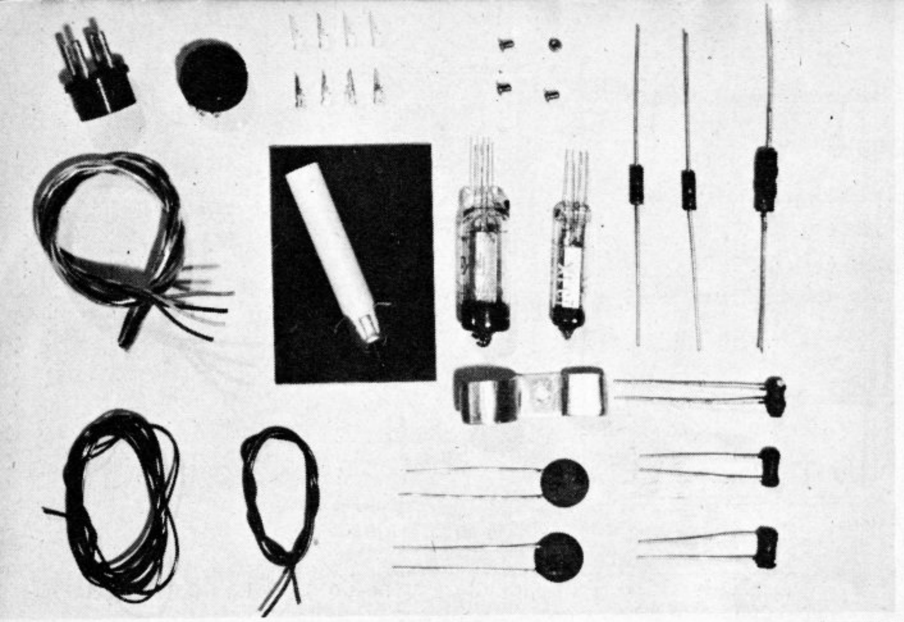


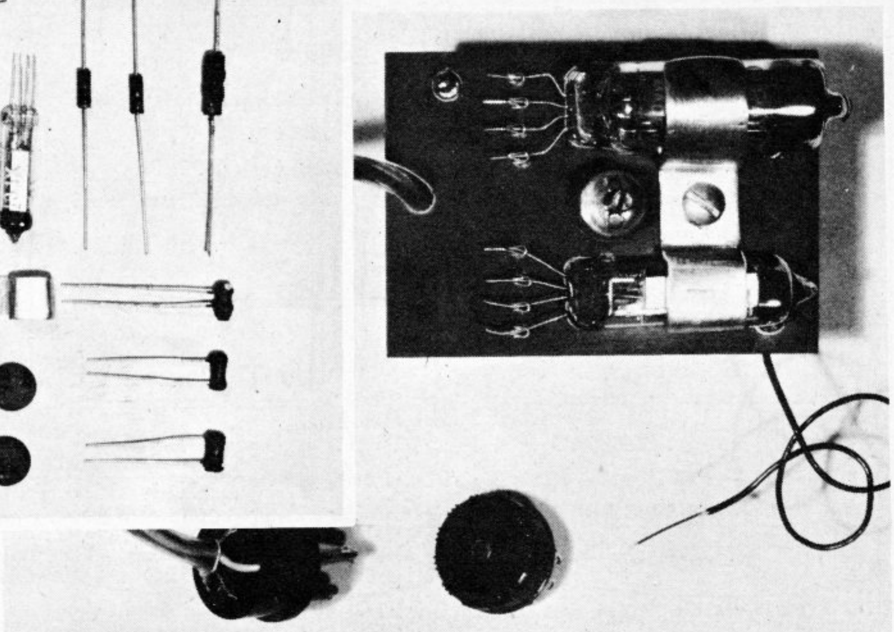


Figure 1 — These are parts, excepting relay which, in this installation, is shock mounted independently. Receiver is rigid, if so desired.

Figure 7, right—Finished receiver is not much longer than the two tiny gas tubes themselves.

The Lorenz Receiver

▼

by ED LORENZ

A two-tube design giving longer tube life, greater sensitivity, reliable relay action, no antenna trimming required.

