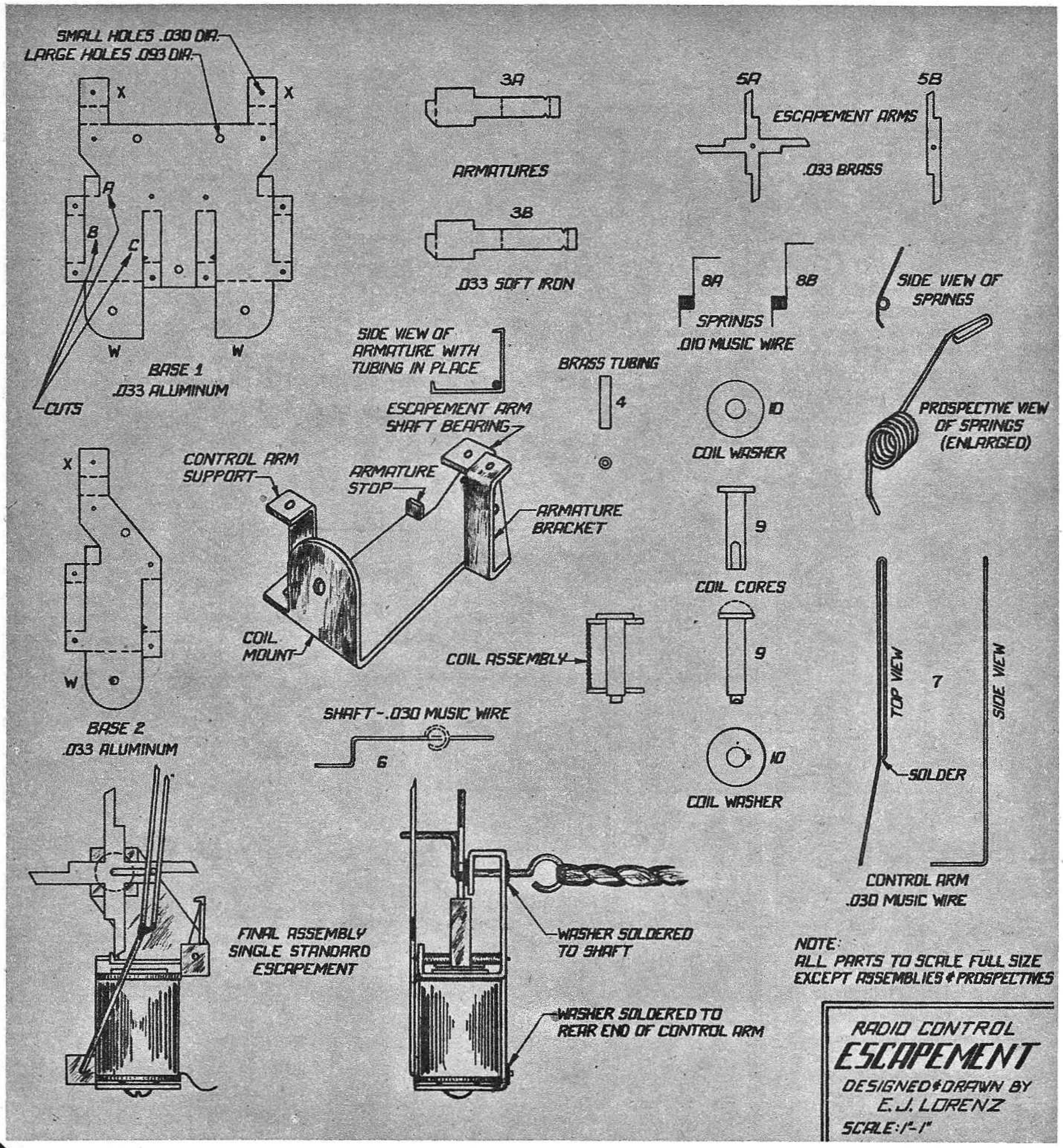
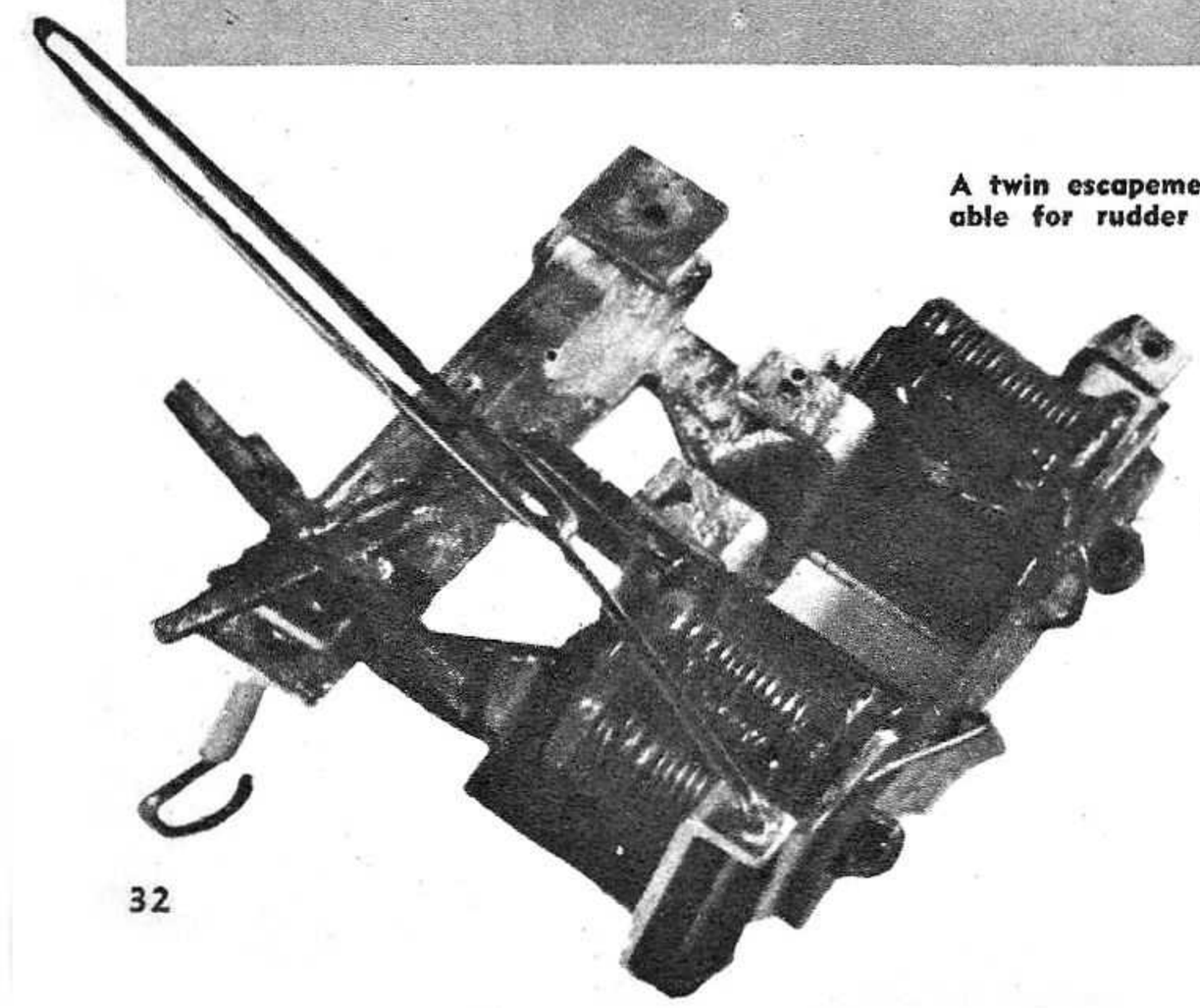
