

Henny
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W7KBE

CUSTOMIZED CABINETS AND CHASSIS

Dress up your homebrew with easily fabricated metal work.

Why are so few hams building electronic gear these days? To find out I conducted a survey among my ham friends, and three major reasons were apparent:

1. Lack of parts and the difficulty in finding the necessary materials at reasonable prices.
2. Choosing the wrong project. It may not be useful to your ham operation, or perhaps it's not within your capabilities or knowledge to successfully complete.
3. The challenge of metal work can be overwhelming.

THE PARTS PROBLEM

Inexpensive parts are readily available from many sources. Here are seven suggestions I have found to be good sources for parts:

1. Local radio clubs often conduct sales and auctions. Large, heavy World War II equipment (often called boat anchors) usually go at give away prices. Strip them down for usable parts and hardware. Keep all the screws, nuts, spacers, and small parts such as capacitors, resistors, etc. Your junk box will soon overflow with the necessary building materials.
2. Garage and silent-key sales. These events often yield worthwhile items. Look for wire, solder, tools, coax fittings, connectors, etc. If you don't have an immediate need for them, buy them and store them for later use.

3. Hamfests. Watch for the notices advertised in ham publications. Invariably the flea market is the main attraction. The variety of material is unbelievable. Where else can you buy a Weston meter for a buck? Test your bargaining skills -- it's fun.

4. Electronic surplus houses. These are scattered across the country, and they frequently advertise in the yellow pages of the local phone book. Better companies often publish catalogues.

5. Junk yards. Some of my best buys were made at junk yards where occasionally electronic material shows up almost as a byproduct and the seller doesn't know the value of this type of material. I recently purchased some excellent coaxial cable at ten cents a foot.

6. Ham friends. Some of your acquaintances may have a basement, garage or attic full of items collected in the heydays of World War II surplus sales.

7. On-the-air swap nets. This can be an excellent source of cheap parts. I have contacted many hams on the air to buy hard-to-get parts.

You must be flexible in your parts selection. Sensible substitutions come from experience.

SELECTING THE RIGHT PROJECT

Keep your first project simple. It's easy to get discouraged if your first attempt is too difficult. As you get one project finished, look for something more complicated to test your abilities. I started building items such as field strength meters, and then moved next to antenna tuners, and finally to a linear amplifier. Bear in mind that what you build should be useful for your ham operations. If you build it and use it, it will enhance your confidence.

PRELIMINARY DESIGN

The foundation of any electronic project is the panel, chassis and cabinet. To determine its size you must do your homework on circuitry design before gathering all the parts.

When you have all the parts you need, the next step is to decide on their proper placement. Look at the illustrations and photos in handbooks to see how the experts do it. Play chess with the parts -- juggle them into a configuration that meets the requirements of the project. For example, short R.F. leads are important. Keep the coils spaced from metal shields by a distance that is at least one half their diameter. R.F. switches have to be close to the coils for short leads. Allow plenty of space around high voltage components to avoid flashovers.

Bear in mind that at some future date you may have to repair your own project, so don't design in layers that will be hard to wire initially, or to repair and replace components later.

METAL FABRICATION

Most hams have a distaste for metal work because of their lack of the proper tools to perform the fabrication, or because of their lack of knowledge on how to use the tools. This situation is easily solved.

With your design and parts placement frozen, your cabinet and chassis dimensions are now determined. Start looking for sources of sheet aluminum. It's the only material easily worked and electrically excellent. My sources are salvage yards, surplus houses, and flea markets. Prices average a dollar and a quarter a pound. Buy 6061T-6 allow for panels or pieces which don't need bending. 1/8" thick material is necessary. It's very stiff and

machines cleanly. Choose a bendable material for the chassis and outer cabinet. You can test this material by bending a small corner with a pair of pliers. It should bend 90° without breaking or springing back. Use 1/16" thick aluminum for these parts.

When looking for sheet aluminum, remember that salvage yards buy and sell "drops". These are random sized pieces left over from a manufacturing process. Almost always you can find material near the correct size. Here's a word of caution: stay away from aluminum which has been exposed to the weather. It's hard to clean up water-stained aluminum.

