A 2-Meter Grounded-Grid Preamp

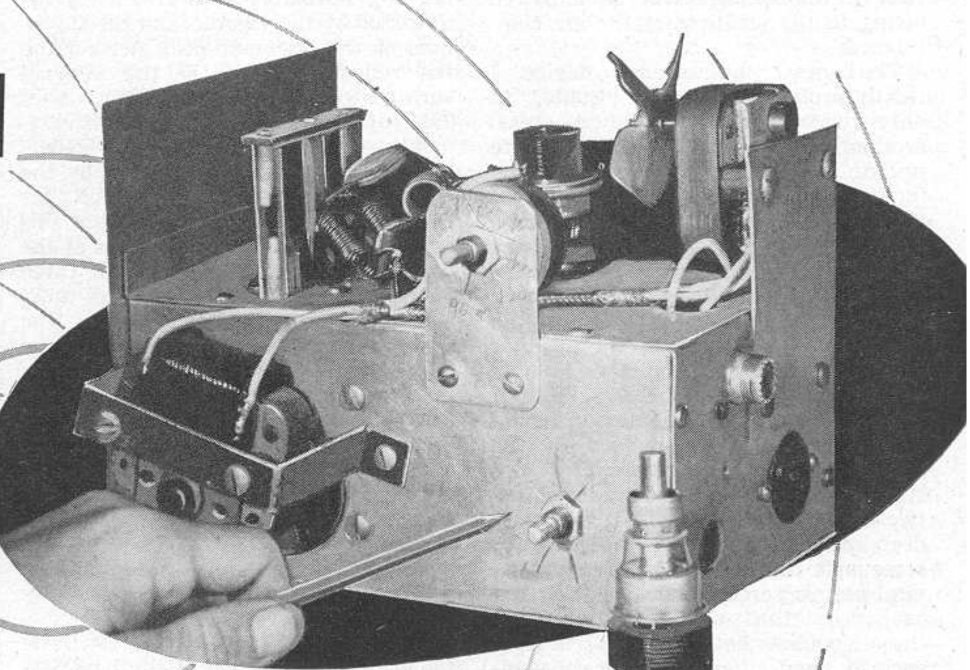

Fig. 1. Over-all view of the two-meter, grounded grid preamp. The chassis measures just 8x5½x3½ inches in all.

By

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Construction details on a broadband, air-cooled unit which uses two 2C39A surplus tubes for stable two-meter operation.

THE device to be described in this article is not meant to be the ultimate in 2 meter r.f. stages by any means, but if you like to tinker and experiment, here's something to sink your soldering iron into. Just think, it might make a good bookend to hold up those old radio magazines, too.

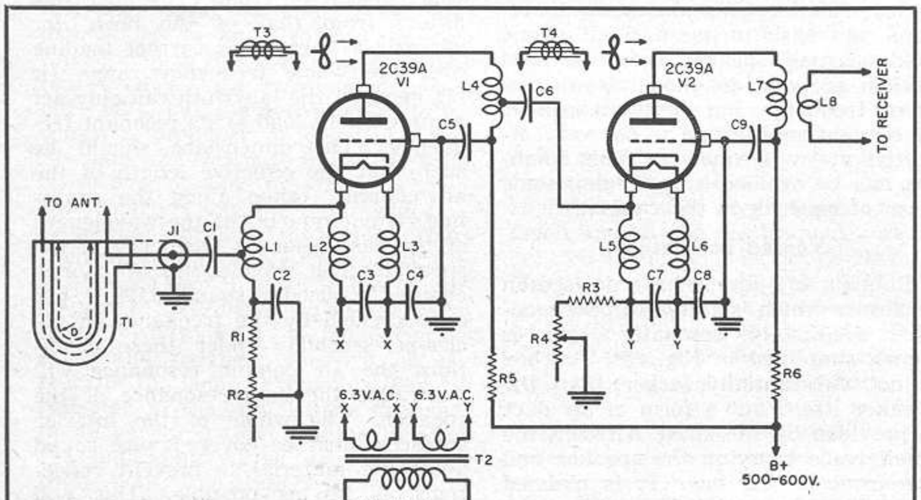
With everyone bringing out his pet circuits of cascodes and cascades, here's another to add to the long list; the author's entry is a broadband grounded-grid r.f. stage, air cooled, which uses transmitting tubes in a receiving circuit.

Before getting into the soldering iron and screwdriver department, a brief explanation of this air-cooled monster is in order. The tube chosen was the 2C39A because it offers some intriguing features. Now don't do a back-flip out of your chair; it's true these tubes are expensive new but there are surplus tubes on the market from many sources.

