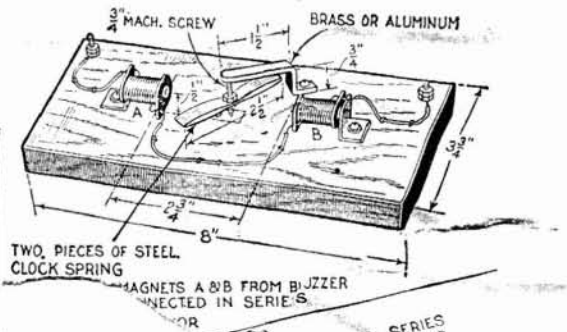
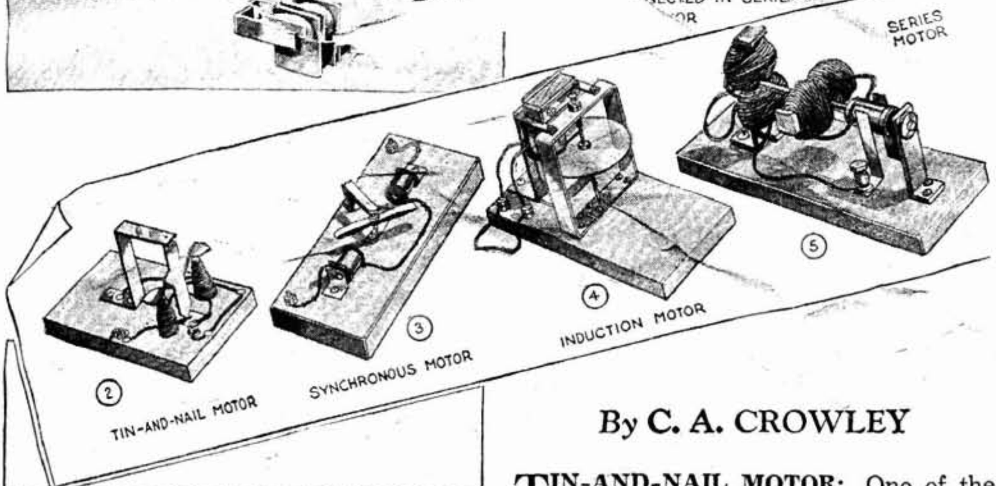
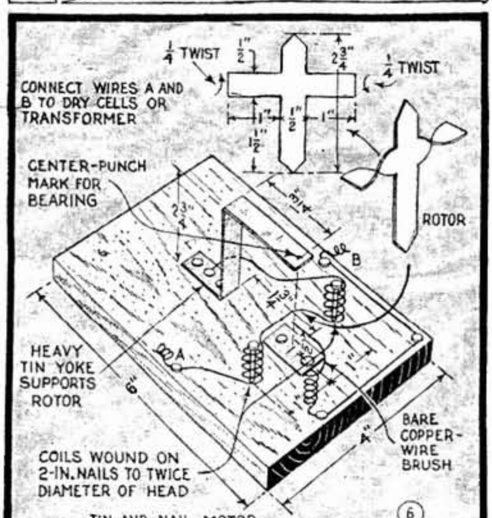
5 TOY





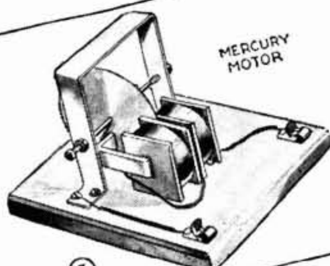
By C. A. CROWLEY



TIN-AND-NAIL MOTOR: One of the simplest forms of an electric motor where small electromagnets cause a tin rotor to spin, is shown in Figs. 2 and 6. This motor runs on a couple of dry cells or will operate on 6 volts a.c. provided by a transformer. The rotor acts like a tiny switch as it wipes against a brush lightly, turning on current momentarily just before its arms pass over the electromagnets. This current impulse, which occurs at each half rotation, is just enough to keep the rotor going. The rotor is cut from tin to the cross shape shown and the side arms are twisted at right angles. The electromagnets or field coils are wound in series on two nails, both windings being in the same direction. The nails are 2 in. apart. One end of the wire is scraped bare and twisted to form a tight coil which serves as a binding post, it being tacked down to