TOOLS TO BE USED

Aluminum can be cut easily with common tools such as a hack saw, sabre saw, circular saw, hole saw and a fly cutter. The use of cutting lubricants such as kerosene or parafin is recommended. Ragged edges resulting from these tools should be cleaned up with a file. Meter holes are cut with a hole saw or fly cutter. Both tools are available at Sears. The fly cutter (to cut meter holes) must be used in a drill press. Clamp the panel to the table, cut it half way through, and then turn the panel over and finish the job. Fly cutters can be dangerous. Use with caution and plenty of lubricant. A drill press must be run at its lowest possible speed when using fly cutters or hole cutters. Greenlee hole punches are useful for making holes in the range of $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter.

Other items needed are aluminum angle, $\frac{1}{4}$ " threaded rod and nuts, 6-32 machine screws and nuts, and #6 drive screws. All these items are available in well-stocked hardware stores.

BENDING ALUMINUM

All chassis and cabinets require your aluminum to be bent, and admittedly, it's difficult to do with regular home tools. Fortunately most towns have a sheet metal shop. Take all your pieces that require bending to the sheet metal shop and get the whole job done at once. Try to catch the proprietor at a slack time and perhaps you can negotiate a favorable price. Let the sheet metal man figure the dimensions for your bends since he knows the allowances that have to be made for proper fitting. Sometimes you can avoid making bends by using angle aluminum.

THE FINISHED PRODUCT

Figure 1 shows the skeleton frame of an assembly designed to house a linear amplifier. Note the simple construction. The front and back panels are the same size, and held together with four $\frac{1}{4}$ " threaded rods. The meter shield has only one 90° bend. The side rails, chassis and outer shell covers each have only two bends. With the outer shell in place, all the necessary shielding is accomplished.

The openness of this chassis for easy assembly is apparent. When all the parts are in place, wiring is easy. Nothing is buried. Coils, switches, and capacitors are placed for efficient operation at radio frequencies. Figure 2 confirms that there is no layering of parts which will ease future repairs, changes, or parts replacement.

Figure 3 is a completed one kilowatt linear amplifier. The outer shell is held to the side rails with #6 sheet metal screws. The front of the cabinet shell protrudes beyond the front panel to give the cabinet a shadow box effect similar to many commercial cabinets.

If you find a commercial cabinet that fits your needs, this open frame construction can still be used. Figure 4 is an antenna tuner, used for 40, 80, and 160 meters. It is designed for open wire line. The sliding switch used here¹ and the coils are home made.² Needless to say it was easy to wire. The assembly shown in Figure 4 slides into a commercial cabinet.

FINISHING THE METAL WORK

When all the holes have been drilled, assemble the pieces to make sure everything goes together as planned. Now disassemble it and clean all surfaces with sandpaper (100 grit). Remove all the burrs and scrub down the metal using Ajax cleanser. Next you're ready for painting. I paint only the front panel and outer shell. Epoxy metal spray paint does a good job. Contrasting colors add to the appearance by making the panel one color and the outer shell another color.

THE FINAL TOUCH

Reassemble and wire in all components. You need to maintain excellent contact between parts and sheel metal. Don't skimp on the number of screws . R.F. grounds are very important.

I have built many of these cabinets for my own use as well as for friends. These designs evolved over a period of years while trying to simplify construction of homebrewed equipment. I consider the finished product very functional. Try it and be happy with a good looking, well done do-it-yourself project.

1 QST Oct, 1983 p. 18

2 Ham Radio, August, 1984 p. 37

Figure 4 This tuner was housed in a commercial cabinet which had a hinged top cover to allow ready access to the tapped coil. The meters display POWER and VSWR.