The interesting features of this tube might help you forget its price. Consulting a manufacturer's data sheet for the 2C39A or a radio handbook you will see that the average *mu* is 100 and the transconductance is around 22,000 μmhos. This is a good point in anybody's book. Under actual test conditions the transconductance runs as high as 25,000 to 30,000 μmhos in some cases. The tube is a "natural" for grounded-grid service because of its unique construction. Some of you 420 mc. operators might keep in mind that the 2C39A is ideally suited for use on that band, at low voltage applications, for receiver front ends.

Another startling feature is the power supply. If you have access to one of your local power company substations, you're all set. Not being able to arrange such facilities, the author used the old-fashioned method the power company supplies and my old GF-11 power supply which gave me about 600 volts d.c. In operation each tube pulls 35 to 90 ma., depending on where you set the variable cathode resistors. Consulting the data sheet again you will see that the 2C39A develops its high transconductance at a plate voltage of 600 volts d.c and 70 ma. and that the tube must be air cooled. If you can sneak the rig into the family refrigerator, you might accomplish something. You could try confiscating the family vacuum cleaner for cooling but that is probably out, unless you only want to clean up the

Fig. 2. Complete schematic of preamp. The coils are hand wound. Refer to article.



R_1, R_3—40 ohm, 1 w. res.
R_2, R_4—75 ohm, 25 w. pot (Ohmite Model H)
R_5, R_6—20 ohm, 1 w. res.
C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8, C_9—.003 μfd., 600 v. mica capacitor
L_1—4 t. #12 en., ½" i.d., ⅞" long, tapped 2½ t. from ground end
L_2, L_3, L_5, L_6—16 t. #16 en., closewound, 5/16" i. d.
L_4—6 t. #12 en., ½" i.d., 1¼" long, tapped 1½ t. from ground end
L_7—6 t. #12 en., ½" i.d., 1½" long
L_8—3 t. #14 bare copper wire with plastic insulation
J1—Male and female coax connector
T_1—Balun trans. 4:1 ratio (D (length in ft.) = 492/f (mc.) × .66)
T_2—Fil. trans., 6.3 v. @ 1 amp., 6.3 v. @ 1 amp. (Single sec. 6.3 v. @ 2 amps. can be used)
T_3, T_4—Small 117 v. a.c. fan (Barcol Motors Model DYAB)
V_1, V_2—2C39A tube

ham shack floor. The author finally settled for two small 117 volt a.c. fans, which can be purchased at most local radio houses.

A few of you are probably shaking your head and muttering: "Why spend all that money on tubes and look at the power requirements." Yes, it's true it pulls enough current to run a good sized transmitter on 2 meters but most ham shacks usually have one or two universal power supplies that can be used and if you inquire at enough surplus houses a pair of tubes can be bought fairly cheap.

Now that all the readers have been scared off, let's continue. The unit described here is presented without any fancy claims of signal-to-noise ratio, db gain, or umteen pages of mathematics. The circuit is a basic grounded-grid adapted for use with the 2C39A. Each tube is very effectively shielded from the other by operating one tube upside down and by a shield between the two tubes. The tubes are highly stable in operation and there is no sign of oscillation with either tight or loose coupling.

The entire r.f. stage was constructed and tuned to the middle of the 2-meter band with only a grid dip meter and no adjustments were found necessary when the unit was put into operation. If no grid dip meter is available, very little adjustment will be needed if the circuit of Fig. 2 is followed.

You will notice that there are no means for tuning either tube. The preamp was made broadband so that it wouldn't be necessary to twiddle dials all night on those weak ones.

For those who like the feel of at least being able to control this monster, two variable cathode potentiometers were provided to adjust the plate current and the gain on weak signals.

The balun transformer shown in Fig. 2 (T_1) should be used for best results when using a balanced feedline; otherwise, a loss in gain will result. The tap on L_1, shown in Fig. 2, indicates that C_1 is connected at 2½ turns from the cold end. A slight reduction in gain will be noticed on an "S" meter if the tap is moved back 1 turn. The tap on L_4 offered the same results when C_6 was moved 1 turn. The coupling of L_7 and L_8 should be as

