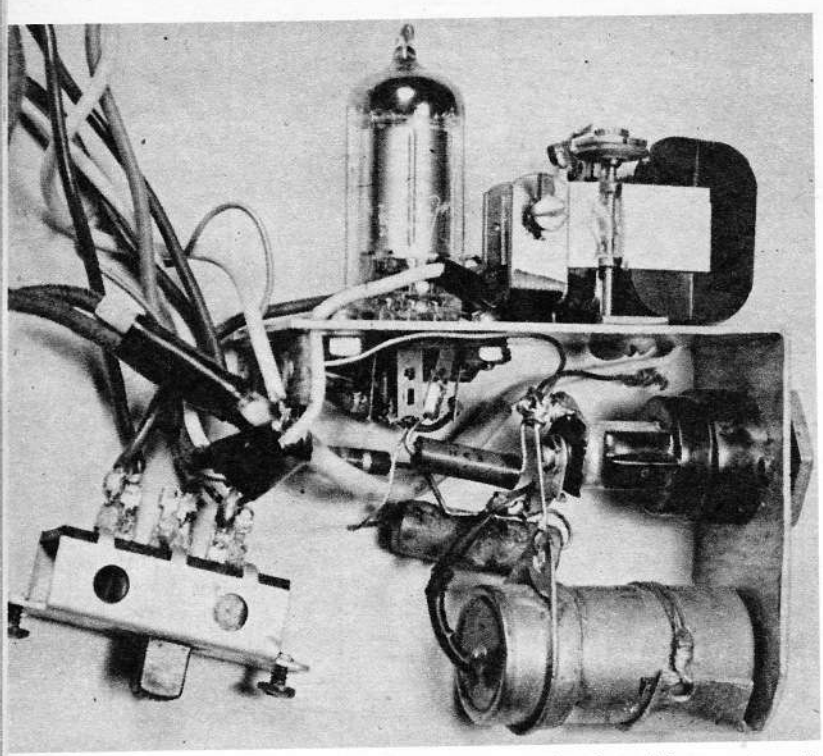


Pulser shown may have its own case and be plugged into any transmitter, or you may build the pulser right into the case of your present transmitter. The "A" battery must be separate; "B" can be the same.

Simple Pulse Proportional Control

Build this inexpensive electronic pulser and lightweight control actuator

By GEORGE G. TRAMMELL

■ Just in case readers are not familiar with pulse proportion and the advantages it affords, let's review briefly. If you move the rudder of your plane back and forth rapidly, the model will continue to fly straight ahead—it takes a bit of time for the plane to respond, after the rudder is moved. Equal left and right rudder movement is therefore our neutral, in proportional control. The rudder actuator is usually connected to give left with no signal, and right with steady signal; about three pulses a second is a good speed.

Turning off the transmitter thus gives full left turn, and holding it on continuously gives full right. Often, though, we don't want full rudder; the ideal control is to use plenty of rudder to start a turn, then ease off, till the model is turning as required. The experts do this by "blipping" the escapement continuously in a wide turn, but with pulse proportion anyone can do as well, or even better.

Suppose we set the control box knob so the signal is on 60% of the time, and off 40%; we get what amounts to 20% right rudder (remember that 50% on and 50% off is neutral). Or, with the knob set to give signal-on 20% of the time (which would turn the rudder right 20% of the time and left the other 80%), the average rudder position to turn the plane would come out to 60% left—a fairly sharp turn. The control box figures all this out for you; all you have to remember is that the rudder position is equivalent to the position of the control knob pointer—both in direction and amount.

There are other advantages, too. You can set the linkage to get lots of turn, so you will have good control in the glide; power turns can be made just as sharp or shallow as you wish. "Out of range" does not sneak up on you so fast, either. If you are holding neutral, and notice that the plane seems to be going a bit to the left, you are probably too far out, and should bring 'er back before it is too late. If something goes wrong with the radio equipment (I've heard it still happens!), the ship doesn't fly away, it spins in. Most builders who have lost planes now concede it is better to have a spin-in than to lose all your valuable equipment entirely.