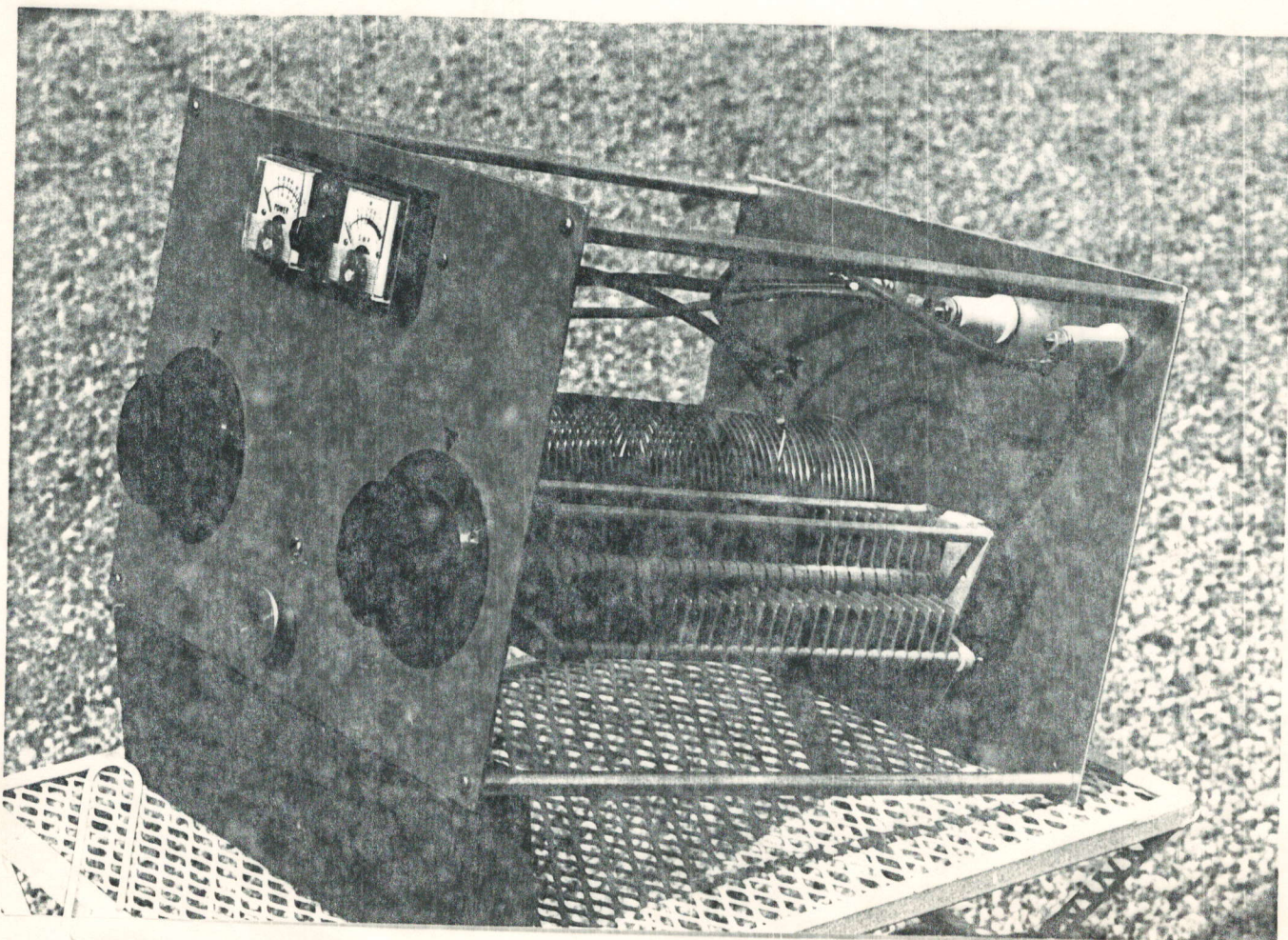


Figure 3 Here's the amplifier buttoned up and ready for action. Plenty of meters are available to monitor all circuitry. A symmetrical layout of the front panel adds to the appearance. Notice the use of surplus dial counters and meters.

