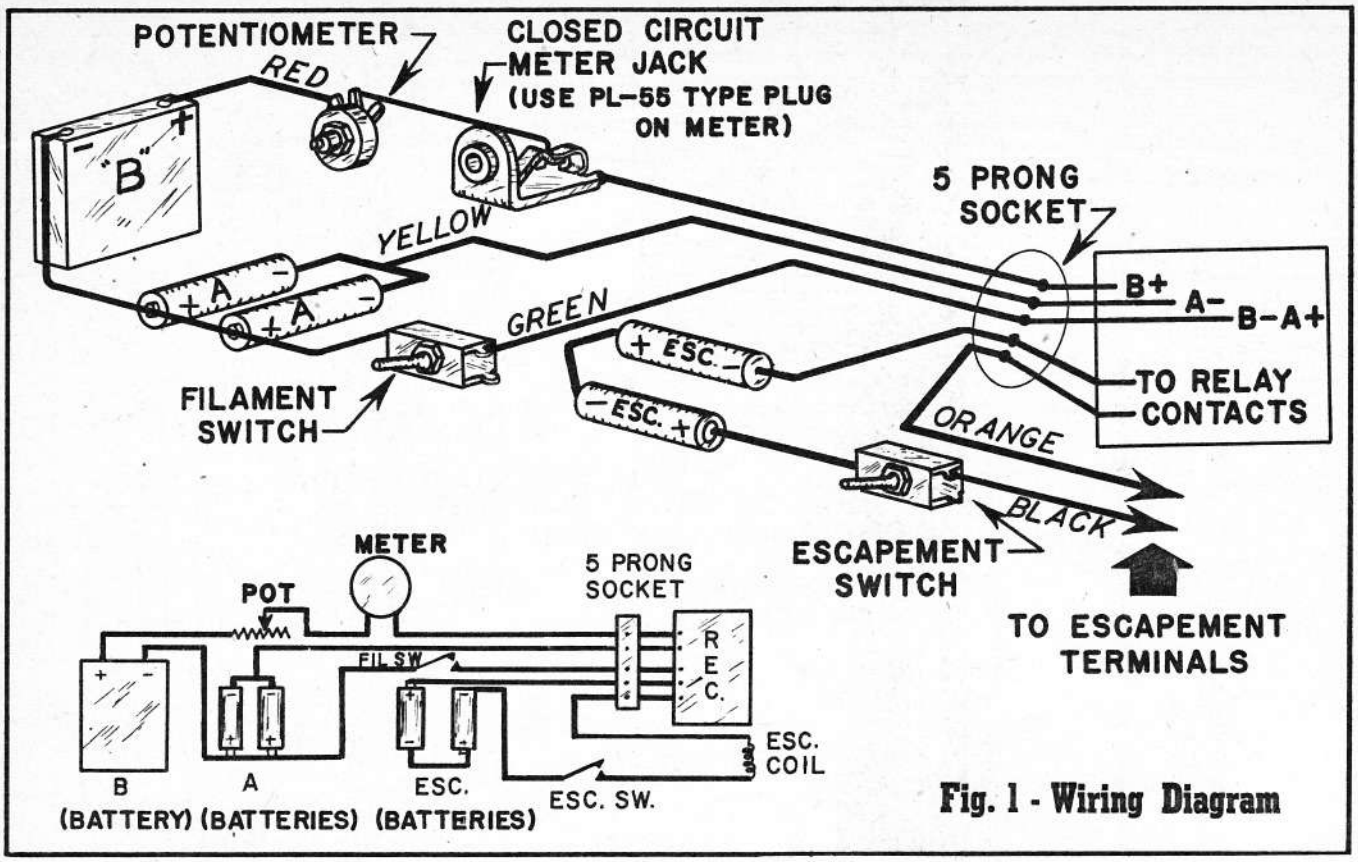
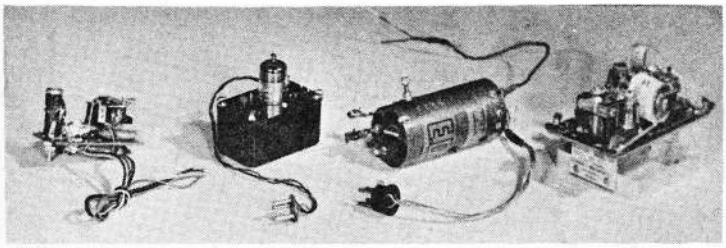
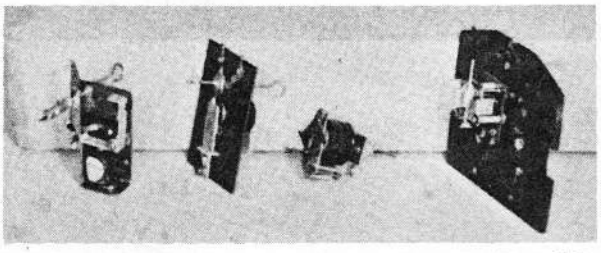


