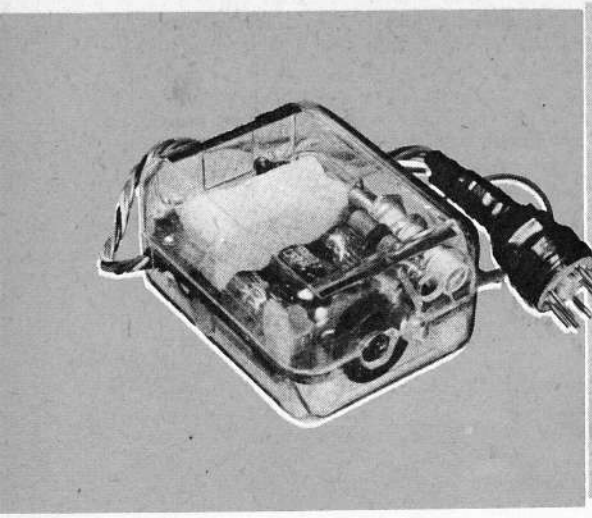
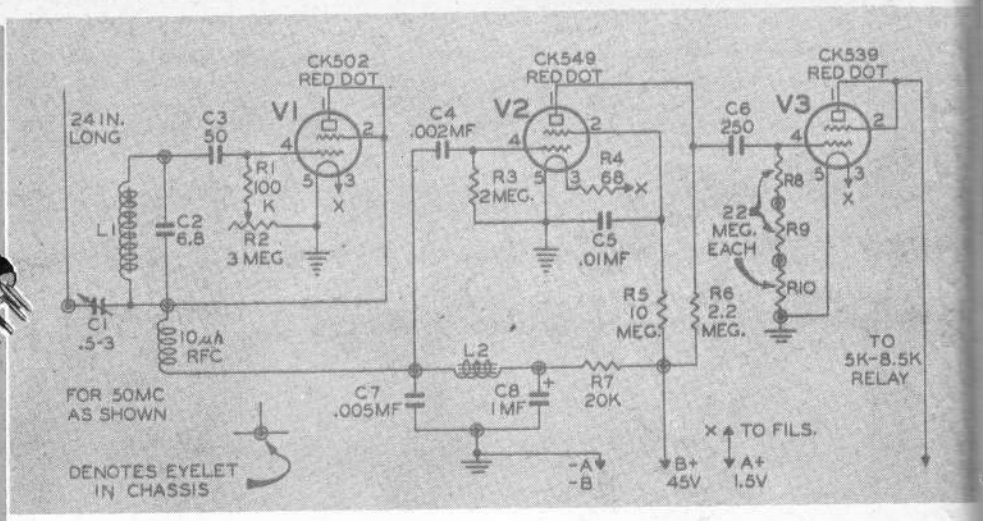




Mac III "AES" R/C Receiver

"Mac" means reliability; "III" is for 3-tuber; while the "AES" indicates "advanced experimenter's special"!

By HOWARD G. McENTEE

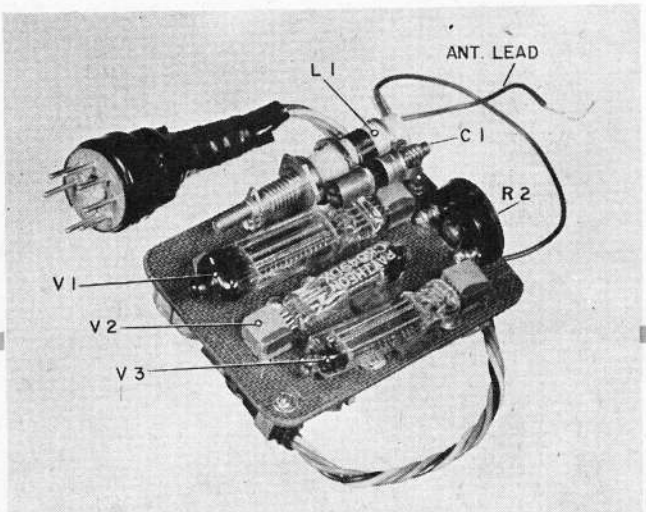
■ One might think from the name "Advanced Experimenter's Special" that this is an extremely complex receiver. It isn't. In light of present-day R/C equipment, with multi-tube receivers quite commonplace, the 3-tuber described here is not too difficult. We have had this one completed and in use for some time. But it is certainly no beginner's outfit, at least from the construction angle. However, quite a few correspondents have asked why ATH didn't print more material for the advanced builder, so here is one for them to chew on.

