on the bottom part of the scale; beginning at the right-hand end do the same on the top of the scale. Now assemble these strips as shown in the accompanying illustration, and stretch a piece of resistance wire, with a resistance of about 6 or 8 ohms, along the center of the scale, fastening its ends under the short brass strips. Seven binding posts are provided, as shown. The resistance wire should be soldered to the strips, as should also the binding posts. This is done in order to cut down resistance to a minimum, and to make the bridge as accurate as possible.

Now in order to use this instrument, we must have several known resistance coils. For all around work, five of these will be sufficient. Obtain five discs of wood about ¼ inch thick by 1 inch in diameter; five the same thickness, but 1½ inches in diameter, and five pieces of ½-inch dowel, ¾ inch long. These are assembled into five spools, as shown, and two holes are drilled through the larger disc on each spool. These holes should be of sufficient size to barely pass short pieces of No. 12 or No. 14 copper wire. The space between the protruding ends of the copper wire should be such that they can be fastened in the two binding posts on the left-hand end of the bridge as shown. On the opposite side from that to which the binding posts are fastened the wire should protrude about ¼ inch so as to provide connections for the wire on the spools.

Wind one spool with enough resistance wire of a known quality to give a resistance of one ohm. Wind another to five, one to ten, one to fifty, and one to one hundred. These will give sufficient values for all ordinary experimental work. In winding these coils the necessary amount of wire should be measured off and doubled. The two ends should be soldered to the short, protruding ends of the heavy copper wires and the double wire wound on the coil. This is done in order to make the winding non-inductive.

Next make a "slider," which is merely the piece of brass strip which is left after cutting off the others from the original length; to one end of this is soldered a flexible lead, which is covered for half its length with several layers of tape, so as to insulate it from the operator's hand.

To use the bridge, connect either a pair of phones or a galvanometer to the "slider," and the center of the long brass strip. Connect one dry cell across the resistance wire and insert one of the known resistance spools as shown. The unknown resistance is connected across the two remaining binding posts.

If phones are used, put them on and move the slider along the resistance wire until a minimum response is heard in the phones when the slider is tapped on the wire. From this position of the slider the unknown resistance can be calculated. If a galvanometer is used the slider is moved until no deflection is shown. To calculate the unknown resistance we will assume that a 5-ohm coil is used. When the circuit is "balanced out," we will assume that the slider is at 350 on the lower scale and 650 on the upper scale. Now we get the equation, 5 is to 350 as X is to 650, and by solving we find that X equals 9 2/7, which is the resistance of the unknown in ohms. By using the other coils, various resistances higher and lower can be determined.

Cutting Metals With Electric Arc

By A. M. Candy

The process of arc cutting is purely a melting operation, the heat energy of the arc terminal being directed along the line where the cut is desired. Graphite or carbon electrodes are usually employed for this work, although bare metallic electrodes have been used by operating them at current values in excess of those used for welding. This latter scheme is not economical and therefore will not be discussed.

In special cases metallic electrodes heavily wrapped with asbestos yarn, using current values higher than normal, have been employed for cutting, the electrodes being first dipped in water, which forms steam and blows the molten metal away. This method, however, is also very expensive and has been used only to a limited extent by the British Admiralty for cutting deep, small diameter holes in armor plate.

For general cutting work graphite or carbon electrodes are used with current values of 300 to 1,000 amperes, depending upon the nature of the work and the cutting speed desired.

Foundries make use of arc welding equipment for repairing defective castings and use the same apparatus for cutting off risers and burs from their castings. There is shown a riser from a large gray iron casting which was cut through the neck in five minutes' time, using 800 amperes; the neck measures 3 × 9 inches. Just as a demonstration the riser was then cut through the main portion, 8 × 8 inches, in 17 minutes, using 800 amperes. With labor at 60 cents an hour and electric power at 2 cents a kilowatt-hour for the motor-generator, we have a cost of 15 cents for cutting neck and 52 cents for cutting body of the riser.

Two sample cuts are shown. The one was cut at a rate of 16½ feet per hour, and the other one at the rate of 21½ feet per hour. Both cuts were made by using 400 amperes.

Where it is desirable to cut material to accurate dimensions, it is necessary to lay out a guide line with white lumber crayon which the operator can follow with his arc. It is then possible to make a neat cut in ¼, ⅜ or ½-inch thick plate steel as illustrated in the center. This shows a piece of ¼-inch plate steel cut at the rate of 75 feet per hour, using 450 amperes.

Companies making a practice of scrapping and rebuilding steel freight cars are said to find the arc process by far the cheapest method for cutting rivets and for cutting up steel plate material into pieces sufficiently small either to be charged directly into the cupola, or to be cut up to such size that the pieces may be handled for recutting in a shear. The plate material in these cases is generally heavily covered with paint or rust, so that current values of 400 to 600 amperes are frequently used and, in some instances, as much as 800 amperes. Using this latter current value, cars have been cut up at