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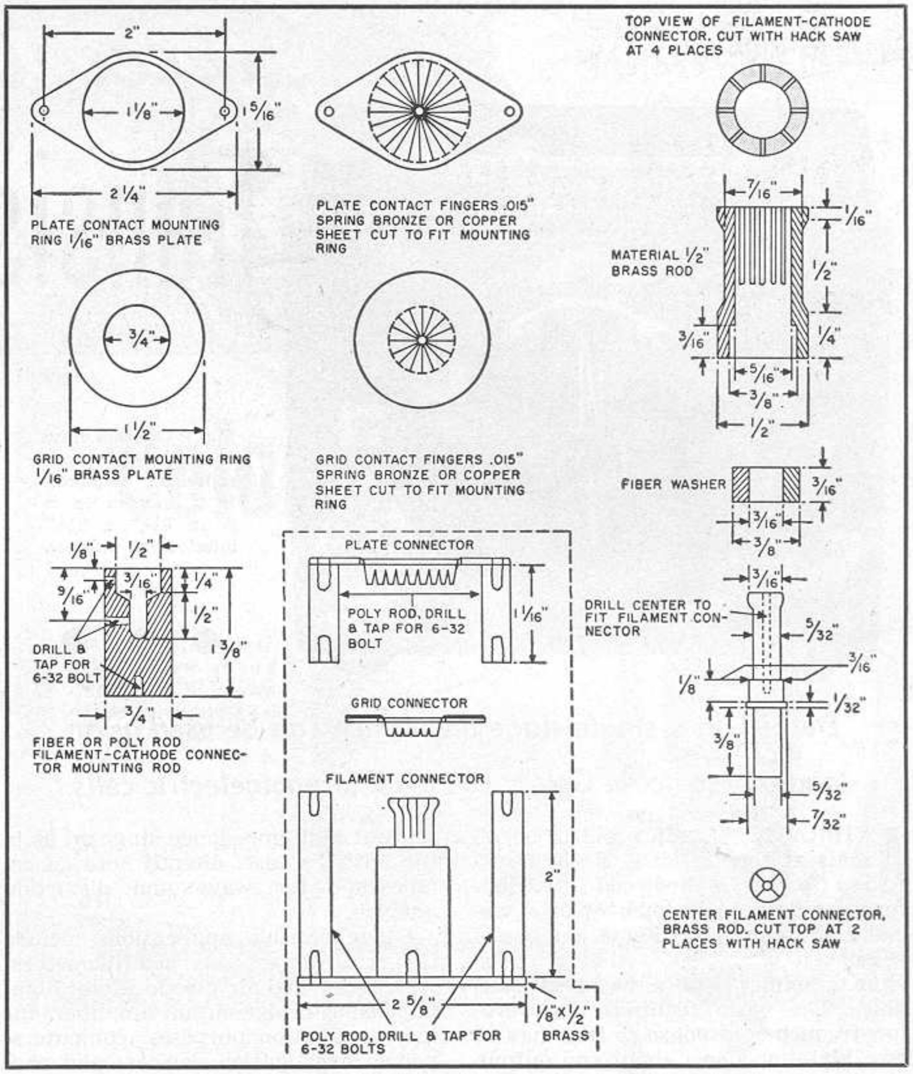
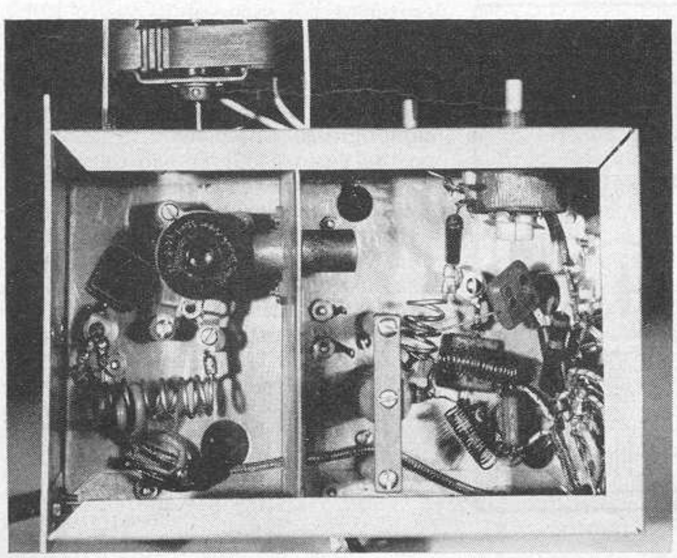
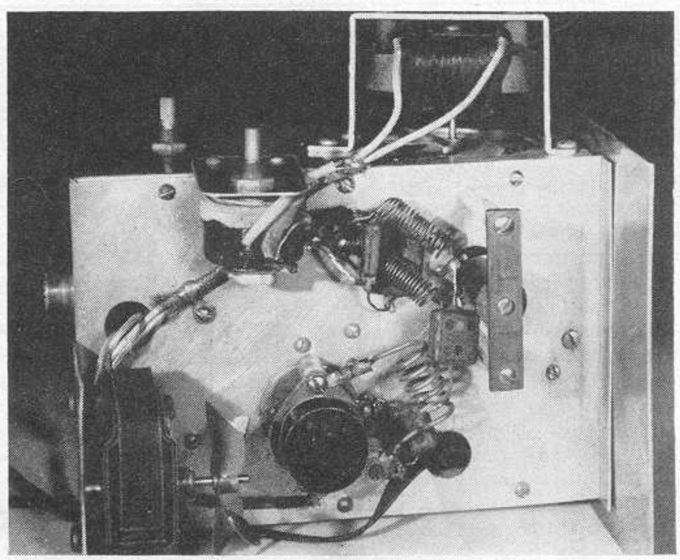


Fig. 3. Mechanical details of the tube mounting and contact fingers.