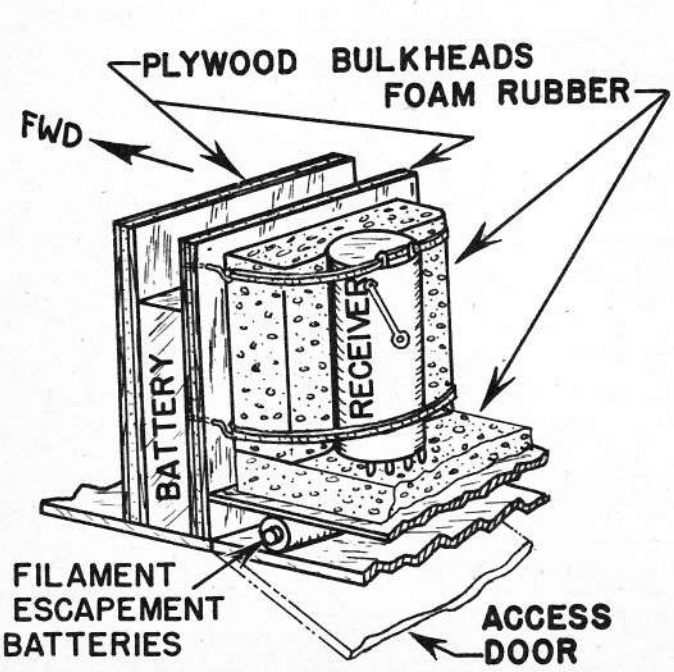
Fig. 1 - Wiring Diagram



R/C receivers left to right: Aerotrol, E.C.C. #951A, E.D. & Citizen-Ship CR.



Self-neutralizing escapements, l. to r. E.D., E.C.C., Aerotrol, Citizen- Ship.



