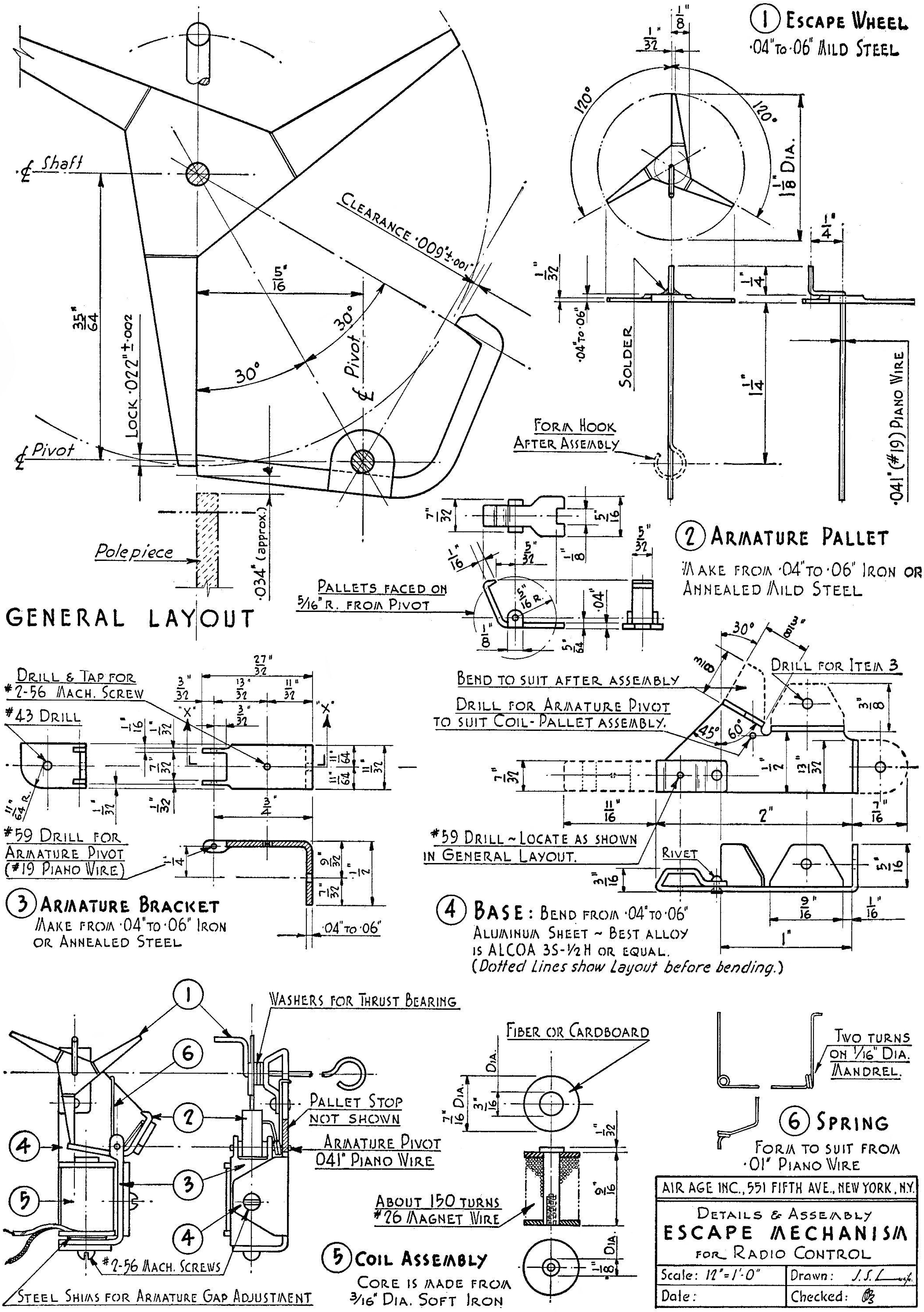


① Escape Wheel
·04" to ·06" Mild Steel
120°
120°
1 1/8" Dia.
1/8"
1/32"
1/4"
1/32"
·04" to ·06"
Solder
1/4"
1 1/4"
Form Hook After Assembly
·041" (#19) Piano Wire
℄ Shaft
35/64"
Lock ·022" ± ·002
℄ Pivot
Clearance ·009" ± ·001"
5/16"
30°
30°
℄ Pivot
Polepiece
·034" (approx.)
GENERAL LAYOUT
② Armature Pallet
Make from ·04" to ·06" Iron or Annealed Mild Steel
7/32"
5/16"
5/32"
1/8"
1/16"
5/32"
5/16" R.
·04"
1/8"
5/64"
Pallets faced on 5/16" R. from Pivot
Drill & Tap for #2-56 Mach. Screw
#43 Drill
11/64" R.
27/32"
3/32"
13/32"
11/32"
3/32"
"X"
"X"
1/16"
1/32"
7/32"
11/64"
11/32"
1/32"
1/32"
1 3/4"
#59 Drill for Armature Pivot (#19 Piano Wire)
1/4"
9/32"
1/2"
7/32"
·04" to ·06"
③ Armature Bracket
Make from ·04" to ·06" Iron or Annealed Steel
30°
3/16"
3/16"
Bend to suit after assembly
Drill for Item 3
Drill for Armature Pivot to suit Coil-Pallet assembly.
45°
60°
3/8"
1/2"
13/32"
7/32"
11/16"
2"
7/16"
#59 Drill ~ Locate as shown in General Layout.
Rivet
3/16"
5/16"
9/16"
1/16"
1"
④ Base: Bend from ·04" to ·06" Aluminum Sheet ~ Best alloy is ALCOA 3S-½H or equal.
(Dotted Lines show Layout before bending.)
Washers for Thrust Bearing
Pallet Stop not shown
Armature Pivot ·041" Piano Wire
#2-56 Mach. Screws
Steel Shims for Armature Gap Adjustment
Fiber or Cardboard
Dia.
7/16" Dia.
3/16"
1/32"
9/16"
About 150 turns #26 Magnet Wire
Dia.
1/8"
⑤ Coil Assembly
Core is made from 3/16" Dia. Soft Iron
Two turns on 1/16" Dia. Mandrel.
⑥ Spring
Form to suit from ·01" Piano Wire
AIR AGE INC., 551 FIFTH AVE., NEW YORK, N.Y.
Details & Assembly
ESCAPE MECHANISM
for Radio Control
Scale: 12" = 1'-0"
Drawn: J.S.L.
Date:
Checked:

PART TWO

Reliable Escapements

by J. S. LUCK

The finished escapement shown with a pen cell for size comparison

OVER a period of years, a friend and I have tested, and finally satisfied ourselves, that the 3-toothed escape wheel is best. We admit that it may be just two voices in, possibly, thousands. Even so, those who intend to stick by the conventional 22½° or 45° escape action will not find these notes entirely without value. The process for laying out any other style escapement is closely related: the mechanics of making it, once the basic requirements are understood, are readily modified.