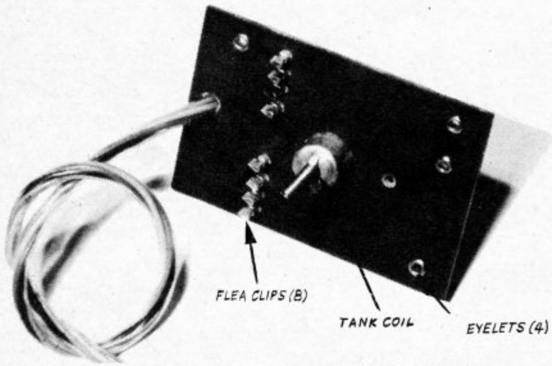


Figure 3—The flea clips permit easy installation and replacement of the tubes. It is unnecessary and most inadvisable to ever solder tube leads.

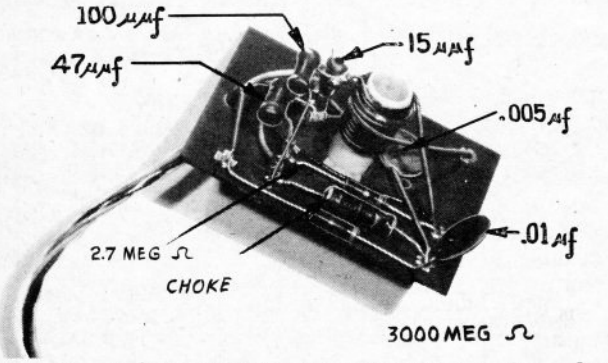
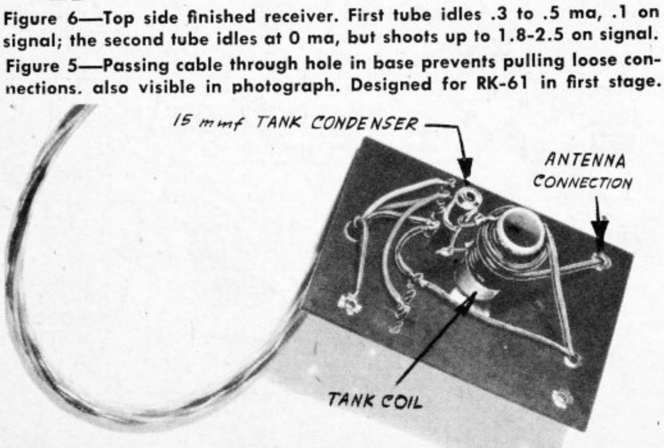


Figure 6—Top side finished receiver. First tube idles .3 to .5 ma, .1 on signal; the second tube idles at 0 ma, but shoots up to 1.8-2.5 on signal.

Figure 5—Passing cable through hole in base prevents pulling loose connections. also visible in photograph. Designed for RK-61 in first stage.



Editor's Note — This receiver was tested by MAN over a period of nine months, making many hundreds of flights. Its performance is oustanding. For 27.255 operation, it is a gas tuber which, with the hard tube Miller receiver presented last issue, completes the coverage of receivers for more experienced readers who ordinarily build up various receiver designs. All others are referred to Aerotrol, by Berkeley, on 27.255, and to MacNabb on 465 and 27.255. Imported equipment is handled by Polk's and American Telasco.

▶ The receiver described in this article is the result of the author's search for a reliable gas tube circuit. A relay operating in a positive manner rather than in the conventional negative way was desired. This means that the relay should close upon receipt of a signal, thus reducing the length of time the tube is conducting, and thereby prolonging its life and also the life of the "B" batteries. Since the life of the gas tubes used for radio control work (the RK-61 and XFG-1) depends on the amount of plate current being drawn, it was decided to reduce the plate current from the regular 1.5 ma to around .5 ma or less. In view of the fact that a low current like this would prove inadequate for relay operation, a relay tube, also called trigger tube, was added.

