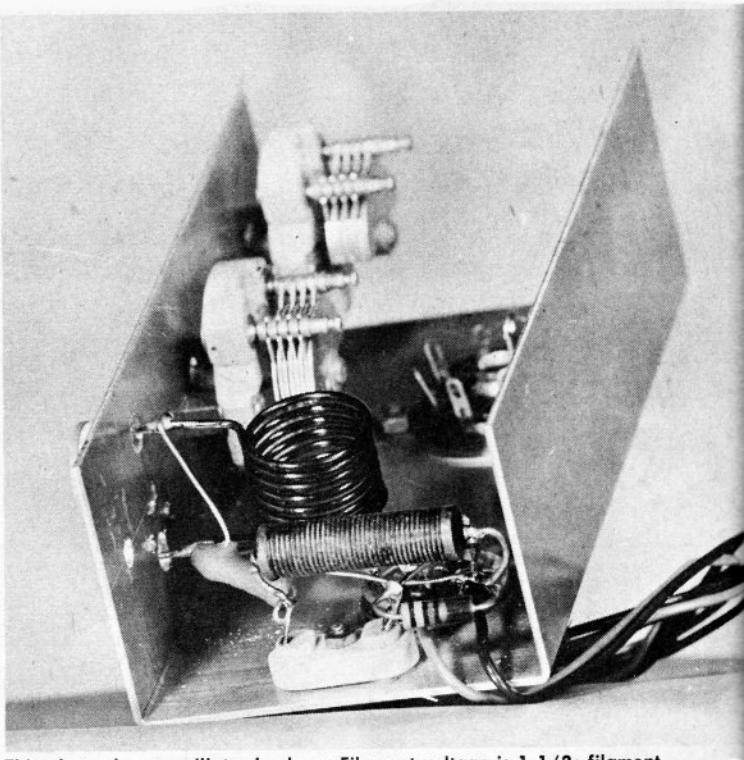
Mr. Lorenz with finished transmitter during one of its field trials. The transmitter is an MOPA type, or master-oscillator-power-amplifier.



This photo shows oscillator hook-up. Filament voltage is 1-1/2; filament current, 270 mils. Plate voltage is 90-180; current (total), 32-40 ma.

The Lorenz Transmitter

This is the transmitter you have been waiting for, a reliable unit incorporating many important features found desirable for airplane control. Designed for conversion to tone.

by E. J. LORENZ

▶ Here is a transmitter that we think you'll find very versatile. No, it isn't a five-watter because we don't need 5 watts of blasting power to work a mere thousand yards. And incidentally, we challenge anyone to do any really accurate controlling of a 50 in. model at that distance. In analyzing what we needed, we used not only the knowledge of our own experience, but that of many experienced RC fliers. The results were as follows:

1. A transmitter with an RF output of 1-1/2 watts is more than sufficient for any RC flight provided that the receiver and transmitter are tuned properly.

2. For maximum efficiency and all around performance, the transmitter should be of the MOPA, or master-oscillator-power-amplifier, type. This means a two-stage unit whereby the oscillator output is not coupled directly to the antenna, but rather goes through an amplifier.

3. For versatility, as when converting to tone control, a MOPA type is practically a must as far as good design practice is concerned.

4. The average oscillator/transmitter is detuned when objects touch or are in the vicinity of the antenna. With a MOPA unit, this effect is eliminated or greatly minimized.

5. Last, but not least—and read this well ye novices and experts alike—tests and consensus show and prove that 80 per cent or more of fly-aways or out-of-control flights could be avoided by proper tuning of the transmitter and receiver. Normal frequency tolerance of our 27.255 mc spot can extend from 27.230 to 27.280 mc. At close range, a transmitter tuned to 27.230 mc may actuate a receiver tuned to the other end of the band at 27.280 mc. All is well at close range, but this difference is the reason, very often, for lack of control at a distance of several hundred feet or more. As we've mentioned before, 1/2 watt of RF is sufficient for reliable control provided the tuning is correct. The only way to be sure is to put as much distance between the receiver and transmitter as possible when tuning; a minimum of 250 ft. usually is adequate.

Now how about taking a look at our unit, which may be converted for tone control (details in a later issue). Here are a few vital statistics on the unit before we go into construction details: filament voltage, 1-1/2 volts; filament current, 270 ma; plate voltage, 90 to 180 volts; plate current, 32-40 ma (total); RF output, 1-1/4—2 watts; very stable design through MOPA; Pi-network, to enable loading various length antennas.