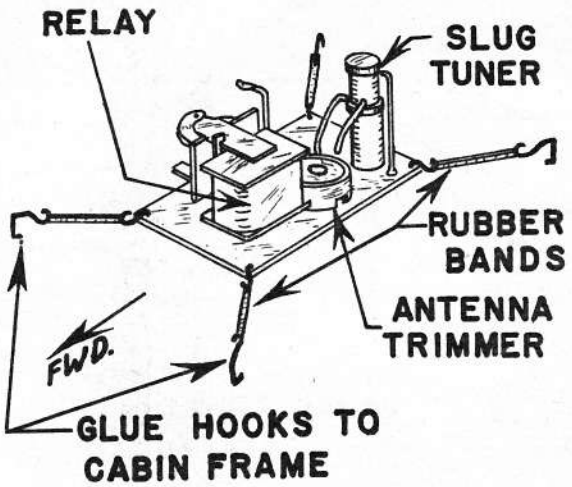


Fig. 2 - Receiver Mounting

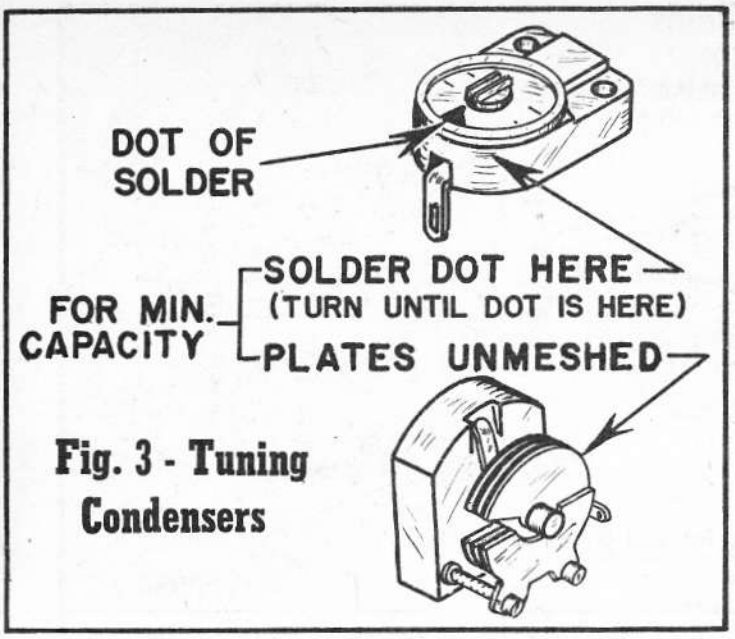


Fig. 3 - Tuning Condensers

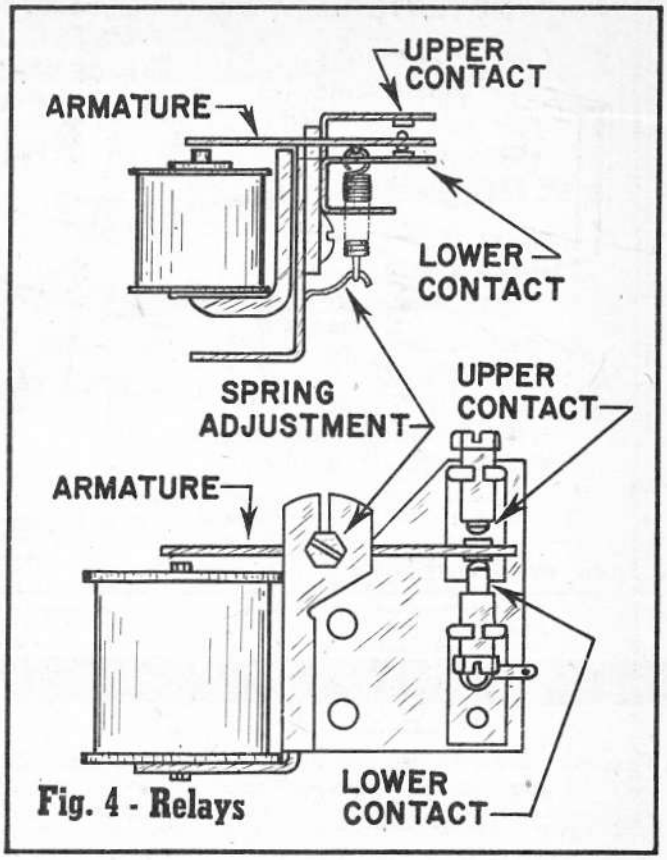
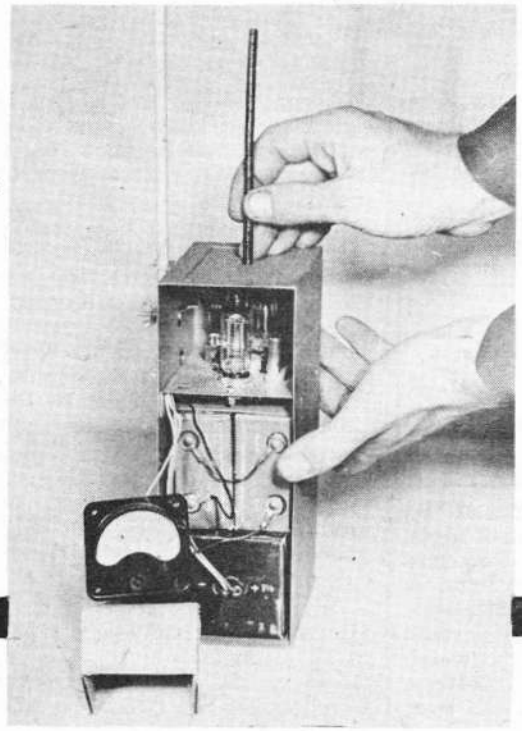


Fig. 4 - Relays

GETTING STARTED IN RADIO CONTROL

Installation And Tuning

by Phil Greenberg



Tuning the Aerotrol Transmitter. Note left hand, keying and holding transmitter while making the tuning adjustments.

● If you read the first installment of this series (Feb. 1953 FLYING MODELS) you now have a general idea of what radio-control is all about and what makes it tick. You also have had time to build your first radio-control plane, using one of the excellent prefabricated kits currently available at hobby shops. Now, it's time to buy your radio-control equipment, and install the necessary apparatus in your ship.

