A LIGHT on one side of this mystery box flashes, and a ring jumps toward it like a trained animal. Within a few seconds a light on the opposite side flashes, and the ring leaps over to it with the same rapidity. This action continues as long as power is applied.

What facet of space-age technology has made it possible for a light to attract what appears to be a black metal ring? Is it an ionic generator of some sort, or some heretofore unknown plasma or form of energy at work? What electronic genius thought this thing up in the first place? Chances are that you will get as many different explanations as there are viewers, if you insist upon answers to your questions.

The flashing light creates the illusion of attracting the ring, and the illusion attracts a crowd. Aside from the commercial aspect of being able to capture the attention of large groups of people, a principle of mutual induction can be demonstrated and the project should make an intriguing entry in science fairs or other similar events.

**How It Works.** A slow-revolving (6-rpm) timing motor alternately energizes a coil located at each end of a semicircular soft iron rod. See Fig. 1. Coil *L1* is energized when contact 1 or 3 is touched by the rotating arm; coil *L2*, when contact 2 or 4 is made. When a coil is energized, a magnetic field is created.

The soft iron rod in the center of the coil concentrates much of the energy in the magnetic field and increases the coupling of the magnetic field to the aluminum ring. This causes an induced current to flow in the ring, which sets up a

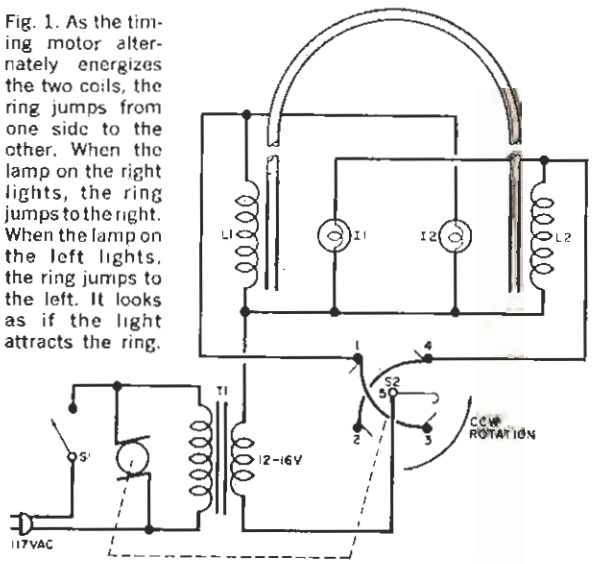
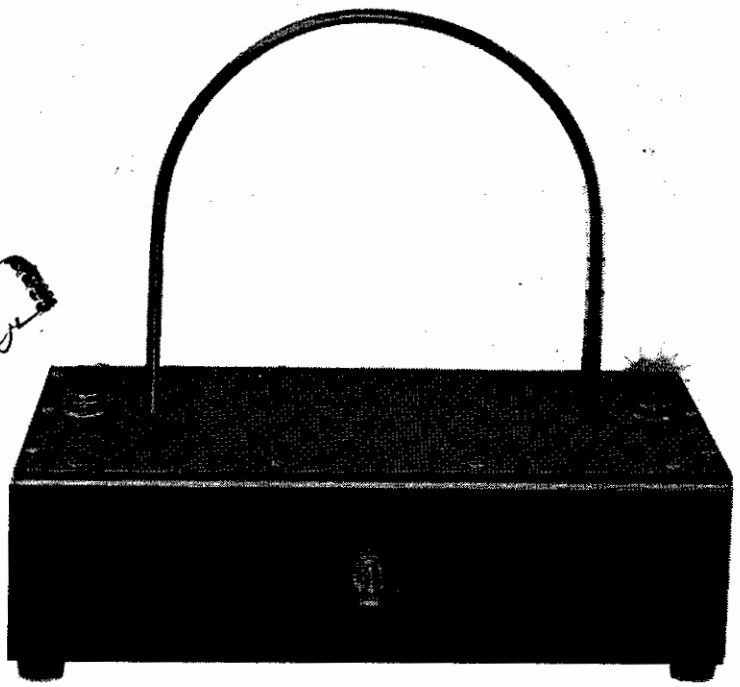



Fig. 1. As the timing motor alternately energizes the two coils, the ring jumps from one side to the other. When the lamp on the right lights, the ring jumps to the right. When the lamp on the left lights, the ring jumps to the left. It looks as if the light attracts the ring.