Read the article and study the drawings and photographs well before beginning construction. Then begin by laying out the .040 in., half-hard aluminum chassis as in Fig. 1. A 1/16 in. soft aluminum chassis may also be used. The socket holes were punched in with Greenlee socket punches and your local "ham" friend possibly could help out here. After all holes have been drilled, bend edges *down* 90° at dotted lines. Holes marked "X" are for mounting to case and the dimensions are not critical. Mount crystal socket by a bolt or eyelet, being sure the center mounting hole will fit the fastener. Mount the 4-30 (*Continued on page 43*)

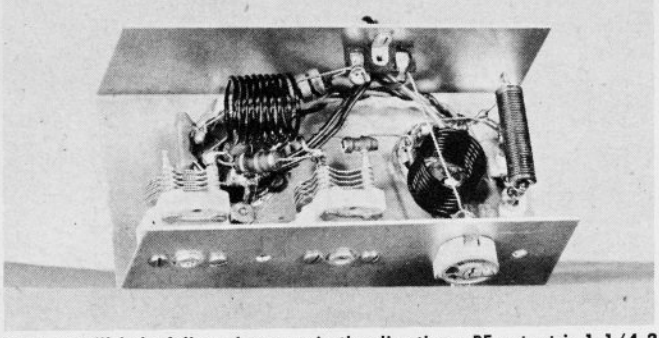
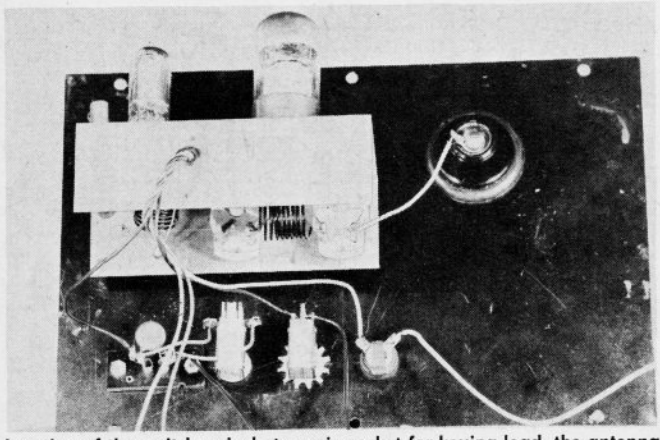
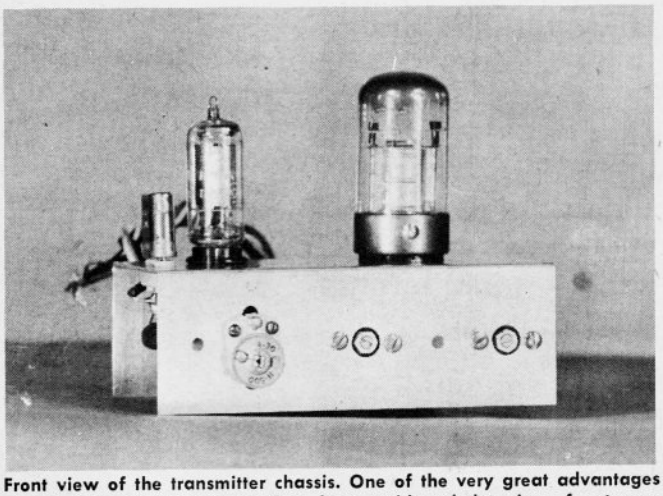


Photo B will help follow the steps in the directions. RF output is 1-1/4-2 watts, ample to fly any airplane with a decent receiver out of sight.