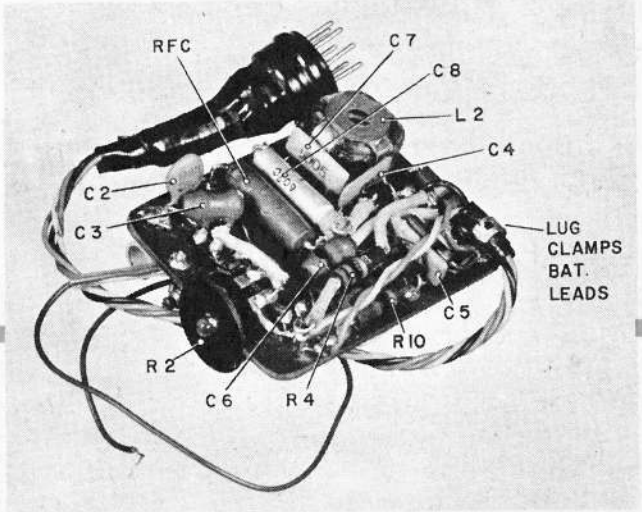
Actually, the set is fairly simple in circuit and easy to get into action. We had a similar one in use for over three years (it is still entirely workable, but has been retired from active flying) and it was the most satisfactory CW receiver (for carrier-only use—with no modulation) that we had ever used. Many long hours were spent on the old set, trying to improve it, but the final circuit is almost exactly the same as the original. We have used different tubes, however, which reduce the A drain and are more readily obtainable.

The present receiver may be used as a basis for other types of receivers; it serves beautifully for reed work, with a couple of slight circuit changes. Other applications—which have not been fully tried out yet—are as the front end of an audio filter or tuned-relay receiver, as a receiver to drive a transistor relay stage, etc. We'll report on these uses in later issues, if they look promising.

When used with straight carrier, this is definitely a low-current receiver, and must be used with a relay that will be happy with one milliampere or so of current change. We have found the Sigma 26F ideal, though the receiver works better with a 5000 ohm relay. The Price and Kurman 5000 ohm relays also work well; the latter was used on the older receiver mentioned previously. As separate relay mounting is getting to be quite the thing nowadays, the set was built less relay, and was condensed into a little plastic case measuring 1¾" x 2¼" x 1 3/16" overall—the same size case that was used for the Mini-50 receiver. Like the latter, the new 3-tuber has been used mainly on 50 mc., but the drawings show the coil to be used on 27¼ mc.

There is a sensitivity control, R2, but it is not critical, and is used mainly to compensate for different tubes at V1, for drops in battery voltage, different antenna lengths, etc. It does not have a sharp setting point, as with the sensitivity control of a single hard-tube receiver. This receiver is nowhere near as sensitive to antenna loading as a single hard-tuber, but does like *light* antenna loading—hence the very small antenna coupling condenser. It can be tuned up near





a transmitter; after you have made preliminary distance checks to satisfy yourself that everything is working right, you will seldom have to make a distance check again; if the set works properly 50 ft. from the transmitter, it will work right at a distance. Tuning is extremely sharp, and again we emphasize that it is quite satisfactory to tune up only 50 ft. from your transmitter, regardless of power used.

As shown here, the set was intended to mount on one end against a bulkhead; therefore the controls are all brought to the other end of the chassis. With the case bottom against 1" of sponge rubber, the latter being against the forward cabin bulkhead, and strips of rubber at bottom and sides, you have a practically crashproof mounting. A single moderately-tight rubber band holds the receiver in its "nest".