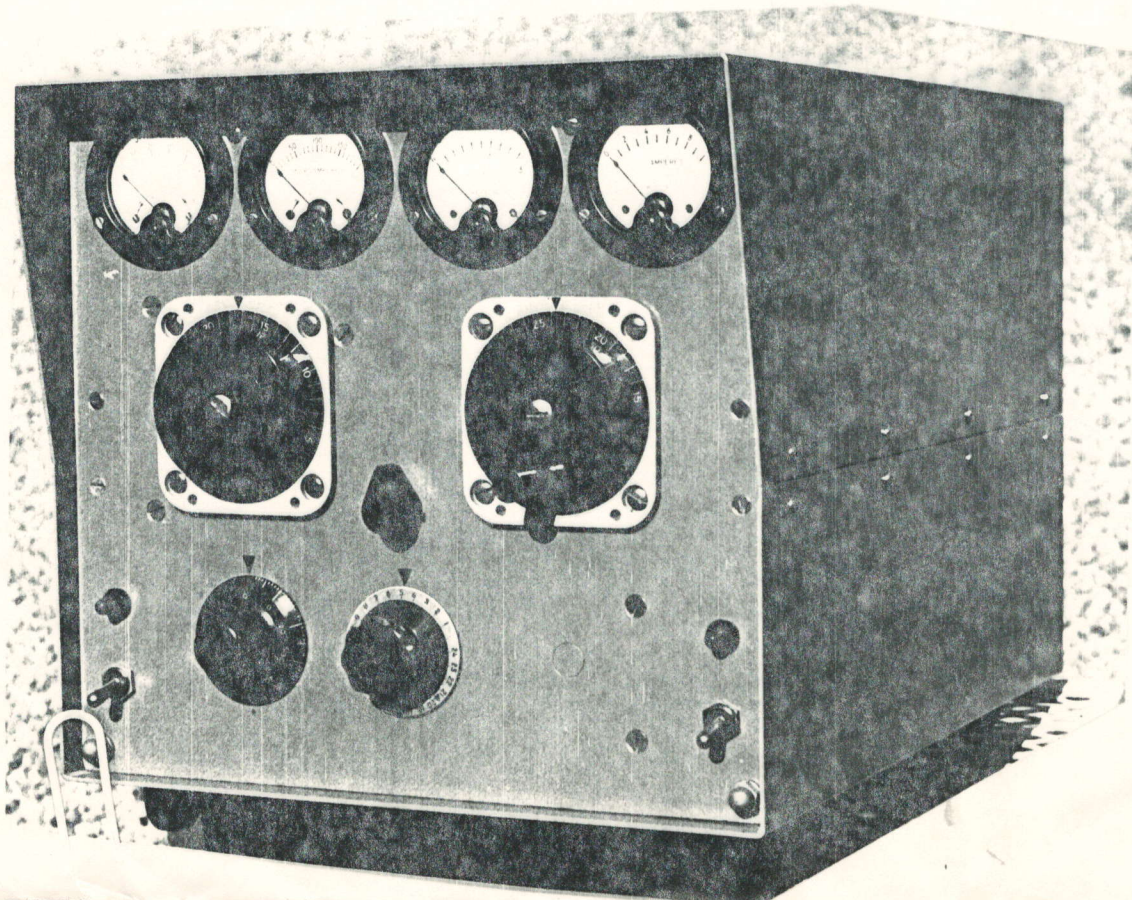


Figure 2 The wiring has been completed and tested on this amplifier that covers all the bands using two roller inductors and a variable vacuum capacitor in a Pi L network.

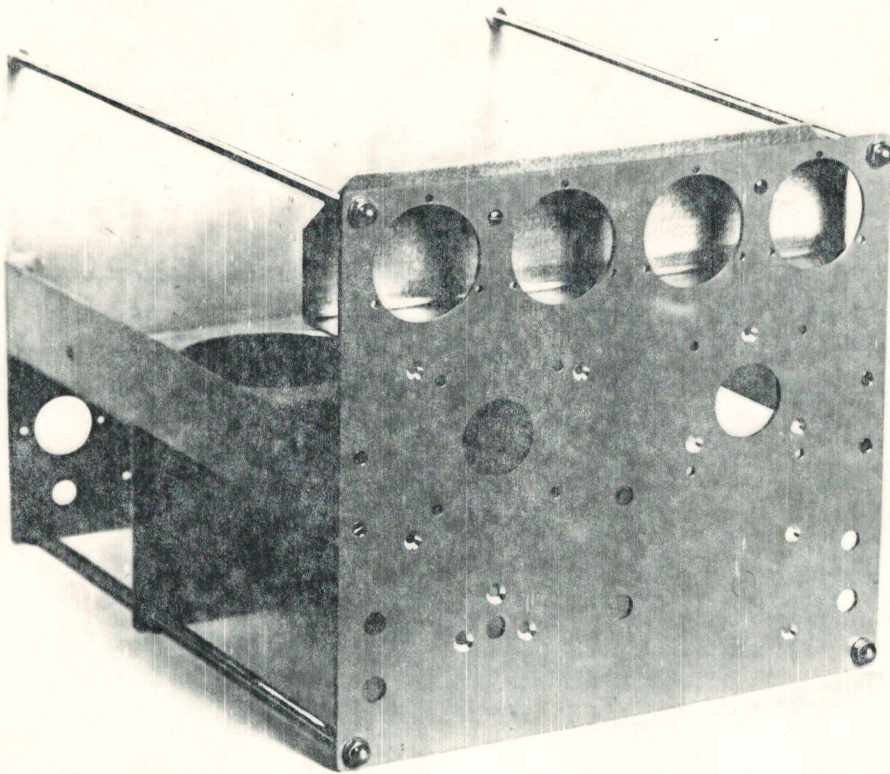


Figure 1 R.F. deck for KW linear amplifier.
There's ample room in this compact 11" x 16"
homebrew chassis for excellent parts place-
ment and ease of wiring from all angles.