

homebrewing equipment

from parts to metal work

Henry

W7KBE

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Helpful hints to get you started

Why are so few hams building electronic gear these days? To find out I conducted a survey among my ham friends. Three major reasons are:

- Lack of parts and difficulty in finding the necessary materials at reasonable prices.
- Choosing the wrong projects. Some pick projects of no use to their ham operations or that are too difficult for them to complete.
- The challenge of metal work can be overwhelming.

the parts problem

Inexpensive parts are readily available from many sources. Here are some possibilities:

- Local radio clubs often hold sales and auctions. Large, heavy World War II equipment (often called boat anchors) usually sells at give-away prices. Strip down for usable parts and hardware. Keep all screws, nuts, spacers, and small parts such as capacitors and resistors. Your junk box will soon overflow with building material.
- Garage and silent-key sales often yield worthwhile items. Look for wire, solder, tools, coax fittings, connectors, etc. If you don't have an immediate need, buy parts and store them for future use.
- Hamfests. Watch for notices in ham publications. The flea market is usually the main attraction; the variety of material is unbelievable. Where else can you buy a Weston meter for a buck? Testing your bargaining skills is fun.
- Electronic surplus houses. These are scattered across the country, and frequently advertise in the yellow pages of the local phone book. Better companies often publish catalogs.
- Junk yards. Some of my best buys were made at junk yards where electronic material occasionally shows up as a byproduct and the seller doesn't know its value. I recently purchased some excellent coaxial cable at ten cents a foot.
- Ham friends. Some of your acquaintances may have a basement, garage, or an attic full of items collected in the heyday of World War II surplus sales.
- On-the-air swap meets can be an excellent source of cheap parts. I have contacted many hams on the air to buy hard-to-get items. You must be flexible in your

selection; sensible substitutions come from experience.

selecting the right project

Keep your first project simple. It's easy to get discouraged if your initial attempt is too difficult. As you finish one project, look for something more complicated to test your abilities. I started building items such as field strength meters, moved on to antenna tuners, and finally to a linear amplifier. Build an item you will use in your ham operations. You'll give your confidence a boost if you build something and use it.

preliminary design

The foundation of any electronic project is the panel, chassis and, cabinet. Do your homework on circuit design and determine its size before gathering materials.

When you have all the necessary parts, decide on their proper placement. Look at handbook illustrations and photos to see how the experts do it. Juggle the parts into a configuration that meets your project's requirements. For example, short rf leads are important. Keep the coils spaced from metal shields by a distance at least one half their (coil) diameter. The rf switches must be close to the coils to maintain short lead length. Allow plenty of space around high-voltage components to avoid flashovers.

Don't design in layers that will be hard to wire initially; it may be difficult to repair or replace components later.

metal fabrication

Most hams dislike metal work either because they don't have the proper tools or don't know how to use them. This situation has an easy solution.

Cabinet and chassis dimensions are determined when your design and parts placement are frozen. Now start looking for sources of sheet aluminum. It's the only material easily worked and electrically excellent. I find aluminum at salvage yards, surplus houses, and flea markets. Prices average \$1.25 per pound. Buy 6061T-6 alloy for panels or pieces that don't need bending. Material 1/8 inch thick is needed; it's stiff and machines cleanly. Choose bendable material for the chassis and outer cabinet. Test for flexibility by bending a small corner with a pair of pliers. It should

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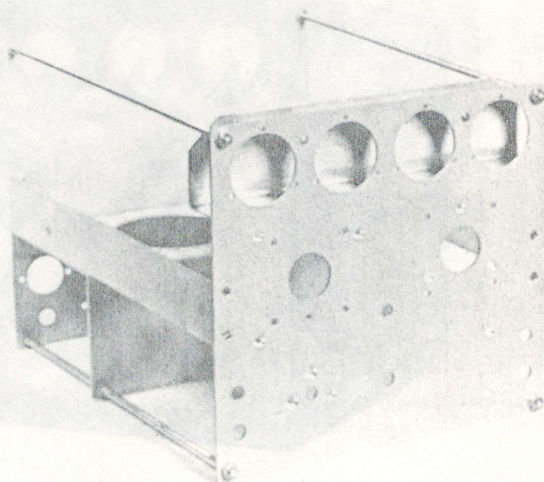


fig. 1. RF deck for KW linear amplifier. There's ample room in this compact 11" x 16" homebrew chassis for excellent parts placement and ease of wiring from all angles.

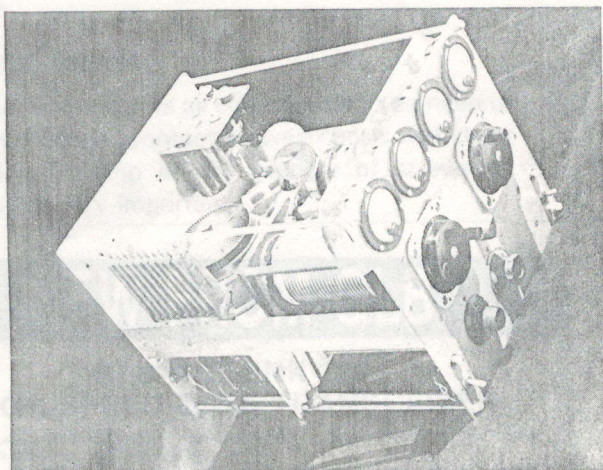


fig. 2. The wiring has been completed and tested on this amplifier that covers all the bands using two roller inductors and a variable vacuum capacitor in a Pi L network.

bend 90 degrees without breaking or springing back. Use 1/16 inch aluminum for these parts.