The receiver draws about 60 ma. A current on 1½ V., and the total idling B drain is .4 ma. With signal this goes up to about 1.4 ma., when using an 8000 ohm relay. It will work down to about 1.25 V. on the filaments, on 50 mc., and even lower on 27¼, while the B voltage may drop to 40 or so; depending upon the relay and setting you use. V3 idles at .2 ma., and we set the relay to operate at .8 ma. and release at .6 ma.

Though no special parts have been used you will have to employ the smallest ones possible in order to duplicate the receiver shown, so stick closely to the parts list. It's entirely likely that the various radio control suppliers will handle all the parts needed. And don't tackle this rig with a 100 watt soldering iron! What you'll need is a "pencil" iron with a tip ⅛" diameter. Also, 1/32" dia. rosin-core solder is a great help on such a job. Since parts placement is rather critical—from the standpoint of getting the set into the case shown—we have indicated the various eyelets on the chassis drawing, and have marked the circuit with little circles to show where eyelets go.

The sockets were fastened by simply pushing their lugs through the five holes and bending them outward a bit. Some of the West Coast builders put a spot of Walther's "Goo" under these sockets to hold them fast (get it at model R.R. shops). The UTC SSO-5 choke needs some modification to fit in the space available; all the core strips are removed, then four strips of core metal ⅛" wide by 1⅛" long are bent around the coil, one on each side. These strips will have to come from another audio transformer—the ones you take out are not long enough. Of course, the choke will work just as well with all the core left in place, and if you make the set a little larger, may be used just as it comes.

R2 is fastened to the chassis by a loop of wire which goes through the two holes shown and is soldered to the two threaded legs on the control; the knob is removed and a round head screw inserted—with a speck of cement on the threads—so that the control may be adjusted by screwdriver.

L1 is held onto the chassis by passing the two clip ends through eyelets, while C1 is soldered directly to L1 and to the antenna eyelet.

When wiring up, check and double check each part before you fasten it in place. It is not too hard to put the parts in and solder the leads, but it's a lot tougher to get them out again, if you make a mistake!

When all is ready for the first test, hook up about 1½ ft. of antenna, turn C1 to minimum capacity and R2 to about half resistance. With all tubes in place and a 5000 ohm relay, you should get a total receiver idling current of about .4 ma.; turn R2 for this current, then try the set with a weak signal. The relay might make a harsh hissing sound, when no signal is coming in, and the plate current will vary a bit—about .1 ma. at most, and preferably no more than .05 ma. If lower than this, increase the antenna condenser to make the set a little "hotter," then increase the resistance of R2 to bring the idling current back to .4 ma. If you hear a singing sound as a signal is tuned in and out, it is a sure sign that you have too much antenna coupling, or too long an antenna.

Like many hard tube receivers, this one is rather sensitive to RF noise in the model. Note the small condenser on the relay contacts; it is only needed on one side, the contact that is *closed with no signal*. Of course, the usual arc suppressors should also be used on the relay points that are utilized in your control system. When the receiver was first installed in a plane which had previously been flown with a single hard-tuber, the former noise suppression system—consisting of the usual series condensers and resistors across the relay points—was found to be insufficient. The plane was equipped with a "Mactuator," a unit that is very efficient but gives a heavy inductive kick when the relay points are opened. After trying various other suppression methods, the simple arrangement shown was adopted and cured the problem completely.

Note that the 1N91 diodes specified were the only ones of quite a few we tried that would do the job; also, that they are connected "backwards" with respect to the battery—no battery current flows through them. The diodes were placed right at the actuator connection lugs. A small condenser is still needed across the contacts of the relay that are closed with no signal; it may be as small as 100 mmf., and is simply an RF bypass.

For use on 27¼ mc., L1 should be wound as shown, C1 changed to at least a 1-7 mmf. trimmer, RFC raised to 200 microhenries, and C2 raised to 10 or 12 mmf. All other components may remain as indicated. The current change in V3 will be about the same as noted for 50 mc use, while V1 and V2 together will draw .2-.25 ma., as they do on 50 mc.