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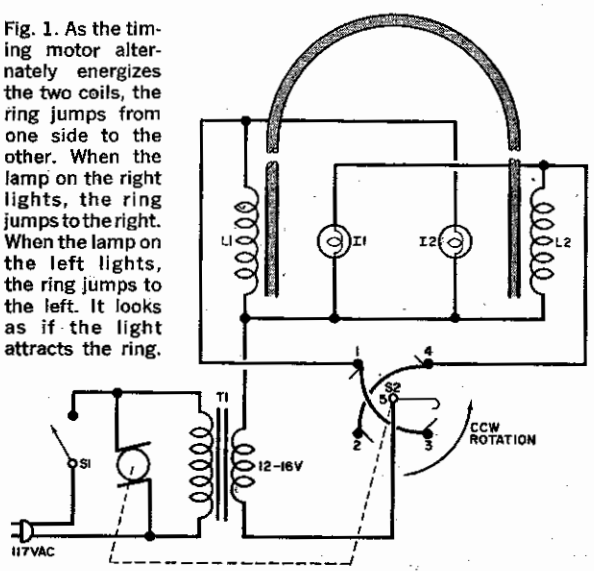


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THIS AMAZING RING HOPS FROM ONE SIDE TO ANOTHER, CHASING THE FLASHING LAMPS

By **WALTER B. FORD**

# BUILD THE CROWD STOPPER

magnetic field of its own. These fields magnetically oppose each other, and the ring is vigorously repelled. It shoots upward and away from the coil, travels around the loop, and lands on the other side, near the other coil. When the other coil is energized, the ring is shot back to where it came from. This back-and-forth motion is in step with the rotation of the timing motor.

The timing motor operates directly off the 117-volt line. Coils *L1* and *L2* operate off the 12-volt secondary winding of *T1*. Lamp *I1* is wired across *L2* and lights when this coil is energized. Similarly, lamp *I2* is connected across *L1* and lights when *L1* is energized. Because each lamp is physically located opposite its coil, there is the illusion that the lamp attracts the ring.

**Construction.** Drill the Masonite panel as shown in Fig. 2. Place the drilled panel over the open space on the aluminum chassis; then mark and drill around the flanged edges of the chassis as shown. Drill a few additional holes in the chassis for ventilation, line cord entrance, switch mounting, and rubber feet.

Remove any nicks from the 24″ soft iron rod being used for the loop, with a fine file or sandpaper. Then polish the rod with emery cloth and steel wool. Make a wood form for shaping the loop (Fig. 3). Attach another piece of wood to the form by means of a back plate so as to provide a slot for holding one end of the rod.

Place the form and back plate in a vise, and insert the iron rod into the slot so that the end of the rod is positioned 5⅞″ from where the semicircle ends. Bend the steel rod around the form, using a rubber mallet or block of wood as necessary. If one side of the rod is

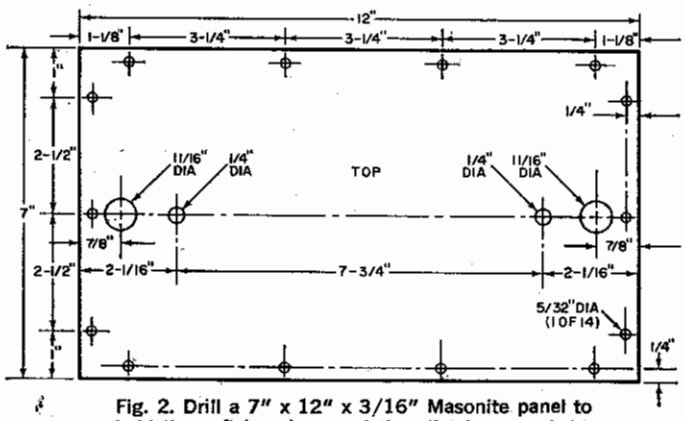


Fig. 2. Drill a 7″ x 12″ x 3/16″ Masonite panel to hold the soft iron loop and the pilot lamp sockets. Position of mounting screw holes is not critical.