Fig. 4. (Left). Bottom view of the preamplifier showing V_2 on the left. L_7 and L_8 are shown at the bottom left. The shield separating V_1 and V_2 shows a section of copper tubing protruding through the shield. This was added after the unit was built and is used with a high-pressure blower. L_1 and C_1 are visible at right of shield. The coaxial connector is input from the antenna.

Fig. 5. (Right). Top view showing L_4 connected to the plate contact ring of V_1. The r.f. chokes, L_5 and L_6, are shown at the top right of the photograph with R_3 and R_4 to the left of the r.f. chokes. The twin-lead is the output to the receiver.





Two-Meter Preamp

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tight as possible for maximum signal transfer. This is one of the critical points; if you don't get the signal out of the last stage the fans are just blowing hot air around the shack.

The r.f. chokes are self-supporting $\lambda/4$ chokes. If desired they can be bifilar wound, as long as the insulation of the wires is adequate. Each tube is connected to a separate filament winding, only because two windings were available with the power supply; otherwise, one winding will be sufficient. R_5 and R_6 were put in to help isolate the "B+" lines. The filament lines, "B+" lines, and 117 volt a.c. lines for the fans are all shielded. Possibly, complete shielding would not be necessary, but after the barn door is closed you can't put the hay in, or is that the way it goes?

The construction of the metal contact fingers for the plate and grid is a very simple task (see Fig. 3). A round disc of beryllium copper, spring bronze, or any stiff thin metal, other than steel or high resistance metal, can be used. First, cut out the discs to size and then drill a small pilot hole in the center of each disc. If an old pair of scissors is available it will make it easier to cut the small slits in the metal. Cut the slits back only far enough so that when they are bent down the whole ring will fit snugly over the contact surface of the tube. Solder the contact fingers to the mounting ring, being careful not to allow the solder to run in between the fingers and stiffen them. The next step is to trim the bottom of the fingers off for neatness. If you happen to have a silver plating bath around the house you're all set; if not, just clean the metal fingers of any grease or oxidation that would prevent good contact to the tube.

The filament-cathode contact fingers are a little more difficult but having access to a set it made it easier on my part. Looking at Fig. 3 you will notice that both the outer and inner contact fingers were machined from brass tubing and brass rods. A little ingenuity on the part of the builder can bypass this problem if you can't get to a metal lathe. Somewhere around the ham shack you can usually find some thin wall copper or brass tubing that will be a near fit over the outer cathode surface. Place the tubing in a vise and cut some even slots with a small jeweler's saw; then form the fingers so they make a snug contact to the tube. A similar arrangement can be made for the inner filament contact by using a brass or copper rod. If no source is available for the plate, grid, or filament connections, the wires can be soldered directly to the tube.

The photographs show the mechanical details of the preamp chassis. The complete preamp is built on a 8" x 5½" x 3½″ aluminum chassis. The top deck is a removable 8″ x 5½″ sheet of aluminum just in case you drill in the wrong spot. Of course, these extra holes are always good for ventilation. The shield between the two tubes can be any convenient piece of aluminum or copper sheet. The wall and front panel are made from four separate pieces of aluminum bolted together.

The author's location is not the best in the world; it is almost at sea level and blocked in by high, thick foliage pine trees to the south. This made a difference of one to two "S" units on the weak ones in most cases.

In over a year of steady use on the 2-meter band, this preamp has made the difference between no signal and a readable signal many times. Besides that, it helped warm up the ham shack on cold nights.

A final reminder on prolonging the life of these tubes is to make sure that the cooling is adequate on the cooler and seals of the tubes. A quick check to see if the tube is running cool is to turn off the "B+" and remove the tube from the socket and hold it in your hand; if you don't have burned digits you're safe, otherwise, don't be surprised to see the solder melt out of the center of the cooler and the tube will gas up after using it for a week or so. —30—

A HINT FOR HAMS

By ROBERT J. MURRAY, W1FSN

SEVERAL instances have been uncovered where Novices and, in some cases, not-so-Novices have used a milliammeter that has a moving vane type of movement in the plate return circuit of a modulated amplifier.

Reports from other hams indicate that the carrier is quite strong but that modulation is practically non-existent, irrespective of the setting of the audio gain control. We have found that this particular type of movement acts as a very good audio choke and effectively keeps modulation from reaching the final.

It is recommended that the meter be shunted after tuning up or that the meter terminals be bypassed with a heavy paper capacitor of from 2 to 10 microfarads, as indicated in the diagram. —30—

Method for shunting or bypassing the test meter when it is of the moving vane type that will suppress modulation of signal.