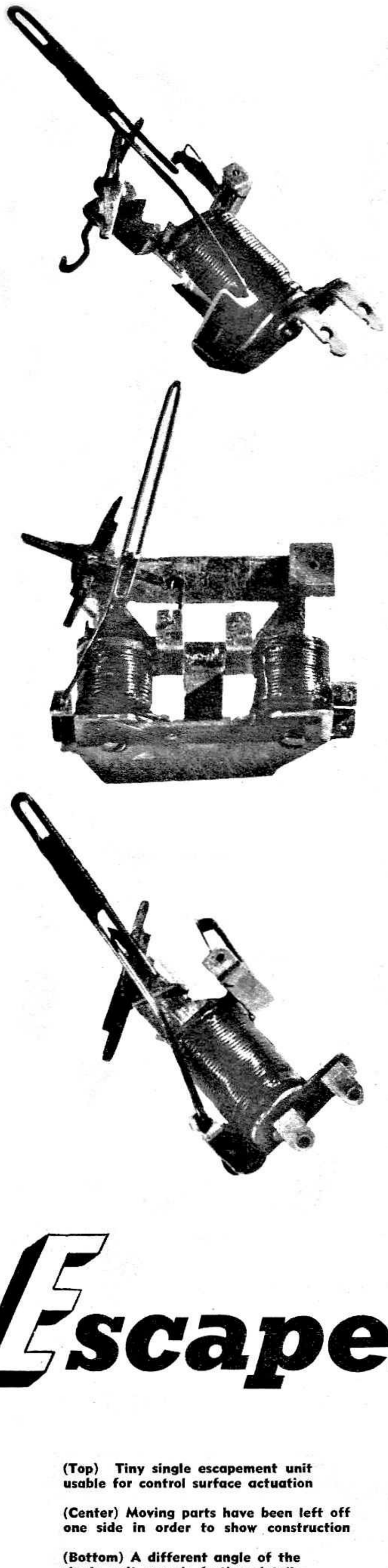