Basically, the operation follows this pattern: As in any super regenerative circuit there is an audible hiss which is heard when no incoming signal is present. Upon receipt of a signal,

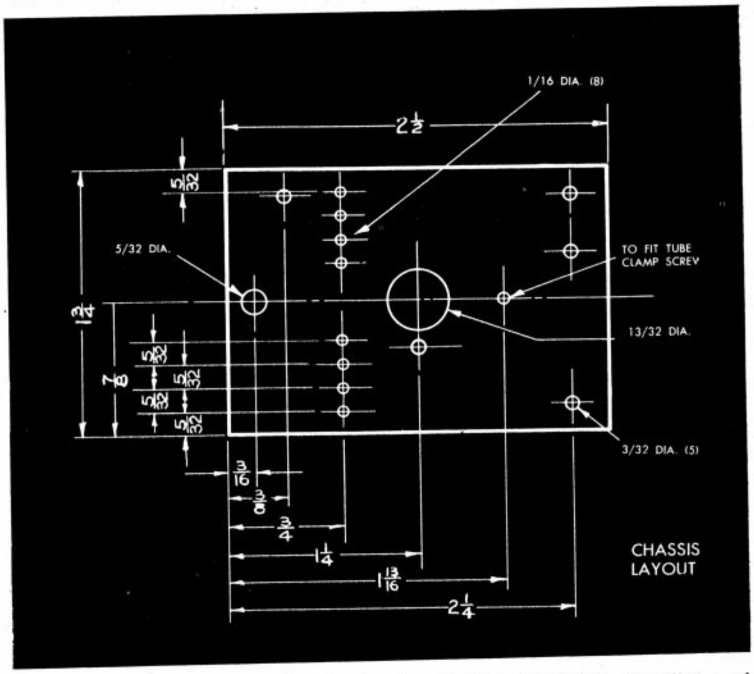


Figure 2—Fully dimensioned chassis, showing all holes for eyelets, flea clips, and tank. Due to low drain, smallest B batteries may be used. Combined idle very low.

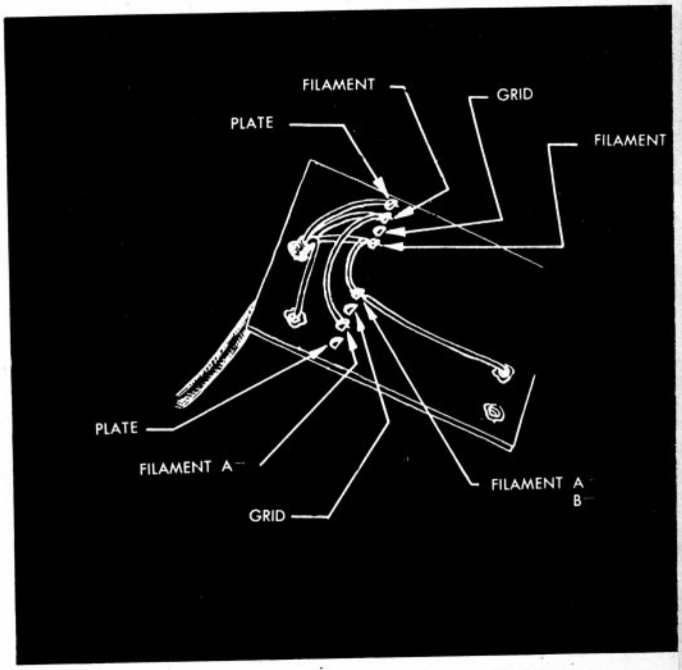
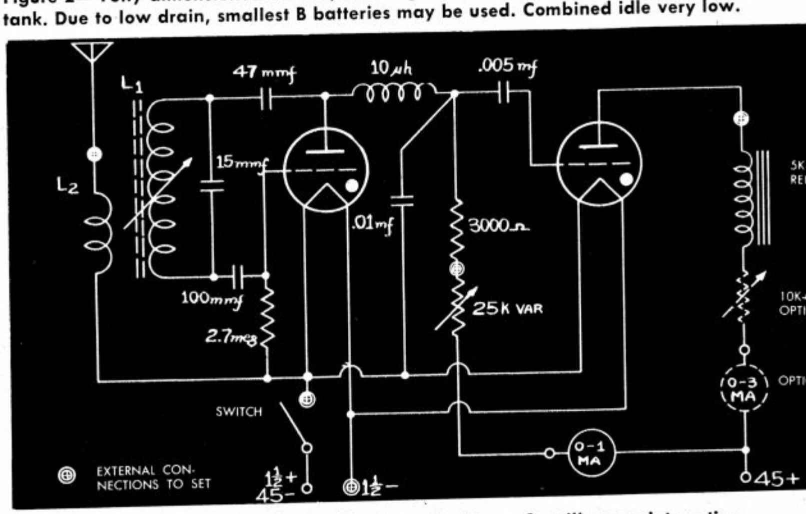
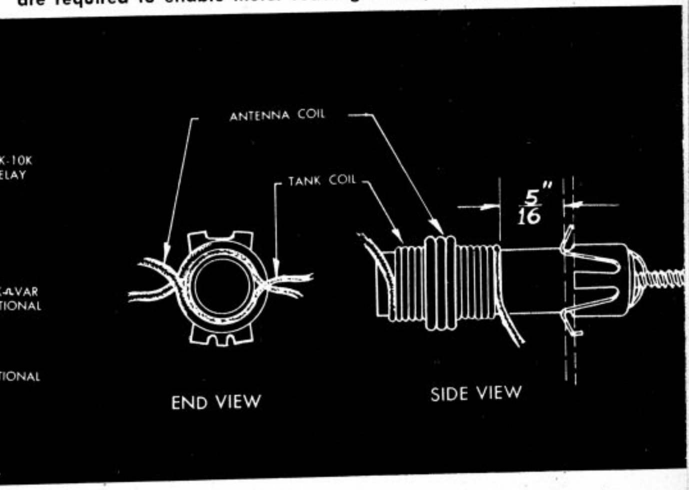


