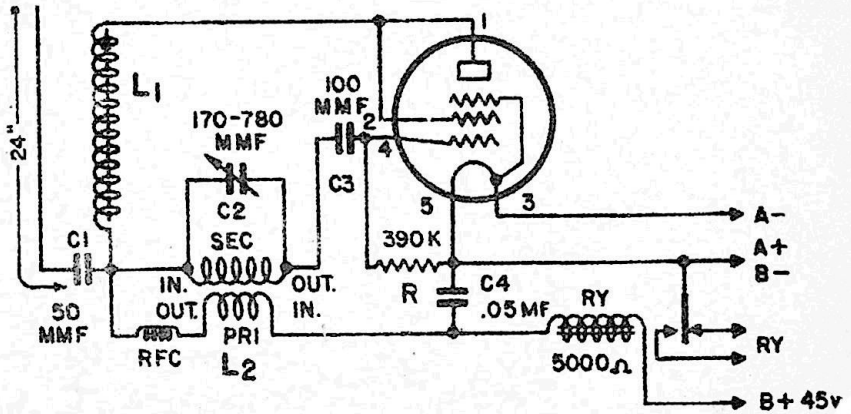
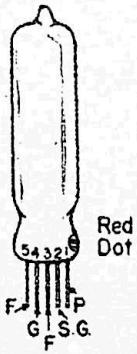
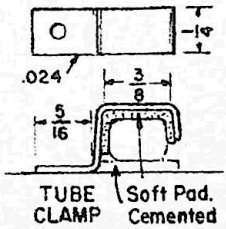
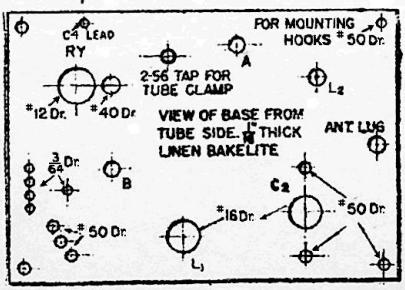
Mini-Mac

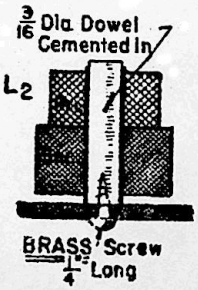
By HOWARD G. McENTEE











■ Since our Simple-Single was introduced in Air Trails last July, a lot of flyers have tried it, most of them with good results (yep—there have been some questions, too; more on this later). Even though the power drain, especially that of the filament, is lower than on any comparable hard tuber, it is still a bit high, when using the smallest-sized batteries that are required for R/C planes in the Half-A category.

So we set out to reduce filament drain, by employing one of the sub-miniature tubes that are so tiny and economical, and when one was found that would do a nice job, it seemed a shame not to go all the way, and produce a sub-miniature receiver to go with it. The result is shown here; the little set measures only 1½ x 1½ x 2⅛" overall, and weighs just over 2 oz., with power cable and battery plugs. The size could be cut even more, and the receiver mounted in a tiny box with the relay separate, as suggested by George Trammell in the Dec. issue. Made to the size shown, though, it will fit in most any plane, and is still large enough so that you won't get the "screamin' meemies" putting it together.

The usual 1/16" linen bakelite "chassis" is utilized. Cut it to the size shown and drill all the holes. The end lugs are cut off the trimmer condenser C2, and it is mounted by the two little tabs near the center. The tube socket is held only by its solder lugs; bend them as shown in the sketch, and bring up a lead to the grid lug.

The ESSCO quench coil is the smallest one we could find, and it is used here without the large bakelite lug plate that is normally attached to it. If yours has the plate, remove it, first unsoldering the four coil leads. Don't bother to mark them, as the diagram will show where they go. Cut the center tubing down to about 1/16" on each end. A 3/16" hardwood dowel is a snug fit, and is held in with model cement; before you insert this dowel, bore a hole in one end, to make it easier to run in the little brass screw that holds the assembly to chassis; don't use longer than a ¼" screw. A word of caution—*don't* use a machine bolt through the coil to hold it in place, as it will cut sensitivity down quite a lot.

We used two little eyelets (A and B on the diagram) to hold down loose wire ends, and a rivet-type lug is needed for the antenna connection. After these items were installed, all other parts were mounted.

To forestall trouble, we advise making the RF coil L1 on the specified form, so you will be sure you can hit the 27¼ mc. spot. Place the winding on the form as shown, to insure that the iron slug will tune properly. So that the slug-threaded shank does not project so far, the slug is placed on the upper side of the winding—that is, the end away from the chassis. A length of 1/32" music wire is held under the coil mounting nut, and bears strongly against the slug shank, to hold the setting under vibration.

The RF choke we used is a commercial one, but can be made as shown on the drawings, if you wish. Don't use one with larger wire or a shorter form—it will not work well, if at all. A coat of *thin* dope over both the choke and L1 turns will hold them in place.

Before firing up the receiver, we suggest that builders go back and read the Simple-Single story in the July and August issues. Practically everything said there applies to this receiver, so it's not necessary to repeat here. However, there are some points we again stress, for we feel that those who have trouble with single hard tubers just do not understand them well enough—possibly because they have been used to gas tube receivers, which behave quite differently.