The quick, positive control is especially helpful on ROG; only the best pilots can keep a plane on a straight path, using just pushbutton control.

The actuator requires less current than the average escapement. We have made them with windings from 6 to 40 ohms; the former draws a half amp. on 3 V., resulting in lots of pull, but running down a set of pencells pretty fast, of course. The winding shown on the actuator described here will average about 20 ohms, and will have plenty of pull to steer a plane under 3 lbs., on only 1½ V. It will handle a 5 pounder on 3 V. For heavier ships, you should use a magnet ¾" dia. x ¼" thick, or larger.

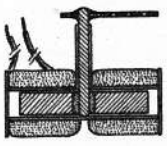
Several simplifications of the writer's original proportional control system have been in use, but most seem to have been born of necessity, due to lack of suitable materials, or inability of the builder to make the more complex equipment. That shown here has been simplified for the average modeler, and the parts are readily available; in fact, kits for both actuator and pulser may be had from Air Trails advertisers.

The pulse box may be built as a separate unit, or you could put it in with your transmitter, and use the same B batteries. The pulser requires a separate A supply, but since only half of the 3S4 filament is used, a couple of D cells will last a long time. The B drain is only about 2 ma.; you can use the smallest 67½ V. batteries, or even run pulser on B batts that are no longer good enough for the transmitter. Since the transmitter is attached to the relay, and the relay armature is usually not insulated from the frame, it is wise to mount the relay on a piece of Bakelite. Otherwise you might have the transmitter voltage between the transmitter case and pulser case (and get a hot one every time you touched the two!).

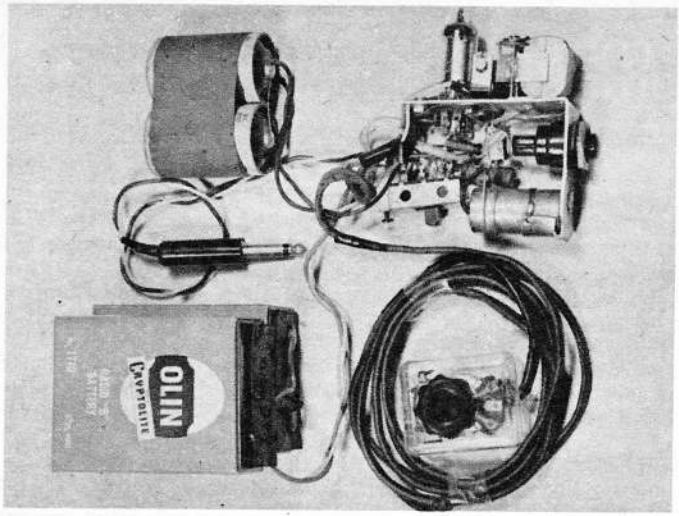
A 5000 ohm potentiometer gives about 180% of knob rotation from full left to full right, but other resistance values will work well. It's wise to select a good Sigma 4F relay for this unit—even a brand new one—as the dirty, beat-up surplus jobs often cannot be adjusted closely enough. Set the armature about .020" from the core (or the thickness of two postal cards). Then adjust the other contact as closely as practical; a gap of .005" or less should be used here. Turn on (*Continued on page* 81)

ACTUATOR WINDINGS

INSULATE THE FORM WITH TISSUE BEFORE WINDING COIL. ABOUT 120' NO.32 ENAMELED COPPER WIRE NEEDED. WIND ONE END AT A TIME, AND BRING OUT A LEAD AT END OF FIRST COIL IF SINGLE BATTERY IS TO BE TRIED. TIE LEADS SECURELY WITH THREAD WHERE THEY LEAVE COIL TO PREVENT ACCIDENTAL PULLOUT. VARNISH COMPLETED COILS WITH TWO OR MORE COATS OF HOT FUEL PROOFER FOR ADDITIONAL STRENGTH.