Figure 9—Compare the drawing with picture, Figure 5. Two jacks are required to enable meter readings. Relay closes with signal.





For those who understand radio itself, schematic, Figure 8, will prove interesting. The large amount of current change in the second tube makes for both a positive and reliable relay operation, and relative freedom from erratic flights due to the effects of vibration. Figure 4 is on the right.

this hiss disappears or greatly diminishes, and it is this characteristic that we have used in triggering the second or relay tube. The no-signal hiss in the first tube is fed to the grid of the second through the coupling condenser. This places a bias on the grid of the second tube which prevents the tube from conducting and passing current through the relay. Now, when the first tube receives a signal, the bias is removed from the second tube and the relay gets the full amount of current passed by the relay tube. In operation, the current on the two tubes is as follows: First Tube, no signal, .3 to .5 ma—signal, .1 ma; Second Tube, 0 ma, 1.8 to 2.5 ma. As can be seen, the gas tubes operate either at zero or very low plate current for the greater part of the time. This results in better battery economy since very little current is drawn when no signal is received. Primarily, however, gas tubes were chosen for the tube complement because of their overall efficiency and for the ease with which they enable the circuit to be built. The tank circuit has been designed to produce a hiss level of high amplitude and stability. The amplitude of the hiss level determines the amount of bias applied to the second tube. This amounts to an average of -4 to -6 volts, which is more than the -3 volts needed on the second tube.

This two-tube receiver has many advantages. First is the extra long life from the efficient gas tubes, as well as the low "B" battery drain gained by using them. Thus the smallest "B" hearing aid batteries are practical for this purpose. Another advantage is the positive action from the relay, which in this case, can be mounted separately as far as 200 feet away from the receiver. The receiver itself is extremely light in weight, has great sensitivity and selectivity. No antenna tuning is necessary.

You will find in constructing this unusual receiver that many methods of layout are possible. It is felt, however, that the one presented here is the simplest and most compact of all. It is suggested that the entire article be read through before construction is started and that the picture be studied in order to clarify the building of the set.