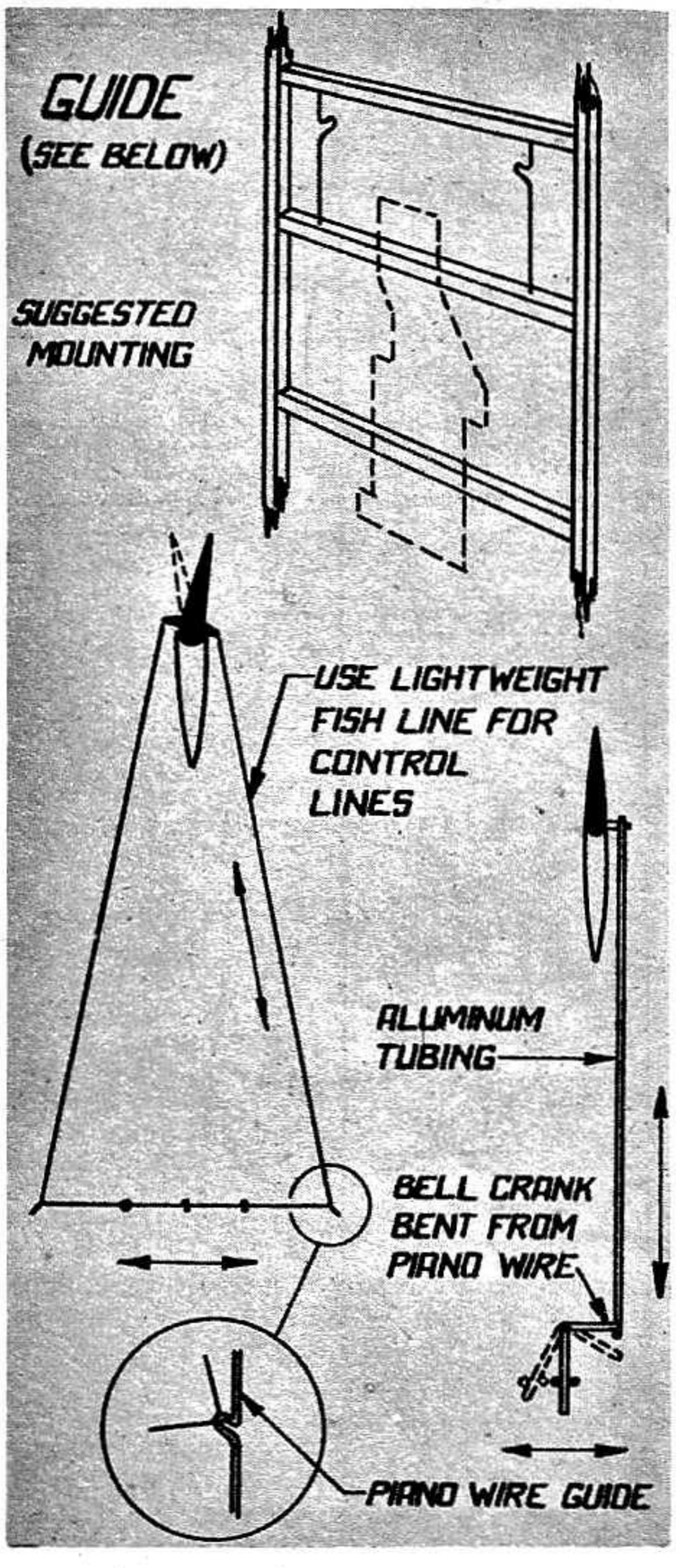


A twin escapement unit which is suitable for rudder and elevator control

R.C.