TRANSMITTERS & RECEIVERS: The first equipment produced for operator-license-free operation was the McNabb "Citizen-Ship" radio-control unit. This is still the only radio-control apparatus for model planes manufactured for operation on the 465 megacycle band. One of its main features is that both transmitter and receiver use a "hard" (high-vacuum) tube. The transmitter is factory-tuned and should not be tampered with in any manner. It has a small plug-in antenna, and self-enclosed batteries, making a neat hand-held unit. The receiver features an integral antenna in addition to the long-life hard tube.

For the 27¼ mc. band, there are now a number of complete units available, as well as individual transmitters or receivers by various manufacturers. Crystal-controlled transmitters currently being marketed are the E.D. "Aristrol," McNabb "Citizen-Ship," Berkeley "Aerotrol," E.C.C. "Transatlantic," and Hobby Enterprise "Control Master." All of these companies produce completed factory-tuned transmitters which can be placed in operation by just plugging in the antenna and suitable batteries. Berkeley's Aerotrol and E.C.C.'s Transatlantic are available in kit form. Instructions for their proper tuning are included with the kits. Or, see the directions for tuning any crystal-controlled transmitter at the end of this article.

While the transmitters are all basically the same, the receivers are quite different. Mainly, the differences can be found in the types of tubes used. E.D., Aerotrol, E.C.C., and Control

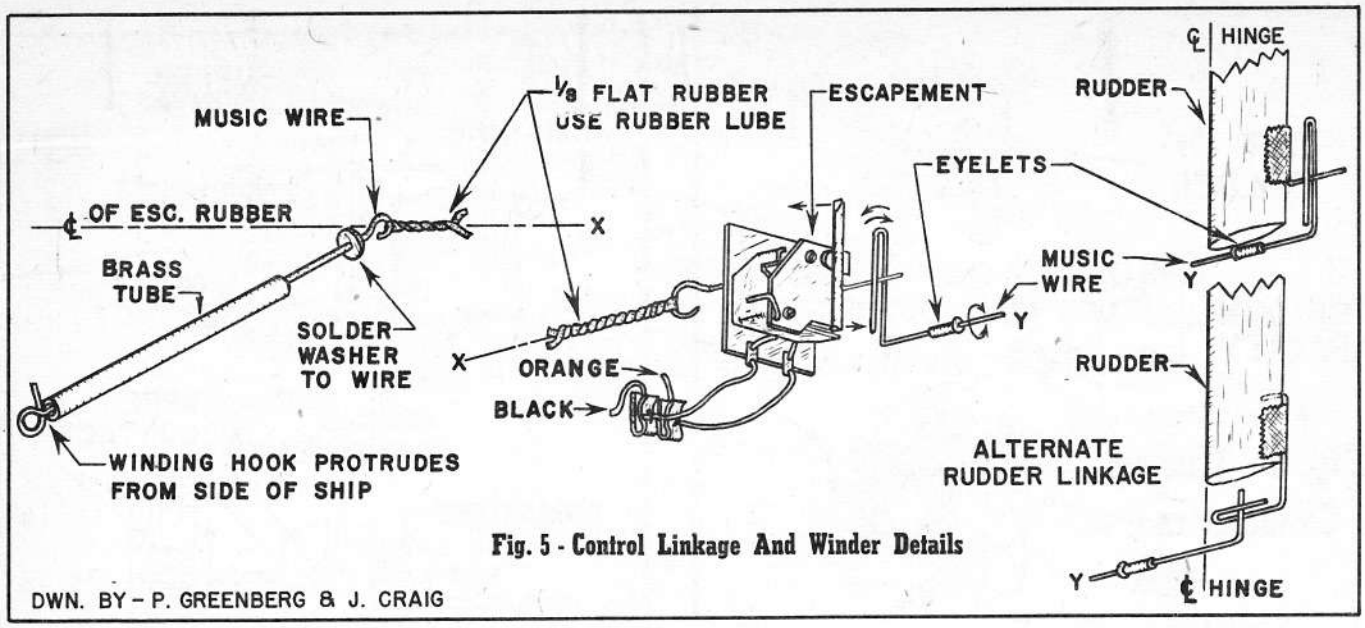


Fig. 5 - Control Linkage And Winder Details

DWN. BY – P. GREENBERG & J. CRAIG

Installation And Tuning

Research receivers use the RK-61 or XFG-1 "gas" tubes. McNabb and E.C.C. produce hard-tube receivers. The hard tubes generally will last much longer than the gas types. The operation of the various receivers is somewhat different and you should thoroughly familiarize yourself with your set before installing it in your airplane.