The receiver may be used for reed operation on either 27¼ or 50 mc. by making the changes appropriate to either band, and in addition, substituting a .001 mf. condenser at C6 and a single 2.2 meg. resistor for the three series resistors (R8, R9 and R10) at the grid of V3. Of course, the relay coil would be substituted for the relay shown in the plate circuit of V3. We would suggest that R2 be retained in a reed receiver, but once set it will seldom have to be changed.

It seems entirely possible that this basic receiver could be altered to operate on audio tone, along the lines of the WAG receiver described in the May 1954 issue of ATH; and as a final idea—the receiver could be used with the tuned-relay output stages of the Juenke-Bonner receiver from the May 1955 issue. All these arrangements would require a bit

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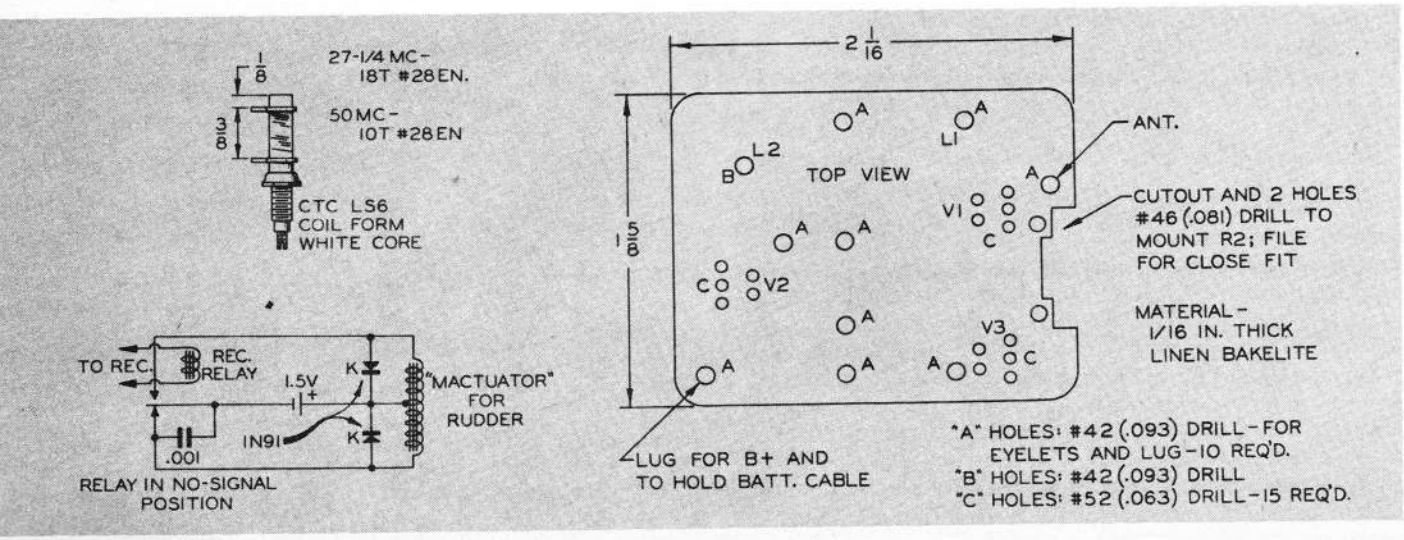

Mac-III "AES"

(*Continued from page 35*)

of experimenting—but then that's just what we intended for the receiver; it's an "advanced experimenter's special".

Parts Requirements for 50 *mc. receiver* (see text for substitute components needed for 27¼ mc.): L1, see Fig. 3. L2-UTC SSO5 choke with most of core removed. Relay-Sigma 26F, 8000 ohms. All tubes, Raytheon. Sockets, Cinch #5WC. RFC-10 microhenry, ESSCO. C1-Erie #535-OR7 trimmer, C2- CRL Type TCZ. C3, C6- RL type D6. C4, C5, C7- CRL type DM. C8-Barco type P75-1. R2- sub-miniature variable resistor-CRL B16-124. All other resistors, ½ W. carbon (⅓ or ¼ W. better, if available). Core metal for modified choke, L2 ESSCO. Plastic case-Bradley #684H.