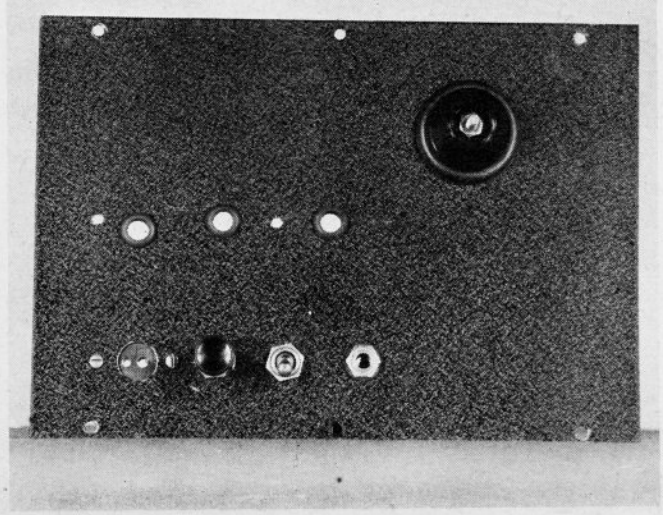


Location of the switches, jack, two-pin socket for keying lead, the antenna post, looking toward the top of the case. Oscillator is sure fire.



Front view of the transmitter chassis. One of the very great advantages of this type of circuit is freedom from accidental detuning of antenna.

Compare this photo of the top of the case with the second picture above. The tubes are a 3A4 and a 3D6. Also compare the picture with Figure 3.



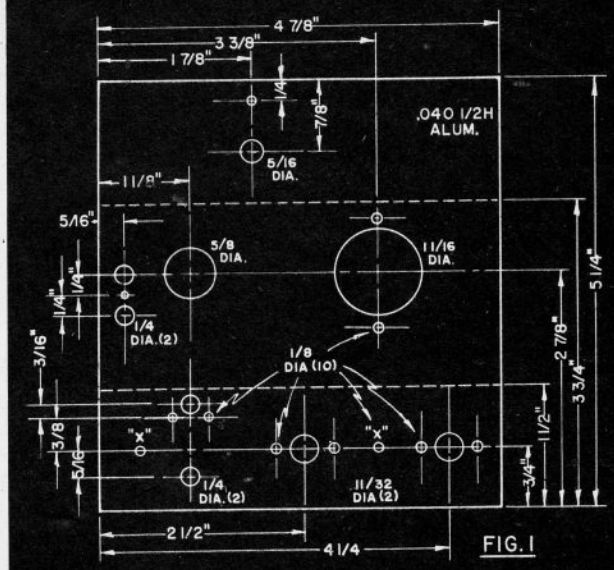
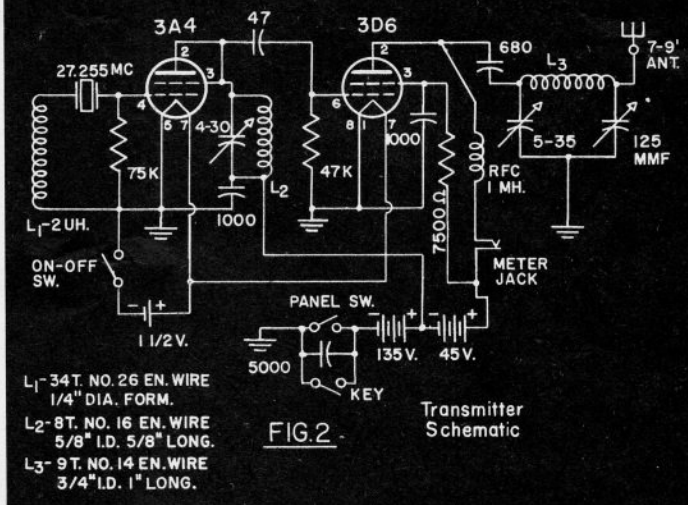


FIG. 1



L1- 3 4 T. NO. 26 EN. WIRE 1/4" DIA. FORM.
L2- 8 T. NO. 16 EN. WIRE 5/8" I.D. 5/8" LONG.
L3- 9 T. NO. 14 EN. WIRE 3/4" I.D. 1" LONG.

FIG. 2 Transmitter Schematic

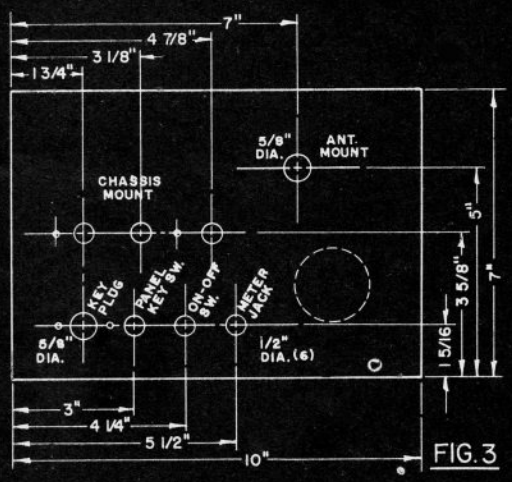


FIG. 3

The Lorenz Transmitter

(*Continued from page* 26)

ceramic variable, the 5-35 mmf air trimmer and the 125 mmf air trimmer.