In the first place, hard tubers have to be set for sensitivity before they can be used; you have to turn the sensitivity control (C2 in this case) till the plate current drops abruptly, then unscrew the trimmer till the current jumps back up to the normal idling point again. *But don't fly with this setting!* Back the trimmer off still more, to get the receiver stability you must have to fly safely; in the Mini-Mac, a further quarter turn is about right. This receiver should idle at about 1.8 ma.; if the idling current is higher than this, it is wise to try another grid

leak (R) to get the current to the point specified. As battery voltage drops the idling current might go down to as low as 1.5 ma. The resistor R we used is marked 390,000 ohms, and measures very close to this, but standard tolerance for carbon resistors is plus or minus 10%, so your resistor could be anywhere from 350 to 430 thousand ohms.

All right, have you got the idling current and sensitivity control all set? Now—and not before—is the time to try the receiver with a signal. A strong one will drop the plate current to around .35 ma., and a weak one to about .6. Of course, the final test is to take the receiver out into the field, get about a quarter to a half mile from the transmitter, and *then* see how the current changes. It will sometimes be found that the receiver works poorly, or not at all right near a transmitter running full blast. This is normal, and is called "overloading." Just get a little farther away. Tuning of the core should be done at least several hundred feet from the transmitter, and preferably at much greater distance. Remember—fairly close to the transmitter, most anything goes. It is when you get your plane out at a half mile or so that you want the tuning to be *right*.

Since the average plate current change of the Mini-Mac is about 1.7 to .5 ma., the relay can be set to pull in at around 1.3 ma., and drop out at .9; this setting was found to be quite possible with the E.D. relay we used. All these tiny relays require some care in mounting, to protect them from excessive vibration, since they just can't be set with the spring tension that you would be able to use with a Sigma, for example. You can use any other relay you want, of course, but if the coil resistance is higher than 5000 ohms, the plate voltage should be raised, to keep the idling current at about 1.8 ma.

The filament of the CK526AX draws only 20 ma., so even a pencell filament supply will give quite a long life. Because of this low filament current, the plate current should never be allowed to go over 1.8 ma.

Operating Hard Tubers

As noted in the first paragraph of this article, hard tubers have caused some troubles; we feel these are due solely to the fact that the users do not understand them. Here are a few points that you should remember:

1. Always be sure your sensitivity control is set correctly. After the receiver and other equipment have been mounted in the plane, become thoroughly acquainted with the operation of this control before you fly the plane. The sens. control should be unscrewed as far as possible from the point where the plate current pops back up (with no signal), while maintaining sufficient sensitivity to operate the receiver at the maximum range you want to fly. Of course, reception in the air is likely to be a bit different than on the ground, but it will probably be better, if anything.

2. If you find the sensitivity control has to be screwed up tight to get the plate current drop (with no signal) it indicates too much antenna is in use. Cut the length a bit, or use a smaller capacity for C1. Two feet of antenna should be plenty for any case; in a large plane, where there is a lot of lengthy wiring, this may be too much.

3. If the plate current drops as it should with signal, but will not come back unless you touch the antenna, or bring your hand near it, back off on the sensitivity control a bit.

4. The ends of L2 *must* be connected as shown on the diagram. If the plate current stands at about 1 ma. and adjustment of C2 makes no change, you have undoubtedly messed up on this detail.

5. All hard tube receivers are bothered by "electrical noise" in the plane. Worst offender in this respect is the linkage to the escapement, especially if the latter is mounted in the front of the ship, with a long wire push or torque rod to the rudder. Best way out of this is to use a wooden torque rod, or to isolate the rod from the escapement by using a piece of bakelite somewhere in the linkage. Bonding the metal parts with very flexible wire is OK, but bonds can break.

6. As batteries drop from use, the idling current will get lower, and the on-signal current will be higher. If the relay is correctly set, you should be able to use the batteries till the A drops to about 1.3 V. and the B to 40 V.

7. Best way to check final tuning and sens. control settings, when you are a good distance from the transmitter, is to lift the plane over your head on the end of a stick

or pole about 6 ft. long. This gets it away from the ground, and it will work much as it does when it is several hundred feet in the air. Next best way is to hold the plane as high as you can *by the wing tips;* keep your hand away from the fuselage to reduce capacity between you and the set, batteries and wiring.

Parts List

L1—CTC type LSM coil form with red core (see dwg). L2—RF choke: Control Research. L3—Quench transformer: Electronic Spec. Supply Co. (Small type with wire leads, no lugs). Ry—E.D. non-polarized relay, 5000 ohms: Polk's. C1—50 mmf. cond.: CRL type D6. C2—170-780 mmf. trimmer condenser: Arco type 469. C3—100 mmf. cond.: CRL type D6. C4—.05 mf. paper cond. 150 V. miniature type. Tube—Raytheon CK528AX sub-miniature. Socket—Sub-min. 5 prong. R—390,000 ohms ½ W. carbon. Base plate—linen bakelite, 1½" x 2⅛" x 1/16" thick. Three small rivet-type lugs: Control Research. Wire for coils, mounting clips, material for tube clamp, battery leads.

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