ESCAPEMENTS: A complete selection of dependable escapements is available at present. E. D. makes a self-neutralizing job with a current-saving device, and also a clockwork escapement. Aerotrol is now marketing a new type of self-neutralizing job. McNabb makes available the Citizen-Ship self-neutralizing escapement and also the Good Bros. four-arm type. The E.C.C. escapement comes in two styles: a self-neutralizing type and a four-arm type, both equipped with a current-saving device.

BATTERIES: Getting the proper batteries for your transmitter is a simple matter—buy those recommended by the manufacturer.

For the receiver, three sets of batteries are required. The first is the "A" battery—a low voltage supply for the filament. Second is the "B" battery, which is the high voltage supply used to feed the relay and actually do the work.

When installing the batteries, install the "B" battery inside the ship butted up against a good solid bulkhead at the front of the cabin. The filament batteries should be installed in the belly of the ship, accessible without removing the wing, leaving the bottom of the fuselage open or installing cover hatches.

Third, you'll need a set of batteries to operate the escapement. These also should be in the belly of the ship, for easy replacement and checking. Use a ⅛" sheet balsa separator between the filament and escapement batteries. The following chart will show you the voltages needed:

RECEIVER BATTERY VOLTAGES

Brand	A Filament	B Plate	Escape.
Super Aerotrol	1.5	45	3-6
E. D.	1.5	45	4½-6
E.C.C. 951A	1.5	60-72	3
Citizen-Ship CR	6	45-67½	3
Control Research	1.5	45	3

There are two general types of "B" batteries used for radio-control units. First are the hearing aid batteries which vary from about 2½ to 8 ounces per set (for two 22½ volt batteries). Second, there are the portable radio batteries which are larger and weigh about 9 ounces for a 45 volt battery. Any ship of about 4' span and over can lift the 9 ounce battery without any trouble, and we prefer this type because of the longer life and increased reliability it offers.

You should use the portable radio type of battery for the Aerotrol, E.D., and E.C.C. receivers, as these sets operate at a high idle current (signal off), and the current drops when you send your signal for a turn.

The McNabb Citizen-Ship 465 mc. and Control Research two-tube receivers operate on a rise in current when you send a signal, and at a relatively low idle current. Thus you can save a little weight by using hearing aid batteries or else take advantage of longer battery life with the larger battery.

When deciding on the battery you want to use, keep in mind that it is more important to have a set-up which will work reliably and as long as possible, than to save a few ounces of weight and risk losing a ship O.O.S. or in a crack-up because of loss of control.

Always be sure to buy fresh batteries. Buy them in a place that sells a lot of batteries. A sure way is to test the batteries with a voltmeter when you buy them. New battery voltage should be higher than the rated voltage. If possible, test them with some kind of a dummy load on them to simulate actual operating conditions.

WIRING YOUR SHIP: The wiring diagram and isometric drawing (Figure 1) show the proper hook-up for the units in the ship. The following components are needed to build the circuit shown:

One Mallory U-29 25,000 ohm Midgetrol, or equivalent (potentiometer); one Mallory A2A midget closed-circuit jack, or equivalent; one Amphenol 78-S5S five-prong socket, or equivalent; and two single-pole single-throw toggle switches. If your receiver comes supplied with any of these parts, you naturally don't have to buy additional ones. Use No. 20 stranded wire for all wiring and rosin-core solder for all joints.

Additionally, you will need one Mallory 7S plug, or equivalent, for use on the milliameter, and one Amphenol 71-5S plug, or equivalent, for use on the receiver leads. As stated last issue, you should have a fairly good 0 to 3 ma. D. C. milliameter for testing and tuning purposes.

All power is brought to the socket and the receiver is plugged in. Solder your receiver leads to the plug. Be sure to keep the numbers on the plug and socket straight, to prevent cross-

(*Please turn to Page 37*)

RADIO CONTROL

(*Continued from Page 24*)

ing wires. The illustration indicates the color code which we use for our wiring installations. By using different colored wires, it is almost impossible to cross the wires.