Figure 1 shows the necessary parts, all of which may be obtained in a "kit" type package from Control Research, P. O. Box 9, Hampton, Virginia; from Polk's Movie Craft Hobbies, 314 Fifth Ave., New York, N. Y. or elsewhere. The complete list is comprised of the following:

one 1/16" x 1-3/4" x 2-1/2" micarta; one RK-61 first tube; one RK-61 or XFG-1 second tube; one 3/8" coil form; eight flea clips; four 3/32" or 1/8" eyelets; one 25,000 ohm potentiometer; one 4-prong plug; one 10 micro-henry choke; one 2.7 megohm 1/2-watt resistor; one 3,000 ohm 1/2-watt resistor; one 15 uuf ceramic capacitor; one 47 uuf ceramic capacitor; one 100 uuf ceramic capacitor; one .005 uf ceramic capacitor; one .01 uf ceramic capacitor; (*Continued on page* 42)

The Lorenz Receiver

(Continued from page 25)

three feet #20 enameled wire; one foot 4-wire cable (four separate wires may be used; one 3/8″ wide strip of aluminum or brass for tube holder; one #4 self-tapping screw for tube holder (this item not pictured). Note that all condensers are of ceramic type, including bypass and coupling condensers, in order to prevent leakage.

Figure 2 is a full size layout of the base, which is made from 1/16″ micarta or similar material. Cut to size and drill as shown. Install eight flea clips for the two tubes and four eyelets as shown in Figure 3.

The tank coil, Figure 4, is constructed around a CTC 3/8″ coil form or around one of the special forms handled by Control Research. Winding is of #20 enameled wires and consists of 17 turns, started 5/16″ from top of form. Make certain wire is free from kinks and is perfectly straight. Pull wire tightly in winding to assure a tight, even coil, making sure that each turn is snugly against preceding one. Bend leads at each end as shown and cut to 1″. After checking to see that winding is located correctly on the form, cement in place, using clear finger nail polish or collodion (obtainable at drug stores). When dry, carefully scrape insulation from ends of wire and then wind antenna coupling coil around tuning coil, using either #20 enameled wire or some of the thin plastic insulated wire sold in radio shops. Solid wire is preferred. DO NOT CEMENT IN PLACE; this is done later in final adjustment. Solder the 15 uuf tubular ceramic across leads of tank coil. Mount coil form in the 13/32″ hole (Figure 3), pushing in until "ears" spring apart on top, thus preventing form from pulling out. The condenser should face the flea clips' end of the chassis.

The cable, or individual wires, are inserted in the 5/32″ diameter hole and after ends have been stripped 1/8″, they are connected as shown in Figure 5 and 9. Note that outside clips are used for plate connections for each tube. Next, the 10 microhenry choke is placed in position pictured in Figure 6, between plate clip and one eyelet. Do not solder eyelet end at this time. Do solder the 47 uuf tubular ceramic between plate clip (one end of 10 uh choke) and lead of tank coil nearest chassis. Place the 2.7 megohm resistor in place between grid clip of first tube and second eyelet at opposite end of chassis. Again, do not solder eyelet end. Solder the 100 uuf tubular ceramic in place between grid clip and bottom end of tank coil. Figure 6 shows these connections. Run a short piece of insulated wire from eyelet at the end of the 2.7 megohm grid resistor to junction of the inside flea clips. Following on with Figure 6, place the .01 bypass condenser between the two eyelets. Before soldering these eyelets, place the 3000 ohm resistor between outside eyelet and the one at other end of chassis. Now, solder these two eyelets. The antenna coil connections are inserted in their designated eyelets. The antenna lead closest to the chassis goes to eyelet at far side of chassis. Before soldering this connection, insert a 6″ length of stranded wire in the eyelet. This is the antenna connection from receiver to plane's antenna. The outside antenna coil lead is soldered to second eyelet at junction of the .01 condenser and the 2.7 megohm resistor.

The .005 uf coupling condenser is soldered at junction of the 3000 ohm resistor, choke, .01 condenser and the other end to grid connection of the second tube. This connection is the third flea clip from the outside, or second tube.

Strip wires from the other end of cable and solder into pins on four-prong plug. Be sure to label wires correctly so correct connections can be made at socket. Figure 9 shows flea clip and eyelet connections to cable.