In Part I, *Fig. 1,* the sequence and arrangement of two- and four-toothed escape wheels were illustrated. Compare them to *Fig. 4* in this text and note the essential differences. On the basis of utmost simplicity alone, the 45° (two-toothed) escapement takes top honors. But battery drain during a sustained turn is heavy. A ten-second turn, in addition to using up a good portion of battery life, may also heat the coil sufficiently to fuse any material placed between armature and coil core to counteract residual magnetism—the cure thus becoming worse than the ill. In the event of loss of control this mechanism returns to neutral.

In regard to the 22½° escape action (four-toothed wheel), the best that can be said for it is that it permits a less abrupt change of direction. During the excitement of actual flying, though, those half turns are inclined to confuse a mental picture of the sequence. The next position is never really known for sure. Besides, I don't see that a half turn held for two seconds accomplishes any more than, let us say, a full turn held for only one second. Battery failure or loss of radio contact results in a rudder positioned in either neutral or a turn.

Our 30° escapement's one fault is that in the event of failure it is no better than the 22½° action. Apart from that, it is as simple as the two-toothed wheel. The sequence is always clearly in mind. From neutral (no signal) one pulse is always *right* and two pulses *left,* or vice versa. The neutral (ON signal—between the two turns) may be used for a thermal relay if desired. This is easy to follow in *Fig. 4.* The sequence shown obtains only when the yoke is driven horizontally by the crank pin on the escape wheel. That is, the rudder axis is at right angles to the escape wheel shaft.