It's a good idea to build the set-up shown on a test board and completely check out the operation of the receiver and escapement. Then you can install the wired circuit in the ship, or duplicate it in the ship and keep the test board for future experiment.

MOUNTING THE RECEIVER: The receiver unit itself can be mounted in several ways. The two most widely used methods are: (1) Suspend the receiver in the cabin by means of rubber bands; (2) Tie it down with rubber bands on a 1" thick sponge rubber pad to the floor of the cabin, or up against a bulkhead located directly behind the "B" battery (see Figure 2).

If you mount your receiver horizontally, keep the relay mounted forward, and have a sponge pad against a solid bulkhead in front of the receiver to take the shock in the event of a crash. Some receivers may be sensitive to wiring, or to rubber pads held near them. If yours is one of these, use the rubber band suspension. Whichever way you mount it, make sure that the relay is clear and the armature can swing freely.

CHECKING THE RECEIVER: Check over the wiring carefully before plugging in the receiver. Plug a O-3 ma. D. C. milliameter into the meter jack. Adjust the potentiometer for lowest current (maximum resistance). Turn the receiver on and reset potentiometer, so that the receiver draws about 1.0 ma. Adjust the antenna trimmer (if provided) for minimum capacitance (Figure 3), leaving the antenna connected. With the transmitter signal "on," adjust the receiver slug tuner until you notice a drop in the plate current. Adjust the tuner carefully for dip to minimum value. With signal "off," current should rise back to the original 1.0 ma. Recheck operation by keying transmitter and readjusting the slug tuner for maximum "dip." The receiver should now operate up to 50 feet away with no trouble at all, which is sufficient for the bench check-out.

ADJUSTING THE RELAY: Most of the receiver relays are adjusted at the factory to operate properly, but now is the time to get into the habit of checking yours. Regardless of the type of receiver you use, all relays are adjusted the same way.

First, study the operation sheet supplied with your receiver to determine the operating conditions for the relay. You will find the "idle" current (signal off) and a recommended "pull-in" and "drop-out" value. The position of the lower contact will determine the "pull-in" and the upper contact position will determine the "drop-out" value.

The tension spring will set the operating range. For instance, if the relay will not pull-in until the plate current is brought up very high, then adjust the spring for less tension. Some relays have screw adjustments for setting the relay, but those which do not have this provision must be adjusted by carefully bending the contact arms and the spring anchorage with needle-nose pliers (see Figure 4).

INSTALLING THE ESCAPEMENTS: When installing the escapement, mount it firmly to a ⅛" piece of plywood as a base. This can be mounted in the plane permanently, or made removable by mounting the panel between two ¼" square runners fixed to each side of the fuselage. Use one loop of ⅛" flat rubber for power, and be sure to use rubber lube on it. The loop should hang slightly limp between the escapement and the other hook. Any tension on the rubber when the escapement is unwound may cause it to bind and stick.

LINKAGE ARRANGEMENTS: There are two types of linkage arrangements in use at present. The torque rod type is shown in Figure 5. The other type uses a bellcrank arrangement to take the motion from the escapement and operate a push-pull rod to the rudder control horn. Whichever you use, the linkage must operate freely, with absolutely no drag or binding. Use eyelets or short straight lengths of tubing for bearings, and slightly undersize music wire.

To make the reverse bends in the wire, anneal it by holding the portion to be bent over a gas flame until red hot, and allow it to cool slowly. Clean the wire with steel wool or emery cloth before bending to shape.

When you make the hinge, be sure that you don't gum it up while doping the ship. It too must operate freely throughout the full swing of the control surface.

RUDDER ADJUSTMENT: Rudder throw can be varied in the installation shown, by bending the wire slightly. In the bellcrank and push-pull rod system, extra holes are provided in the bellcrank and control horn to obtain a suitable control movement.

Nobody can tell before the first flight how much rudder movement will be necessary to bring the ship around against the wind. We suggest using more than your plans call for, just to be sure that you have enough. The first few turns you make may show that you have too much, but we feel that it is better to feel out a sensitive control rather than fly a ship out of sight with everything except the rudder working perfectly.

CHECKING YOUR BATTERIES: Once the receiver batteries are in operation, you should test them while actually operating the set. The method we use to determine the safe limits of battery life is as follows:

1. Connect a voltmeter to the bat-

tery under test, and note the "no load" (set off) voltage.