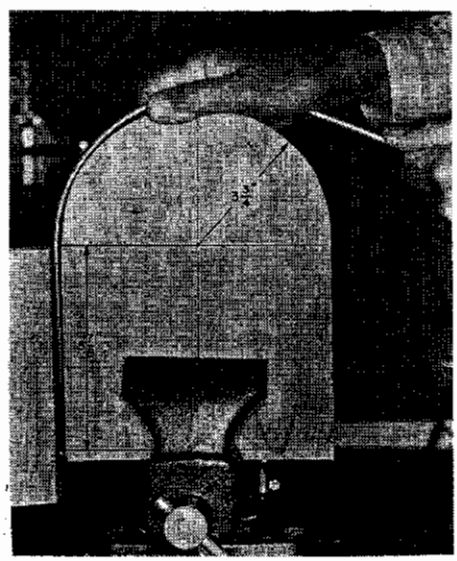


Fig. 3. Carefully bend the rod around the wood form to obtain a smooth shape in the loop. Rod must be clean and free from burrs to permit the ring to travel freely without interference.

## PARTS LIST

*I1, I2—12-16 volt miniature bayonet lamp*
*L1, L2—See text*
*S1—S.p.s.t. toggle switch*
*S2—See text*
*T1—Filament transformer; 117-volt primary, 12-16 volt secondary, 2 amp., minimum (Allied Radio 62 G 331 or equivalent)*
*1—6-rpm timing motor, 117 volts a.c., 60 cycles —see text*
*1—7" x 12" x 3/16" piece of Masonite*
*1—2¾" x 2¾" x 3/16" piece of Masonite*
*1—3" x 7" x 12" aluminum chassis (Bud AC-408 or equivalent)*
*1—24" soft iron rod, ¼" diameter*
*2—1⅜" fiber or Micarta washers, ⅛" thick*
*1—8' length of soft iron wire, 16 or 18 gauge*
*1—22-gauge enameled magnet wire—see text*
*2—Pilot light assemblies (Allied Radio 7 E 891)*
*1—½" brass rod, ½" diameter*
*4—Pieces of 20- or 22-gauge round brass tubing, ¼" o.d., ½" long*
*1—½" piece of 20- or 22-gauge seamless aluminum tubing, ⅜" o.d. (won't work with a seam)*
*4—5/16" x 9/16" pieces of 26-gauge spring brass*
*1—5/16" x 1⅞" piece of 26-gauge spring brass*
*Misc.—Line cord, ¾" x 6-32 brass round-head machine screws (4), 2" x 6-32 steel round-head machine screws (2); 6-32 hexagon brass nuts (8), 6-32 hexagon steel nuts (2), rubber screw bumpers (4), ⅜" x 6 sheet metal screws (14), ½" x 1½" wood dowels (2), ¼" rubber grommet, ¼"-20 hexagon steel nuts (4), ¾"-diameter steel washers with ¼" center (2), #6 lock washers (4); and #6 brass washers (4)*

longer than the other after forming, cut it to make both sides even. Then thread about ½" from the ends using a ¼" die.

*Construction of L1 and L2.* Make two coil forms with fiber or Micarta washers and strips of thin cardboard as shown in Fig. 4. Wrap a strip of 2"-wide cardboard around a ½" wood dowel and apply glue between the layers of cardboard without getting any glue on the wood dowel. Drill holes in the fiber coil ends to fit the cardboard tube and cement the tube and the ends together. Then drill two 1/16" holes in one end washer of each coil form to pass the wires through.

Wind approximately 80' of No. 22 enamel-covered magnet wire on each form. The exact amount is not important, but it is important to wind the coil turns close together and evenly. Suppliers of magnetic wire generally sell the wire wound on ½-lb. spools. One such spool is usually enough for both coils.

Mount the pilot light assemblies to the Masonite as shown in Fig. 5. Then center the two coils on the underside of the panel and over the ¼" holes, and cement the coils in place. The aluminum ring

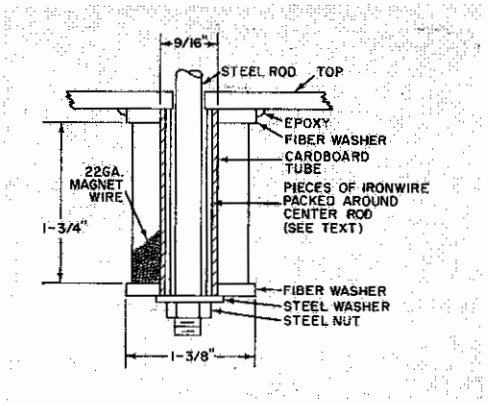


Fig. 4. Construct coil forms as shown. Each coil takes about 80 feet of No. 22 enamel-coated wire. A ½-pound spool should be enough for both coils.