This receiver has been designed to use the RK-61 tube in the first stage. Once the antenna coil has been positioned properly and frequency adjusted correctly, there are no variables throughout the life of the tube, other than an occasional check on the first stage plate current. This is done by varying the 25K potentiometer. Experimental models of this receiver were left on for extended periods of time with no readjustment except to see that the "A" battery did not fall below 1.2 volts. These time periods have exceeded 26, 40, and 52 hours on separate occasions, using the same tube for each of the three tests. All that was needed at the end of the 40 and 52 hour periods was a replacement of the 1-1/2 volt "A" battery, a Burgess TE cell.

Before making an installation of this receiver, it is suggested that it be connected as shown in Figure 8 for bench testing. It is preferred that an 0-1 ma meter be used for first stage testing although a *good* 0-3 ma meter may be used. Connect receiver as shown but do not connect the "B-plus" to the second stage. Be sure that the 25K potentiometer is turned to its full resistance. This will place 28,000 ohms resistance in the plate circuit of the first stage which should then draw from .2 to .5 ma. Attach a 20" length of wire to antenna lead and position antenna coil about one-third of the way up from grid end (the 100 uuf capacitor) of tank coil. Now tune receiver to 27.255 mc by varying the brass screw on the powdered iron slug. Upon hitting resonance, current will drop to .1 ma or less. In addition to using a meter, a pair of low resistance headphones, about 2000 ohms, placed in series with meter, is an excellent means of obtaining proper settings for optimum performance. A local "ham" or radio shop should be able to supply a set for initial testing. A loud, coarse hiss which is fairly stable and steady in strength indicates optimum operation for this receiver. Positioning antenna coil will bring about this position; at the same time, there will be a slight fluctuation of the meter needle, approximately .01 ma. If antenna coil is too near the plate end of the tank coil, maximum sensitivity may not be obtained. If it is too near the grid end, antenna will tend to overload the receiver and knock it out of oscillation. Vary the 25K potentiometer to obtain a reading of .4 to .5 ma. If your RK-61 is new, it may not fall to .5 ma even with full resistance in circuit. In this case, run plate current up to 1 ma and let the tube idle at this setting for about 20 minutes or so, checking occasionally to see whether .5 ma can be obtained. When the first stage is operating properly, connect the "B-plus" to the relay of the second stage. An 0-3 or 0-5 ma meter may be placed in series with the relay so that the change in plate current may be observed. This, however, is not needed in plane installation. When no signal is being received, the first tube will idle at .5 ma and the second stage will indicate a zero reading. If the second stage goes to 2 ma or more, it indicates either that the .005 coupling condenser is bad, or the first stage is too heavily loaded. To correct latter, move antenna coil toward plate end of tank coil a little bit. Upon receipt of a signal, the first stage will drop to .1 ma or less and second stage will rise from zero to 1.8 ma or more, depending on resistance of the relay. Since the second tube is conducting only while a signal is being sent, which is a very short time, it is best to allow full current of 1.8 to 2.5 ma to be drawn. However, if it is desired to keep current around 1.5 ma in order to prolong the life of the "B" battery and second tube, a 10K potentiometer may be placed in series with the relay and adjusted to obtain correct current.

By operating relay from 0 to 2 ma current, the spring tension on the armature and the contact spacing may be increased for additional vibration resistance. In connecting relay for this set, note that the normally open contact is used. This is opposite to standard use of the normally closed contact on regular receivers.

In making your installation, allow for a meter jack in the first stage and a switch to cut the A-plus, B-minus lead from the batteries. The receiver may be mounted solidly in the plane, but relay should be shock-mounted on a Lord mount, as described in the October, 1952 M.A.N. The relay should be shock-mounted preferably on firewall of the plane although it may be installed in a similar position elsewhere.

The installation in a plane, boat, or car will include the following: the socket for the cable plug, a 1-1/2 volt filament supply, the 45 volt plate supply, a relay, the 25K potentiometer, a closed circuit jack in the first stage plate lead for plugging in the 0-1 ma meter, and the desired actuator and power source. The batteries, receiver, and associated components may be mounted solidly, the relay being the only shock-mounted item. In a boat or race car, even the relay may be mounted solidly. Use standard wire for connections in the hookup. DO NOT USE ACID CORE SOLDER. Keep wiring neat.

This circuit has been built, in various physical layouts, by both experts and novices, and operation has been almost perfect in all cases.