2. Turn the set on and adjust the plate current to the load current: "Idle" (signal off) for Aerotrol, E.D., or E.C.C.; "Operate" (signal on) for Control Research two-tube and McNabb 465.

The voltage will drop just a bit, and stay steady, when the load is applied —if the batteries are in good shape. If the voltage takes an initial drop (like a fresh battery), and then slowly continues to drop, then you know the battery is getting weak. When the total voltage drop is severe enough to make the "idle" adjustment or operation touchy or inconsistent, then it is best to install a fresh battery.

The complete battery check should last for about three or four minutes (about as long as a complete flight), and notice the operation throughout the entire test. This is very important, because while the set is turned off, the batteries rest up a bit and recuperate. When you turn it on, the batteries may appear fresh again, but this false voltage disappears within a half minute or so if the battery is getting weak.

In addition to the receiver batteries, a periodic check should be made on the transmitter and escapement batteries. The procedure is the same as for the receiver, except that "signal on" is the operating load for the transmitter. Similarly, you should energize the escapement to check the escapement batteries.

TUNING YOUR TRANSMITTER: If you build your transmitter from a kit or from plans, you must tune it yourself. The correct procedure is as follows (read this over completely until you understand it before attempting to tune your transmitter):

1. Completely assemble the transmitter and install it in its case, according to the directions in the kit.

2. Plug in tube and crystal.

3. Connect filament ("A") battery and B+ lead of "B" battery.

4. Insert an O-5O ma. D.C. milliameter in series with keying lead and B—.

5. Rotate tuning condenser to "minimum" capacity. (see Figure 3).

6. Turn on filament switch.

7. Momentarily pulse the keying switch and note if you are drawing plate current. Do not hold "on" more than a few seconds—long enough to note meter reading. If meter moves to zero side, reverse leads to meter.

8. Using an alignment tool (ICA 6158 —24¢) as shown in phto, rotate tuning condenser slowly, while holding keying switch "on". As you rotate the condenser towards high capacity (see Figure 3), you will notice a point where the plate current shown on the meter begins to "drop" (becomes lower). Continue rotating until the plate current drops to the lowest value it will reach. If you continue to turn the condenser, the plate current will rise again—rotate it back to the minimum plate current value you had before.

9. Tuning must be done with the antenna in place, extended to its full length. All further checking of the transmitter must be done with the antenna on, including short range and indoor checking of receiver operation.

10. The plate current "dip" indicates that the circuit is oscillating. Recheck the operation by holding transmitter in various positions, close to and away from your body, to see if plate current rises again in any position. This indicates that the circuit has stopped oscillating. If this happens, turn tuning condenser very slightly towards "low capacity" and recheck operation as above. The meter reading should be close to the minimum value.

11. The antenna coil position must not be changed after tuning as this will affect tuning, possibly throwing the circuit out of oscillation. In the E.C.C. transmitter, the antenna coil is already in position. In the Aerotrol transmitter, set the antenna coil as shown in plans before tuning. Further adjustment of antenna coil should be done with a Field Strength Meter.

IN OUR NEXT ARTICLE we will describe the proper procedure for making field and distance checks, as well as covering general operating practice. We also will show how we fly our ships.

WHY CAN'T WE WIN?

(*Continued from Page* 30)

using other propeller designs will be made.

And there you have it—our suggestions for improving the caliber of this country's 1953 Wakefield designs. Let's face it—the U. S. team has not been able to bring back the Wakefield Cup for four long years . . . it's time for a change! But to win the Cup we have to do better than our competitors —and we must accept the fact that what we have done up to now has not been good enough.

Merely imitating the winning 1952 Wakefield design won't do the trick—our overseas adversaries can be expected to improve the performance of their models, so our designs must surpass those used in 1952 by the opposition, and by a sizable margin.

If you do not possess extensive experience in the design of Wakefield Models, we suggest that you use either one of our two designs as a basis for your 1953 ship—at least take the time to analyze the facts we have presented and put them on trial before passing judgment. We are certain that if you do you may find the suggestions made can do much to help you produce a high performance Wakefield design. If you are experienced, don't make the mistake of stopping when you feel you have obtained a successful design.

We *can* win the Wakefields this year —but only if each one of us moves forward with a constant evolution of new ideas. Let's get started now and build that winning model!