With the type we used, the rotor is grounded to the mounting studs. Mount the seven-pin miniature socket so the pins 1-7 face toward the front of the chassis. We used the ring mount type; otherwise, two extra holes will be needed for the saddle mount type. Mount the Locktal socket so that pins 1-8 also face forward. Fasten a small solder lug on the front of the socket flange at pins 1-8. Mount the two lug terminal strip on the rear side and place a rubber grommet in the 5/16 in. hole. This completes the hardware on the chassis and now we are ready for placing in the components.

Filament and plate supply wires should be about 16 in. long and should be color coded for ease of hook-up later. Connect filaments first, using pin 7 on the oscillator socket (7-pin min.) and pin 7 of the Locktal amplifier as the A-plus lead. Pin 5 on the oscillator and pins 1-8 on the amplifier are the A-minus connections.

Bring separate leads out through the grommet, after attaching to the A-plus and A-minus connections. Photo A shows the hook-up of the oscillator. Wind the oscillator coil of No. 16 wire on a 5/8 in. diameter form and pull out to a 5/8 in. length. This is soldered to the lugs on the 4-30 variable. A short piece of wire is soldered between pins 2-3 on the socket and the lug on the variable, closest to the bend on the chassis. Another short piece of wire is soldered from the other end of the coil-capacitor lug to one of the lugs on the terminal strip. Photo B shows this. A 1,000 mmf tubular ceramic is soldered between pin 5 on the oscillator socket to the end of the coil nearest the open side of the chassis. The 2 microhenry choke is soldered between one side of the crystal

socket and pin 5. From the other side of the crystal socket, a short wire goes to pin 4 of the socket. The 75K resistor also goes from this side of the crystal socket to pin 5 of the tube socket. Connect a wire to the terminal lug, where the tank wire connection is made, and bring it out through the grommet. This completes the oscillator section.

In order to reduce testing and "debugging" time, we'll now test the oscillator. With the 3A4 tube and crystal in place, connect the filaments, making sure the wire from pin 5 goes to A-minus and the wire from pin 7 goes to A-plus. Using 90 volts for the plate supply, run a wire from A-minus to B-minus and connect a 0-50 ma DC meter between B-plus and the lead coming from the terminal strip. Now, slowly rotate the tuning capacitor until a dip in current is noted. This should drop to about 7-8 ma. Increasing the capacity will cause a further drop until a point is reached where the current will suddenly shoot up again. At this point, back off until the capacity is reduced enough to obtain a reading of 7-8 ma. If a drop cannot be had, check the wiring and possibly the tube and crystal. This oscillator circuit is a sure fire thing and, when properly wired, will not fail to oscillate.

Now we're ready for the amplifier. Solder a 1 millihenry choke between pin 2 of the amplifier socket and the other lug on the terminal strip. The 680 mmf tubular capacitor is soldered between pin 2 and the stator, or stationary, lug of the main 5-35 tuning capacitor (Photo B). The 47K grid resistor is soldered between pins 1-8 and the ground lug, and pin 6 of the socket. The 47 mmf coupling capacitor is soldered between pin 6 of the amplifier socket and pins 2-3 of the oscillator socket. A 7,500 ohm screen dropping resistor is soldered between pin 3 of the amplifier socket and the same lug on the terminal strip to which the choke is connected. The screen bypass (1,000 mmf) capacitor is soldered between pin 3 and pins 1-8 and the ground lug. Another wire is brought through the grommet to this same ground lug. This is the B-minus lead. The tank coil is wound as follows and is soldered between the stator lugs of the 5-35 and the 125 mmf trimmer. Wind nine turns of No. 14 enameled wire on 3/4 in. form and then stretch to 1 in. length.