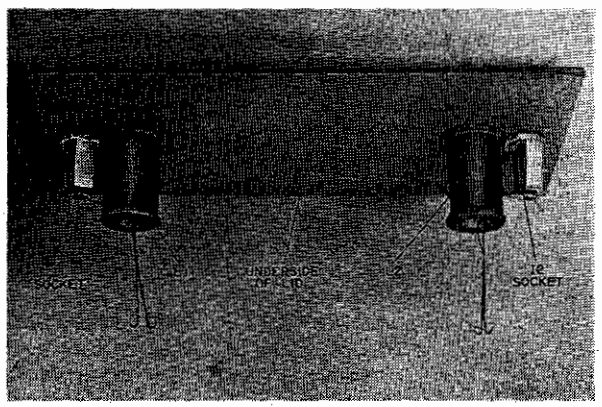


Fig. 5. Cement the finished coils to the bottom of the panel. Use extra long coil leads to avoid undue stress on the connections when assembling the unit.

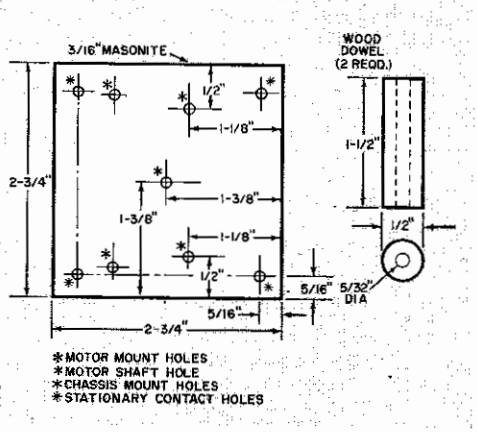


Fig. 6. Fabricate the rotary switch on a 2¾" x 2¾" piece of Masonite and bolt it to the chassis using two ½"-long dowels and 2"-long screws.

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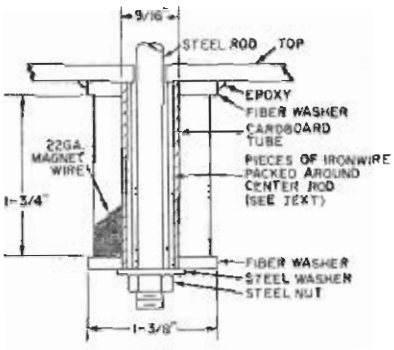


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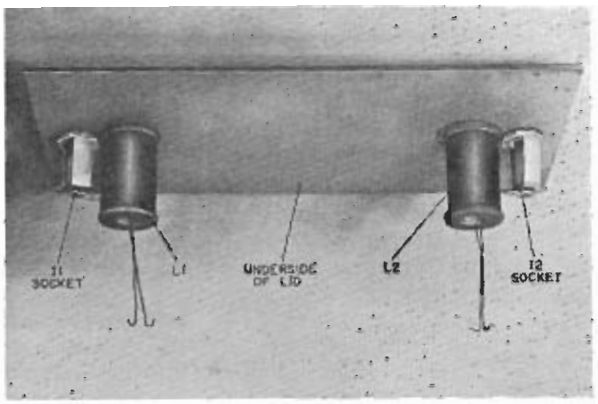


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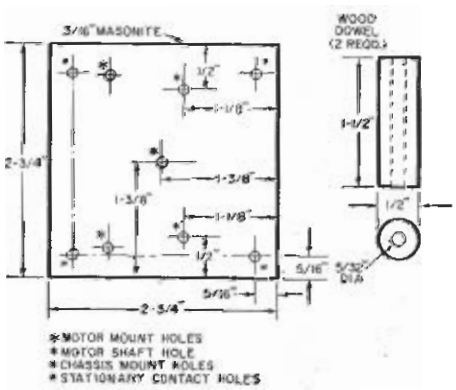



Fig. 6. Fabricate the rotary switch on a 2¾" x 2¾" piece of Masonite and bolt it to the chassis using two ½"-long dowels and 2"-long screws.