Details are provided here for constructing several ultra-lightweight escapements for your radio control model





Suggestions for mounting and connecting escapement to the rudder

Escapements

by E. J. LORENZ

(Top) Tiny single escapement unit usable for control surface actuation

(Center) Moving parts have been left off one side in order to show construction

(Bottom) A different angle of the single unit reveals further details

WITH wartime restrictions now lifted, radio controlled models are beginning to dominate the scene again. If you are one of the many followers of this interesting and fast developing phase of model building, you are probably anxious to get started on a new radio controlled plane, or make improvements on one you already have built.

In this article are plans for a newly developed escapement for radio control, designed especially for those of you who are interested in cutting down the weight or size of your model. It is a simple, lightweight but foolproof unit to actuate the rudder or elevator or other controls. Designed primarily for the Class A radio controlled model, this escapement is easily adaptable for use in planes as small as 38 inches or as large as 7 feet. It weighs but .35 oz. and operates on 1½-3 volts. All the materials are readily available to the average model builder or can be obtained at any small radio shop.

The tools necessary are: a small fine-cut file; tin snips, or chisel and hammer; hand drill with .030" and .093" drills; small long nose pliers; small vise. The materials needed are: a piece of .033 aluminum; small piece of brass and one of soft iron, approximately .033 thick; ⅛" soft iron rivet ½" long or a piece of soft iron from which to turn the core piece; music wire size .010 and .030; several small washers; small piece of 1/32" fibre or plywood; and about 10 feet of No. 26 enameled copper wire. The plans are self explanatory, but read the instructions carefully as they explain the simplest and best way to make each part.

Plans are given for four different types, single and double escapements with either standard or self neutralizing action. The double unit is merely a consolidation of two single units on one base. The standard action escapement operates in the following manner: one impulse will take the control arm from neutral to either left or right; a second impulse is needed to return the arm to neutral; a third impulse will then place it in the right or left position; and a fourth impulse completes the cycle and returns the arm to neutral. In the self neutralizing escapement, one impulse will place the arm in either a left or right position and it will remain there until the impulse is removed. The arm will then automatically return to neutral and be ready to follow thru in the opposite direction upon receipt of the next impulse. The advantage of the standard action escapement is that it takes less current to operate inasmuch as no current is used while the arm is in a left or right position. The advantage of the self neutralizing unit is that if the receiver or transmitter should become inoperative, the control arm automatically returns to neutral. Also, there is less confusion in determining how many impulses will be needed to get from one position to another.

The base (Nos. 1 or 2) is first laid out on the .033 aluminum by tracing the full size pattern. Cut it out with tin snips or a chisel and hammer. After it is cut, hammer it flat and file down any rough edges. Cuts A, B and C are made with a single edge razor blade, hammered along the lines. This is to assure as narrow a cut as possible since we want to keep the dimensions to a minimum. After these cuts are made, flatten the piece out again and then mark the lines where it is to be bent.

All bends are 90 degree angles. First bend end piece W, the coil mount by placing it in a vise.

Follow with the opposite end piece X. The ⅛" space between X and the main base is formed over a ⅛" thick piece of metal such as the edge of a file. The remaining bends for the armature bracket and the control arm support are made with long nose pliers. After all bends are made, check the piece to see that everything is lined up at right angles. Next, drill holes as noted on the full size plan. Care should be taken to see that these holes are drilled perpendicular to the base, preferably in a drill press. This completes the base.

The armature (either 3A or 3B) is made next from .033 soft iron. Solecore iron is the best although a piece cut from a transformer core, obtainable at a radio shop, may be used. The making of this piece is self explanatory from the drawing, 3B being used for the self neutralizing unit. When this is completed, the small piece of brass tubing (4) is soldered in place. Make sure this is at right angles to both arms of the armature. This length of tubing should make an easy fit between

(*Turn to page* 89)

R. C. Escapements

(*Continued from page* 33)

the armature bracket but should not be too loose endways.

Next, the escapement arms (5A, 5B) are cut from .033 brass to the size shown in the drawing. It is important that the length of each arm from the center hole be the same. Escapement arm 5A can only be used with armature 3A, which is for the standard unit.

The shaft with the crank throw (6) is next bent from .030 music wire. The hook for the rubber is bent after assembly. Next, the control arm (7) is bent from .030 music wire, or heavier if desired. The slot in the arm is to fit the crank throw on the shaft and should be .030" wide. Too tight a fit will prevent smooth operation and cause binding; on the other hand a slot too wide will allow the control arm to wobble back and forth with a resulting play in the rudder or elevator movement. The armature spring (8) is made by *tightly* winding six turns of .010 music wire around a 1/16" diameter rod. Leave about 1-1/4" on each end of the spring to allow for shaping and cutting to size.