MOTORS convey basic ideas

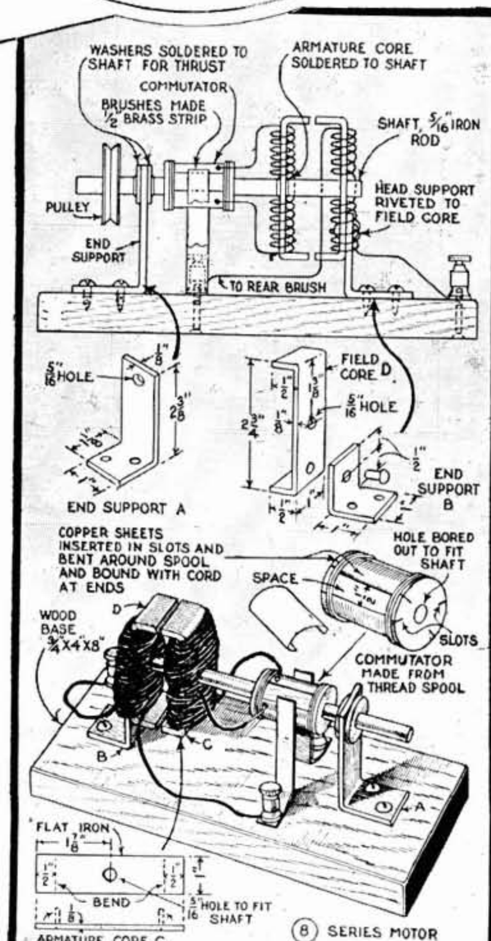
These simple electric motors, which run on low-voltage a.c. or d.c. as specified, are constructed from nails, wire and scraps of iron and tin. All of them have been built and made to operate; one provides ample power to drive small toys



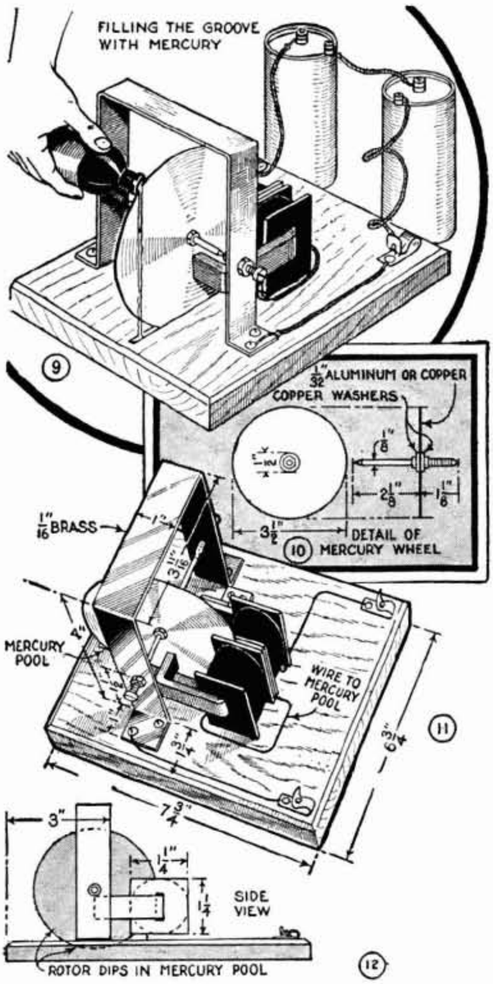
(7)

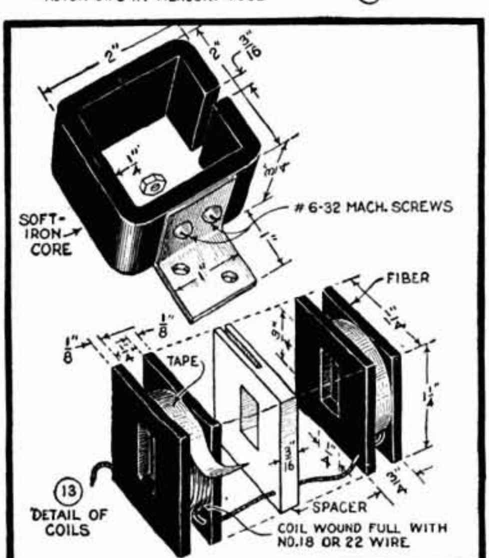
the baseboard at point A, Fig. 6. At this point connections to a transformer or battery are made. The other end of the wire is tacked to the yoke that supports the upper end of the rotor. A length of bare copper wire is used as a brush, rubbing lightly against the edges of the rotor about ½ in. above the base. It is formed to a coil to provide flexibility. The other end of the brush wire is bared and formed into a binding-post coil at point B to which the other side of the transformer or battery is connected. Center-punch marks are made in the yoke and in a small tin base plate, halfway between the two nails. Then the rotor is set in place so that the arms are about ⅛ in. above the tops of the nails. The brush is adjusted so that it touches the edges of the rotor and also releases before the arms pass over the nail heads. After connecting the motor to the current supply, give the rotor a start by turning it and the motor should run.