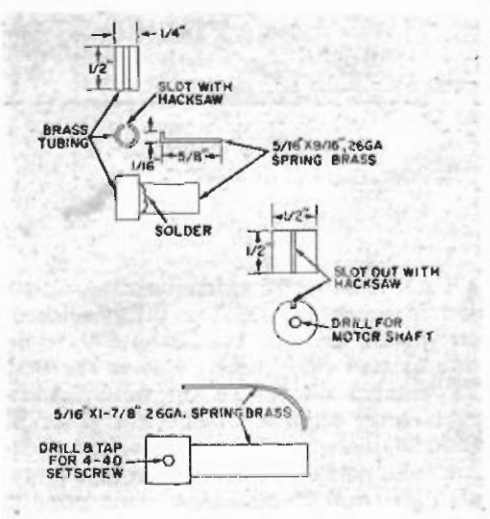



Fig. 7. Contacts are made from strips of spring metal soldered to short lengths of tubing. Drill the rotating contact to fit snugly on the motor shaft.

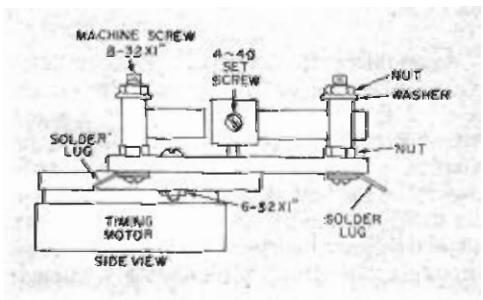



Fig. 8. Stationary contacts (side view) should be positioned to provide gentle contact and timed to extinguish the light just before the ring reaches it.

which flips back and forth on the steel loop is made from ½"-long, ⅜"-o.d., 20- or 22-gauge aluminum tubing; both ends of the ring should be reamed before the ring is placed on the loop.

Insert the ends of the loop from the top of the panel through the centers of the coils until the ends extend ¼" beyond the coils. Then turn the unit upside down and support the ends in the same position. Cut a number of pieces of No. 16 or 18 soft iron wire, each slightly less than 2" long, and straighten the pieces as much as possible. Then insert the wires around the steel loop ends (Fig. 4) in the center of the coils, applying a coating of epoxy cement to each piece as it is inserted in place.

Tightly pack both coils with the wires. You'll find it easier to insert the wires if you sharpen one end of the wire with a file. Then cut notches in the steel washer to clear the coil leads; place the washers and nuts over the ¼" rod projecting from the coil ends. Do not tighten the nuts until the epoxy glue has set.

Drill the 2¾" x 2¾" Masonite board used to mount switch *S2* as shown in Fig. 6. Measure the spacing of the mounting holes on your timing motor and drill corresponding holes in the base.

Herbach and Rademan Inc., 1204 Arch St., Philadelphia, Pa., 19107, offers a line of synchronous timing motors from ½ to 30 rpm. The 6-rpm model is priced at $4.95, f.o.b. Philadelphia. Motor rpm is not critical and almost any timing motor, down to 1 rpm, will work well.

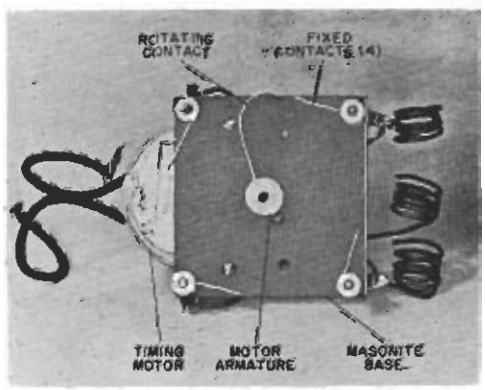
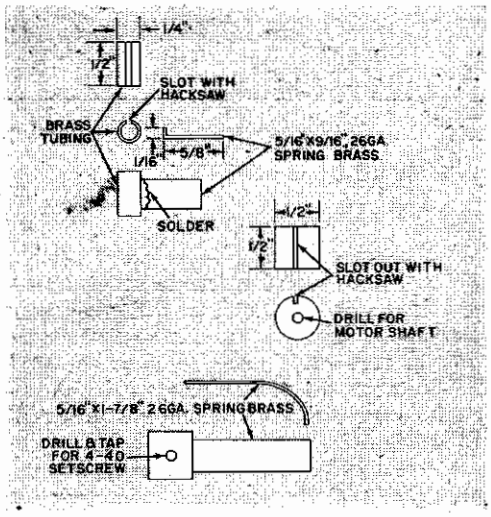



Fig. 9. Curve the rotating contact to get a gentle spring-like action. Contact and motor leads should be long enough to allow assembly without stress.