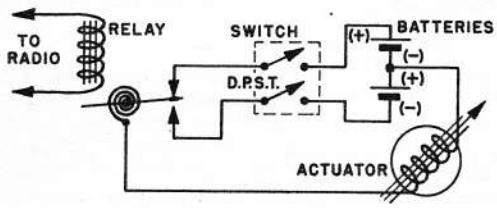


CROSS SECTION THROUGH ASSEMBLED ACTUATOR UNIT.

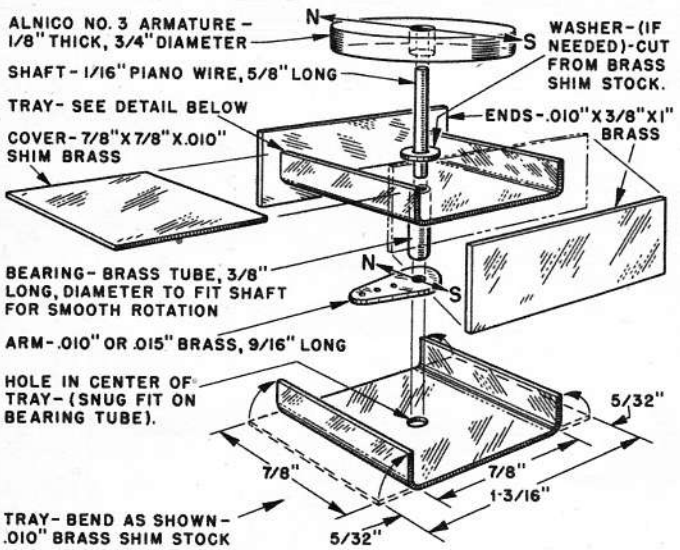


Here's the works. One good feature is that if you use separate "B" supply, you can utilize batteries that are no longer good enough for the xmtr since the B drain is only about 2 ma. Filament D cells will last indefinitely.

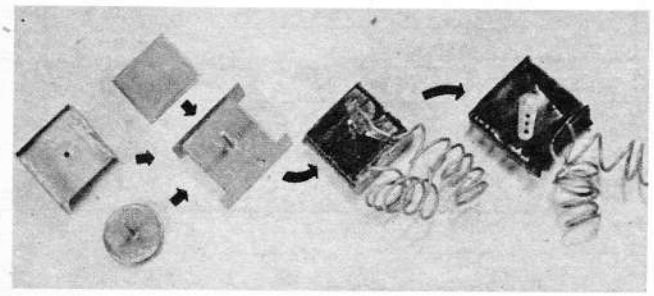
ACTUATOR TO RADIO RELAY CIRCUIT



ACTUATOR PARTS AND ASSEMBLY

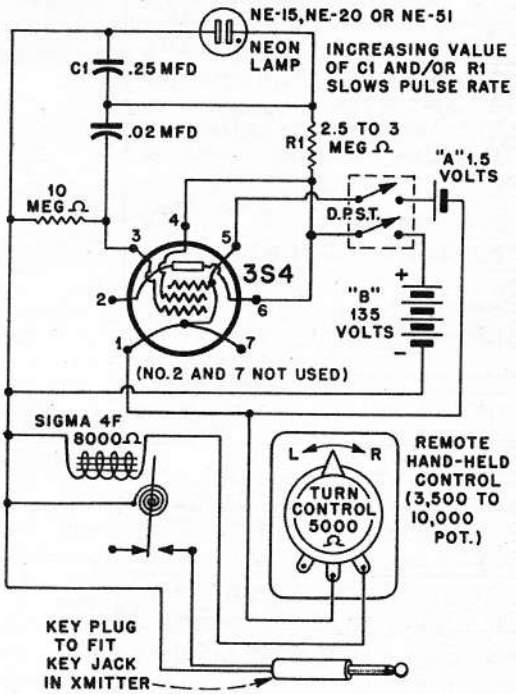


Actuator construction is easier if all parts that match are tinned before assembly. This is specially true of shaft and rotor where you should use acid core solder or acid flux, in order to get a perfect bond.