This leaves only the coil to be constructed before assembling the unit. The coil core (9) is either turned from soft iron and tapped for a 2-56 machine screw at the bottom or filed down from a 1/8" soft iron rivet about 1/2" long. The shank of the core piece is 1/8" diameter with a cap on the top 1/4" diameter and 1/32" thick. The shank is 1/2" long for a turned piece and slightly longer if made from a rivet (to allow for thickness of mounting piece and riveting). If a rivet is filed down, a shoulder will have to be filed around the bottom to fit the mounting hole on the base. It should be drilled out slightly and extend through the hole about 1/64" so it may be riveted.

Next cut two washers from 1/32" fibre according to the drawing. A small hole is drilled in the bottom washer as shown to allow the end of the inner layer of wire to be drawn through. Both washers should be a tight fit on the shank of the core piece. Slide them on the core and give the assembly two coats of clear nail lacquer or dope. When dry, wind 6 layers of No. 26 enameled copper wire on the core, allowing about 2" of wire from the bottom layer to protrude through the washer hole. A thin coat of dope should be applied as a means of insulation between each layer of windings. Make the winding neat, close together and flat. Give the completed coil two coats of clear nail lacquer or dope, the lacquer being preferred in all cases.

Now for the final assembly. Scrape the enamel insulation from the wire protruding from the winding and make one loop around the bottom of the shank on the coil. Secure the coil to the mounting piece with a 2-56 machine screw or by riveting it, with the loop of wire making good contact with the base. The base is used as one side of the electrical connection to the coil.

Slip the spring over the tubing on the armature with the upper end bent, as shown, around the top armature arm. The short end of the spring is hooked over a notch cut on the side of the armature bracket. The assembly is fastened with a piece of music wire as an axle through the bracket and tubing. The spring should push the armature away from the top of the coil. Make sure the armature is inside the stop on the base; the top of this stop may have to be filed down so that it fits the cut out space on the coil end of the armature arm.

The shaft is next soldered in position on the escapement arm as shown. Several washers are slipped on the shaft before it is put in place. Enough washers are needed to bring the escapement arms in the center of the armature tabs. A hook for the rubber is bent and a small washer is soldered in place to prevent the shaft moving forward. The control arm is next put in position with the crank throw on the escapement arms going through the slot in the control arm. A small washer soldered on the end protruding on the back of the base will prevent it from coming out.

We're now ready for the final adjustment, which is accomplished in the following steps: 1. The armature should be forced away by spring pressure from the top of the winding, but motion should be limited by the armature stop on the base. 2. The armature stop is bent so as to hold the armature about 3/64" away from the top of the core. 3. The escapement arms should be held by the bottom tab on the armature by about 1/32" when they are rotated and the armature is in a normal position (away from top of the coil). A slight amount of filing may be necessary. 4. When the armature is depressed against the top of the coil, the arms should clear the top of the tab by about .005". 5. With the armature in normal position the escapement arms should miss the upper tab by about .005" but should stop them by about 1/32" when it is depressed. A slight amount of bending on the upper arm of the armature will give the desired results.

One loop of 1/8" flat rubber about 12-14" long is attached to the hook on the shaft and anchored in the plane or on the board being used for test purposes. About 125 turns, wound so the escapement arms turn in a clockwise direction, is sufficient to power the unit for any normal flight. The coil was designed to operate from one penlight cell. It is suggested that the power for operating this unit be obtained from the same source as the ignition and that a small storage battery of two volts be used. Three volts should be used if more rubber is employed to obtain more power from the control arm.

It has been found that an elevator or rudder area of 5-15% of total horizontal or vertical surface is sufficient for good control, with 8% being an optimum value. A trailing edge movement of approximately 1/8" is also suggested. These values depend of course on the type of plane, its characteristics and speed. Too much rudder area or movement will throw the plane into an uncontrollable spin. The amount of movement depends on the position in which the control cable is attached to the control arm and the length of the control horn on elevator or rudder.

The double escapement makes a compact arrangement for two channel control and is built in the same manner as the single unit except that the escapement arms and movement are reversed on one side. Besides being lightweight and small in size, these escapements are inexpensive and do not necessitate complicated receivers or other control components, thus making them adaptable for the beginner as well as the advanced builder.