When looking for sheet aluminum, remember that salvage yards buy and sell *drops* (random sized pieces left from manufacturing processes). You can usually find material close to the correct size. One word of caution: stay away from aluminum that has been exposed to the weather — it's hard to clean.

tools to use

You can cut aluminum easily with hack, sabre, circular, and hole saws or with a fly cutter. Cut meter holes with a hole saw or fly cutter (which must be used in a drill press at its lowest speed). Fly cutters can be dangerous; use cutting lubricants like kerosene or paraffin and smooth ragged edges with a file. Clamp the panel to the table, cut halfway through, then turn the

panel over to finish the job. Greenlee punches are useful for making holes ranging from 1/2 to 1-1/2 inches in diameter.

Aluminum angle, 1/4-inch threaded rod and nuts, 6-32 machine screws and nuts, and no. 6 drive screws are needed and can be found at well-stocked hardware stores.

bending aluminum

You'll need to bend the aluminum for the chassis and cabinets, something that's difficult to do with regular home tools. Take the pieces that need bending to a local sheet metal shop. Let the metal worker figure the dimensions as 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 1/4-inch threaded rods. To assure perfect alignment between front and back panels, clamp them together and drill holes for the 1/4-inch threaded rod through both. The meter shield has only one 90 degree bend. The side rails, chassis, and outer shell covers all have two bends. With the outer shell in place, all the necessary shielding is complete.

The chassis is open for ease of assembly. When all parts are in place, wiring is easy. Nothing is buried. Coils, switches, and capacitors are placed for efficient operation at radio frequencies. Figure 2 shows that there is no layering of parts. This makes future repairs, changes, or parts replacement easy.

Figure 3 shows a completed 1-kW linear amplifier. The outer shell is held to the side rails with no. 6 sheet metal screws. The front of the cabinet extends beyond the front panel to give a shadow box effect similar to many commercial cabinets.

This open frame construction can be still be used if you find a commercial cabinet that fits your needs. Figure 4 shows an antenna tuner for 40, 80, and 160 meters designed for open wire line. The sliding switch¹ and the coils² are homemade. The assembly in fig. 4 was easy to wire and slides into a commercial cabinet.

finishing the metal work

After drilling the holes, assemble the pieces to make sure everything fits. Now disassemble and clean each surface with sandpaper (100 grit). Remove all burrs and scrub down the metal with an abrasive cleanser; now you're ready to paint. I paint only the front panel and outer shell; try making the panel one color and the outer shell another as contrasting colors enhance

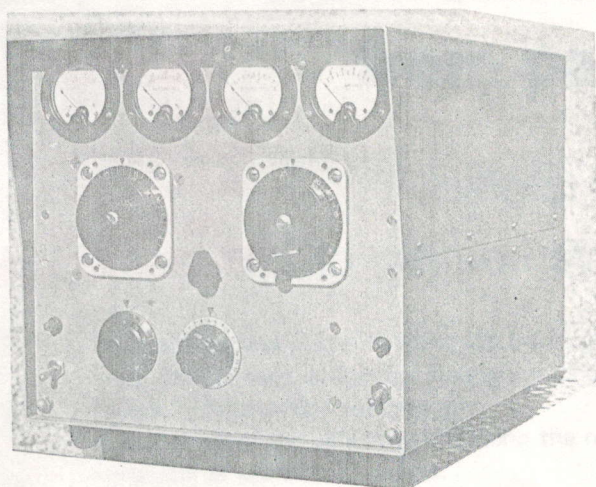


fig. 3. Here's the amplifier buttoned up and ready for action. Plenty of meters are available to monitor all circuitry. A symmetrical layout of the front panel adds to the appearance. Notice the use of surplus dial counters and meters.

the appearance. Epoxy metal spray paint does a good job.

the final touch

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

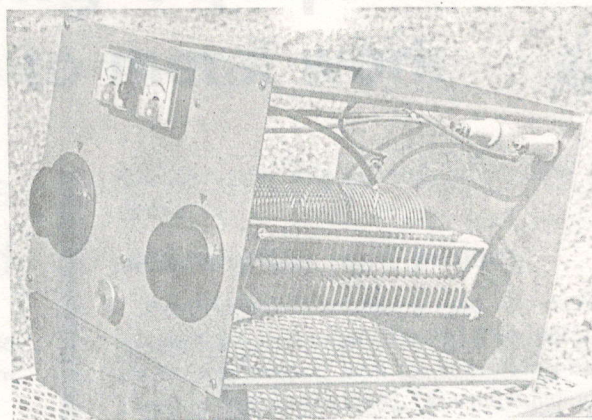


fig. 4. This tuner was housed in a commercial cabinet which had a hinged top cover to allow ready access to the tapped coil. The meters display POWER and VSWR.

I have built many of these cabinets for my friends and myself. The designs evolved over years of trying to simplify construction of homebrewed equipment. I think the finished product is very functional. Why not give it a try?

1. Johnson, Paul A., "Be Switched, Easily," *QST*, February 1983, page 18.
2. Johnson, Paul A., "Constructing Air-wound Coils," *ham radio*, August 1984, page 37.

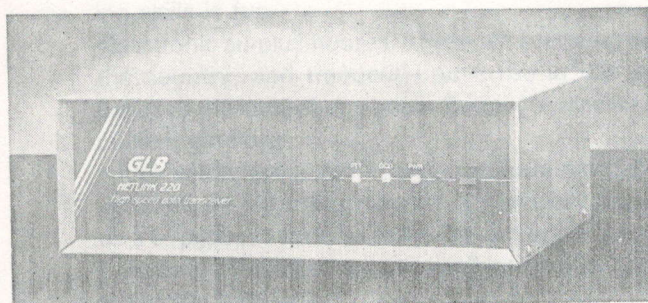
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