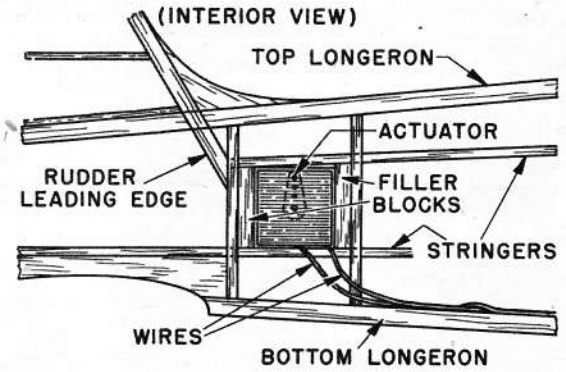


ELECTRONIC PULSER

SAWTOOTH RELAXATION OSCILLATOR AND CATHODE FOLLOWER

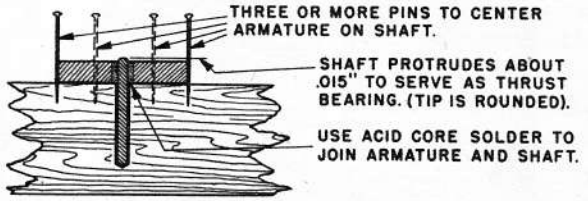


ACTUATOR INSTALLATION

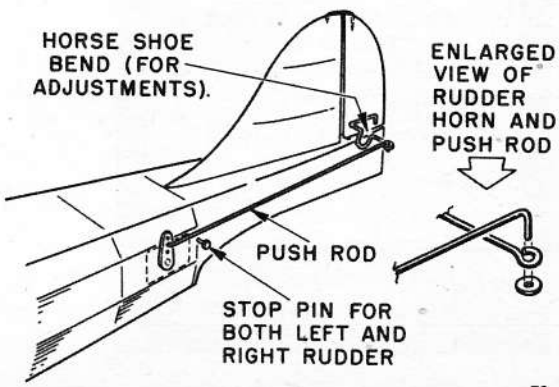


SHAFT-ARMATURE ASSEMBLY

(USE SAME SYSTEM TO MOUNT BEARING IN TRAY)



ACTUATOR LINKAGE DETAIL



Pulse Proportional

(*Continued from page 52*)

the power switch, and the neon tube should start flashing. By adjusting the armature tension spring on the relay (with the pot. knob in mid-position) even on and off pulses may be had. You can check this by the sound of the relay. Turning the knob left should give shorter and shorter pulses, until the relay ceases operation; the other way, the pulses get longer till the relay contacts remain closed. Readjust the spring tension to get the neutral—or even on-off pulses—at the center of the knob rotation. Some builders put another pot. in the case in place of fixed resistor R1, so that they can change the speed of pulsing to suit them.

The actuator is a very simple mechanism, and you will note that the only magnetic material in it is the rotor disc and the shaft. The shim brass case is just heavy enough to hold its shape while winding; its strength comes from the varnish put on after the winding is completed. Several heavy coats of fuel proofer will do the job. Be sure to lubricate the rounded lower end of the shaft, where it rests against the inside of the case—you can't reach it after the unit has been finished.

If you use a different-sized alnico disc, you can change the case dimensions to suit. Unless the disc is an inch or more in diameter, you can still use #32 wire, but #30 is better for the larger sizes.

If the actuator is mounted as shown, the linkage friction will be kept to a minimum. You can glue on a bit of sponge rubber to stop the rotor short of 180 degree travel, or use a pin as suggested. A stop must be used though, for without it the rotor can stop on dead center, or even swing around to the opposite side and give you reverse rudder action. The horseshoe bend in the soft iron wire rudder horn allows adjustment of neutral, and also total distance of travel.

Be sure the rudder hinges are very free; by hinging the rudder about 20% back from the front edge, the power required to move it is somewhat reduced, and you can count on plenty of control, even in violent maneuvers. And don't be worried when you feel the amount of push on the rudder, when the actuator is turned on; it doesn't take anywhere near as much as you might think to produce a screaming spiral dive!