Dyed-in-the-wool fractional turn addicts may be happier with the arrangement shown on *Fig. 5.* The yoke in this instance is driven radially from a pivot. The pivot point in the diagram gives a fractional turn at "no signal" and a full turn, "on signal." The difference between fractional and full turn deflection depends upon the distance from yoke pivot to escape wheel shaft. There is no particular advantage to this arrangement, although, like control of a full-sized ship, immediate full control is eased off as soon as change of direction or attitude is realized. I have never tried it in radio control, but it may be quite good. Pivoting the yoke from the bottom rather the top, as shown, would reverse the action: then you would have full control with "no signal," and fractional movement "on signal." Personally, I favor the arrangement in *Fig. 4.*

The detail and assembly drawings of this 30° escapement do not pretend to be completely dimensioned. The drawing was made with the thought of allowing leeway for materials most probably on hand, rather than with any idea that the mechanism would be turned out in quantity to rigid specifications. The prototype of the escapement detailed weighs .42 oz., and it operates faultlessly and positively on one single pen cell. This means a tremendous safety factor when 3 or 4½ volts are used and the return spring tension raised slightly.

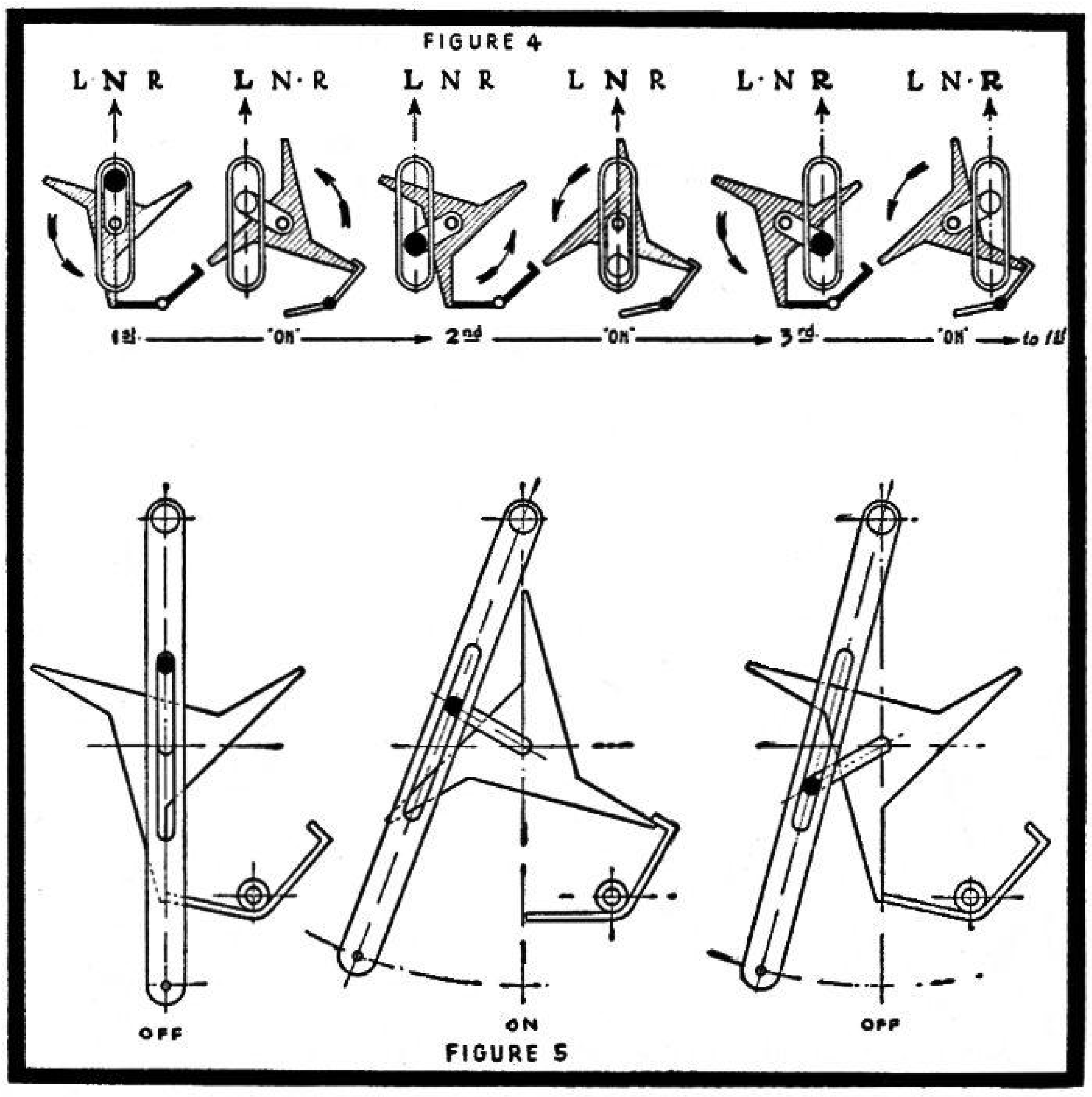
Comments on each component going into the complete mechanism will follow. I hope I am not taking too much for granted when tools, somewhat outside the requirements of straight model building, are called for. They wouldn't cost so much anyway: quite a bit less than a commercial escapement of top quality.