Synchronous Motor: A synchronous motor is one that operates at a constant speed, which is equal to or a submultiple of the frequency of the alternating current supplied to it. A simple synchronous motor



(8) SERIES MOTOR



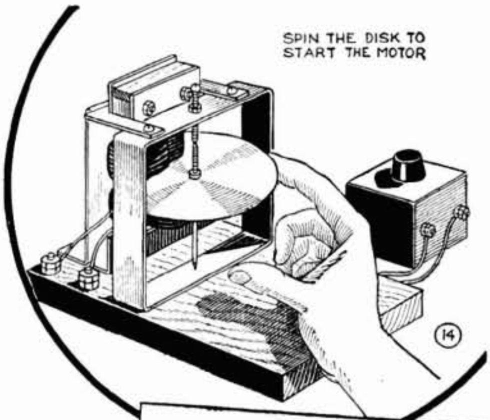


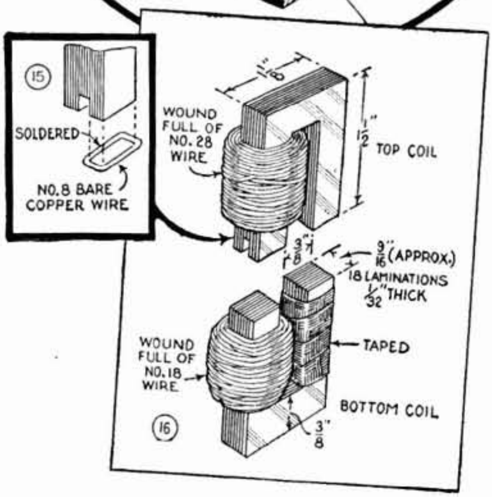
operating on low-voltage a.c. from a bell transformer is shown in Figs. 1 and 3. The field coils A and B are two magnets from a buzzer or doorbell placed so that the windings run in the same direction. These are connected in series. The rotor consists of two pieces of steel clock spring and the shaft is a No. 6-32 machine screw filed to a point at each end. Two nuts hold the springs to the shaft as shown. The shaft is pivoted between center-punched marks in the base plate and the supporting arm. There is no electrical connection to the rotor of this motor. The motor will continue to operate at about the speed at which it is started.

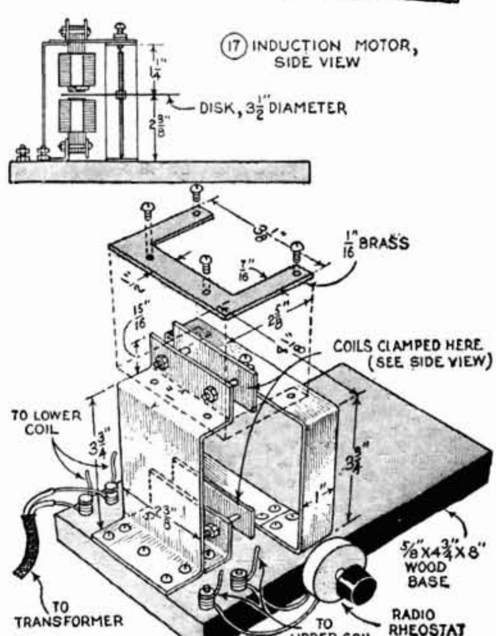
Series Motor: The motor shown in Fig. 5 runs on 6 volts d.c. or 8 to 12 volts a.c. from a toy transformer, and it can be fitted with a pulley to operate small models or other devices, delivering considerable power for its size. Details of construction are shown in Fig. 8. The armature and field cores C and D, as well as the end supports A and B, are made of 1/8-in. strap iron. Armature and field coils are wound with bell wire which approximately should fill the space. The armature is slipped on the shaft and is held in place by peening or with a drop of solder. The commutator is made from a thread spool and two strips of copper. Slots are sawed in opposite sides of the spool, the edges of the copper strips are inserted into the slots, and the strips are bent around the spools. There should be about 1/4 to 3/8-in. clearance between the two copper segments. The edges of the commutator should be wrapped securely with strong cord. The leads from the armature coil are soldered to the two copper segments of the commutator, and the armature is put in place. Two washers are soldered to the shaft on either side of the end support to limit end play. The brushes are made of spring brass, 1/2 in. wide. It may be necessary to give the motor a start by hand. If it does not run as first assembled, turn the commutator on the shaft to a position which will cause the motor to take hold.

Mercury-Pool Motor: The mercury-pool motor shown in Figs. 7 and 9 is a type used in d.c. watt-hour meters and other meters. It operates on two or three dry cells connected in series. It will not operate on a.c. Details of construction are shown in Figs. 9 to 13 inclusive. The rotor is a disk of 1/32-in. aluminum or copper mounted on a small shaft which is placed between two machine screws which are center-punched at one end to serve as bearings and are locked to the frame with nuts. The mercury pool is cut in the wooden base, directly under the rotor. Next, an electromagnet is made. The core is ¼-in. flat iron bent as shown in Fig. 13 and the two coils are wound full of No. 18 or No. 22 magnet wire, a spacer being placed between them. Both coils must be wound in the same direction. The electromagnet is mounted so that the rotor revolves freely between the coils, and the poles of the magnet are directly below the shaft of the rotor. Electrical connections are shown in Fig. 11. One terminal is connected to the coil, and the other side of the coil is connected to a wire dipping into the mercury pool. The rotor also dips into the pool. The second terminal is connected to the frame of the motor.