Next, start making the four stationary contacts from 20- to 22-gauge, ¼"-o.d., brass tubing cut to ½" in length. As shown in Figs. 7, 8, and 9, they are made by soldering a 5/16" x 9/16" 26-gauge piece of brass spring into the slotted tubing. When making the contacts, cut each length in line with the "grain" of the metal to prevent it from snapping when bent. The alignment of the grain can be determined by observing the direction in which the metal tends to curl when laid on a flat surface.

The rotating contact is made by soldering a strip of spring brass into a piece of slotted brass rod as shown in Fig. 7. Dress down the edges of the rotary and stationary contacts to insure quiet operation. Each of the four sta-

(*Continued on page* 96)

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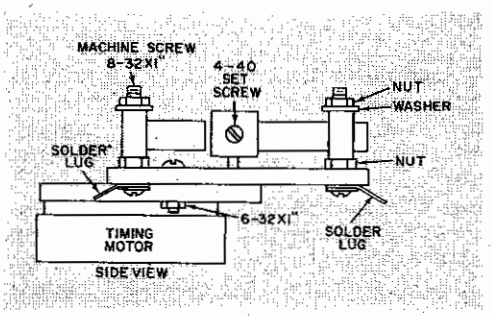


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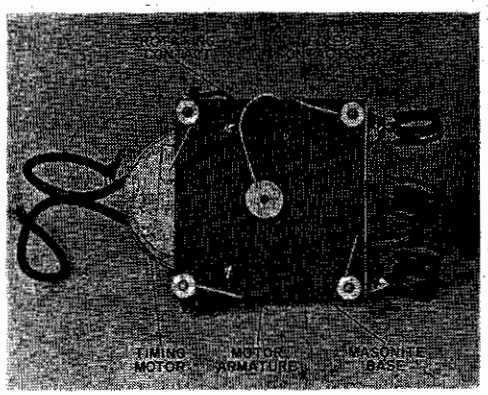


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(*Continued on page* 96)

## CROWD STOPPER

(*Continued from page* 51)

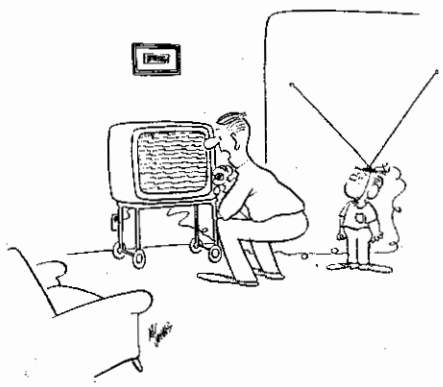
tionary contacts is mounted on a ¾" x *6-32* brass machine screw, and the rotating contact is mounted on the armature of the motor.

*Timing Motor and Switch (S2).* Assemble the motor and switch as in Figs. 8 and 9. If you're using a counterclockwise motor, position the four switch contacts as shown; otherwise, reverse orientation of the switch contacts.

Connect stationary switch contacts 1 and 3 together and 2 and 4 together; use solder lugs beneath the mounting screws to make it easier to solder the leads. Also, solder a 10" lead to each pair of contacts. Then fasten the switch assembly to the bottom of the chassis with two 2" machine screws and two 1½" wood dowels; the motor faces down.

*Final Wiring.* Mount *T1* so it will clear the coils when the chassis lid is put on. When wiring the rest of the unit, make sure leads are long enough for the lid to be removed without having to break the connections. Turn the rotary contact by hand and note the pressure between it and the stationary contacts: there should be just enough pressure to make contact without slowing down the motor.

**Installation.** Plug the unit in, and adjust the contacts so a lamp will go out just before the flip ring reaches it. When all adjustments have been made, arrange the wiring neatly inside the chassis to prevent interference with the operation of the motor. —30—



"Now take one step back, and two to the left."