ITEM 1. Most scrap boxes will yield a piece of mild steel of about the right thickness. I fret-sawed mine out roughly to shape from annealed steel strip, with a coping saw fitted with a metal-cutting blade. A fine file thinned out the teeth and brought the outline close to finished size. The shaft hole was made with a No. 50 drill, and a straight length of .041" (No. 19) piano wire forced in. A temporary bearing was made for the shaft and the process of trueing up begun. A smooth Nicholson file, a well-worn file, crocus cloth, and a burnisher made from a crochet hook (borrowed from my wife's sewing basket when she wasn't looking) were used to finish the job. The shaft was bent to form a crank and soldered firmly and neatly into place with plenty of heat and then plunged in water. All traces of acid flux were meticulously removed.

ITEM 2. The only tricky job here is to form the lugs for the pivot. Forming soft iron is very easy, but if steel is used make sure it is properly annealed first. If the material used is more than .04" thick, it should be filed down to size. Accuracy is essential, and finishing the pallets is as important as finishing the teeth of the escape wheel. One desirable feature of using steel as a material is that it may be hardened when the part is finished. Worth considering, even if steel is much less malleable.

ITEM 3. If possible the bracket should be .06", or even 1/16"

(*Turn to page* 54)



Reliable Escapements

(*Continued from page 23*)

thick, as this will provide more material for forging the lugs with a peening hammer. Three drills are needed; a #59, a #43, and a #50 for the #2-56 tap. When drilling the pivot holes make sure they are aligned perfectly.

ITEM 4. Finding a suitable aluminum alloy for this part is the biggest snag. Aluminum and its alloys, as you probably know, have characteristics ranging all the way from a lead-like softness to the hardness and strength of mild steel. You could tie a ½″

rod of 1-SO into a knot with ease, but even Charles Atlas might be excused if he perspired gently as he did the same to a piece of 75-S. Well! that is by the way. The ideal alloy is 3-S½H. It will take a sharp bend without cracking and is strong enough to remain rigid after forming. Going to the scrap bin again, several alloys may be found. As they will hardly be marked, the best thing is to test them by making sharp bends and feeling for rigidity. The "strong alloys" 17ST or 24ST, sometimes known as *duraluminum,* will not take sharp bends without cracking. If that is all that can be obtained, make the bends with generous radii and allow for this when cutting the blank.

ITEM 5. I must warn you that I am almost completely ignorant on electrical matters. The coil detailed on the drawing may certainly not be the best possible. I can only say that of the more than fifty I have wound with various sizes of wire, more or less turns, and different core sizes, this was best. I didn't have a suitable piece of soft iron for the core so I used a 6" nail instead. The nail was thrust into a glowing heap of coals in the furnace and left there overnight to cool. In the morning it was removed from the ashes, in its softest state I am sure. A portion of the nail was chucked in a hand drill, which was clamped in a vise, and turned down to specifications with files. The end of the core was drilled and tapped with a #2-56 thread. The fiber discs were a tight fit on the core.

To wind the coil; the discs were slipped onto the core, a #2-56 machine screw, with the head cut off, was used as the shank to be chucked in a hand drill. With the drill clamped in a vise, 150 turns of #26 enamelled copper wire were carefully wound in place.

ITEM 6. This was made from .01" control line wire and needs no explanation. Just be sure that coiled portion fits loosely over the armature pivot.

ASSEMBLY. Mount wheel (1) and bracket (3) on the base (4). Using ITEM 3 as a guide, drill through the base for the armature pivot. The pivot should just protrude through the back of the base in order to assure a rigidly held relationship between shaft and pivot centers. Mount pallet and coil. Get out the M.A.N. with Part 1 of these notes and start adjusting. The finished escapement should give you precise and trouble-free service. I rather believe an occasional inspection; touching up for wear, and lubricating the shaft bearings and pivot holes, etc., is desirable. Pallets and escape teeth, should be lubricated very sparingly, if at all, and then only with a light smear of sewing machine oil.

I do hope you like this escapement and get as much fun out of making it as I did.