To test, insert the 3A4 and the 3D6 tube and the crystal and connect the filaments as before. Check the oscillator to be sure it is functioning; in fact, reduce the capacity setting a little more. Set the amplifier tuning capacitor (5-35 mmf) to minimum and ground the antenna lead side of the 125 mmf capacitor to the chassis with a short piece of wire. Now apply 135 volts to the amplifier. The current reading on the amplifier will be about 20-25 ma. Rotate the tuning capacitor until a dip is obtained. This dip indicates that the oscillator is feeding a signal to the amplifier and that the amplifier is then tuned to resonance. A No. 47 or No. 48 brown bead flashlight bulb connected to a two-turn, 3/4 in. diameter loop of insulated wire makes a good indicator of RF power when held near the end of the tank coil. It may also be inserted between several turns near the end of the coil. If a dip does not occur, reduce the capacity setting on the oscillator capacitor and retune the amplifier. When the minimum dip is obtained, the oscillator setting should be increased further to increase the amplifier dip.

Drill the cover of the box as shown in Fig. 3 and mount the switches, jacks, etc., as shown in Photo D. Use insulated washers when mounting the meter jack. The dotted circle on Fig. 3 shows a suggested placement if permanent mounting of a 0-50 ma DC meter is desired. The transmitter chassis is mounted away from the cover by two 1/2

in. brass or fiber spacers. Be sure the mounting holes on the cover and the holes on the chassis marked "X" line up. Rubber grommets are placed in the 1/2 in. holes used for tuning. Then you are ready for final tuning.

After connecting the batteries to the proper leads (use 90 volts on the oscillator and 135 volts on the amplifier), place transmitter assembly in the box and attach the antenna, which should be 8-9 ft. long. With the 0-50 ma DC meter in place, turn the filament switch on and depress the keying button. The amplifier current should read about 20 ma. If the reading is in excess of 30 ma, it means the oscillator is not operating properly, in which case retune the oscillator as previously described. Bringing the oscillator into resonance will drop the amplifier current to a lower value. To obtain the best results in loading the antenna, using the Pi-network, a field strength meter is highly desirable. With the amplifier current tuned to minimum, increase the capacity of the 125 mmf antenna tuning capacitor until the field strength meter reads maximum. Adjustment of the 5-35 main tuning capacitor may be necessary as the loading on the antenna is varied. Set the FSM about 35-40 ft. away and tune the transmitter for maximum deflection of the FSM needle. A ham friend should be of some assistance to you in building and tuning this unit. Once tuned, it will hold its adjustments, and while it is not necessarily the most powerful, it is stable, and best of all, it can be readily converted for audio tone work at a later time.

Following is a parts list for this transmitter. The parts may be obtained from various suppliers of model RC components and your local radio supply house. Do not use surplus parts and stick to the types and values as given:

Lorenz Transmitter—Parts List

1 3A4 tube (RCA)
1 3D6 tube (Sylvania)
1 seven-pin miniature socket, saddle or ring mount (Amphenol 78-7P)
1 Loktal socket (Amphenol 78-S8L)
1 27.255 mc crystal (Petersen)
1 crystal socket (Johnson 126-105)
1 National 2 microhenry choke (or form and wire to wind same)
1 4-30 mmf ceramic variable capacitor (two eyelets or bolts)
1 5-35 mmf air trimmers (four mounting screws)
1 125 mmf air trimmer (four mounting screws for this and 5-35)
1 7 x 8 x 10 case or suitable equivalent (ICA 3802)
1 8-9 ft. antenna
1 closed circuit jack and insulating washers (ICA 1871)
1 push button switch (ICA 1282)
1 on-off switch (ICA 1296)
1 keying cable plug-socket (Cinch)
1 75K 1/2-watt resistor (IRC)
1 47K 1/2-watt resistor (IRC)
1 7,500-ohm, 1/2-watt resistor (IRC)
1 1-millihenry RFC choke
1 47 mmf tubular ceramic capacitor (Centralab)
1 680 mmf tubular ceramic capacitor (Centralab)
2 1,000 mmf (.001 mf) tubular ceramic capacitors (Centralab)
1 5,000 mmf (.005 mf) tubular ceramic capacitors (Centralab)
2 ft. No. 16 enameled copper wire
2-1/2 ft. No. 14 enameled copper wire
1 antenna mount to fit antenna used
1 four-lug terminal strip
1 No. 6 dry cell OR RCA-type VS-004 battery
3 or 4 RCA VS-013 45-volt batteries
Hardware as needed: two 1/2-in. spacers, two 3/4-in. No. 6 bolts, eyelets, etc. END