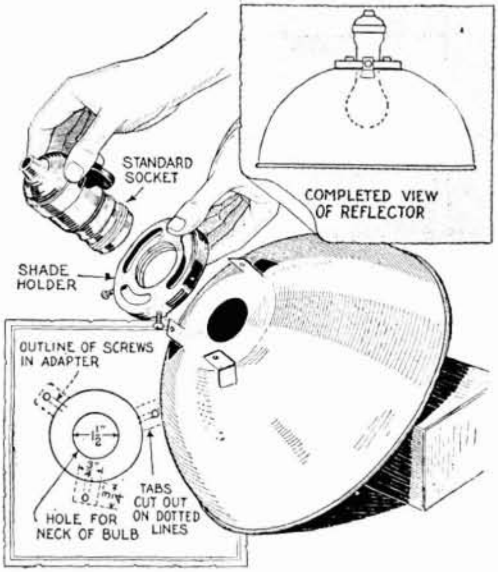
Induction Motor: Operated on low-voltage a.c. from a toy transformer, the disk-type induction motor shown in Fig. 4 exemplifies a principle used in meters of various types. It will not operate on d.c. Details of parts are given in Figs. 14 to 17 inclusive. The laminations used are approximately of the dimensions shown in Fig. 17 and can be obtained from an old audio transformer used in radio. Two stacks of laminations, each 9/16 in. thick, are required for the lower and upper coil. The upper coil is wound with No. 28 d.c.c. wire, enough wire being wound on the coil to fill the winding space on the core. The lower coil is wound with No. 18 wire. The leads from each coil are brought out to a pair of binding posts on opposite sides of the motor. The core of the upper coil is drilled directly below the coil and a single turn of No. 8 bare copper wire is inserted as shown in Fig. 15. The ends of this wire should be lapped carefully and soldered together. The frame is made of No. 16-ga. sheet brass. The rotor is a disk of sheet copper or aluminum. It is moved up or down on the shaft until it is in the proper position between the two cores. The upper coil terminals are connected to a radio rheostat and the lower coil is connected to the transformer supplying 6 volts. It will be necessary to shift the upper coil slightly to one side or the other in order to get the motor to operate properly. Once the proper position has been found, the speed can be controlled by adjusting the rheostat.







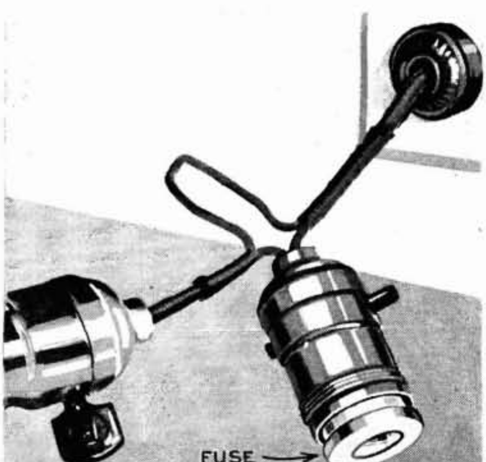
Easy Way of Mounting Reflector on a Lamp Socket



When you have occasion to attach a homemade reflector, such as the type made from an aluminum mixing bowl, to a lamp socket, try the method shown. First get a regular glass-shade holder of the type that screws onto the end of the socket. Then form tabs in the reflector and bend them up and drill them to take the screws in the holder.

Simple Tester for Short Circuits

If a lamp or some appliance in the home is blowing fuses, you can make a tester to locate the trouble. Just take a short electric cord with a plug on one end and a socket on the other. Remove the insulation in the center and connect a socket containing a fuse, preferably one of low amperage, to one of the wires. To use the tester, remove all appliance wires and then plug in the tester to each one in turn. When the faulty appliance is found the fuse in the tester will blow.



Time Switch Operates Appliances in Your Home

Here is a simple time switch that anyone can make to turn on a radio, toaster, electric iron or coffee percolator at a given time. All you need is an alarm clock and a mercury switch. If desired, the latter can be made from a small phial. This is attached to a strip of heavy brass, which is in turn soldered to the alarm winding key after the latter has been removed. In use, the alarm is wound just enough to tip the switch, after which further winding is unnecessary as resetting the switch by pulling down the arm winds the alarm. A stop pin must be soldered to the back of the clock to check movement of the arm after the switch has been tipped. The switch can be used to turn off an appliance by simply reversing the position so that the mercury flows away from the electrodes when the alarm tips the switch.