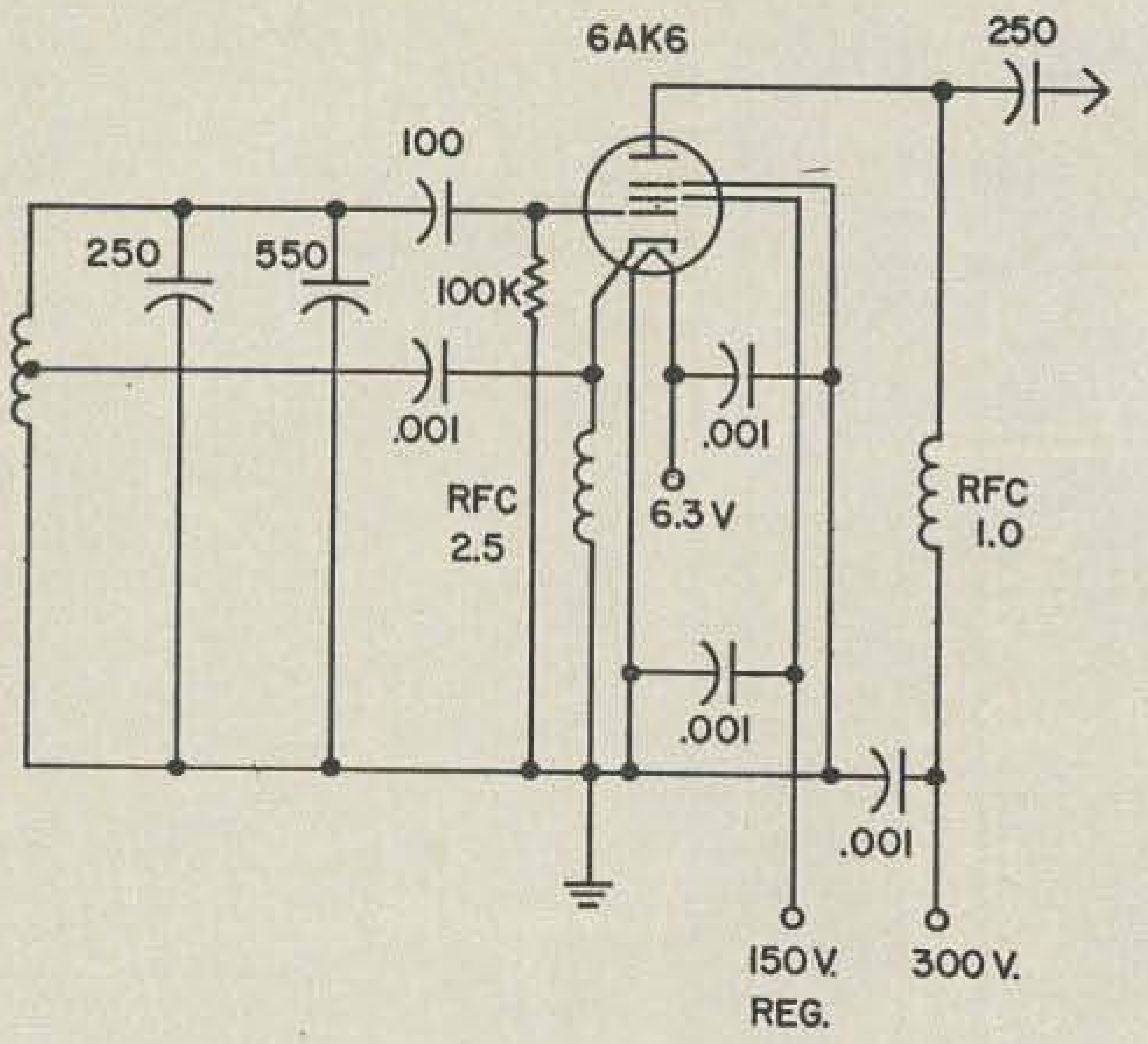

With the exception of filament disc by-pass all fixed capacitors are silver micas.

six months has been completely satisfactory, with one possible exception. Drive on all bands is more than adequate except on ten phone, where it is about a milliampere short at the 6146 grid. If you find it necessary this could probably be most easily remedied by peaking the slugged coil in the DX-60 or by tuning the plate circuit of the VFO to pick up the second harmonic. Speaking of harmonics at this point, let's remind ourselves that working ten with an eighty meter VFO requires extra attention to the output frequency.

The original plan, as you may have guessed, called for mounting this unit inside the DX-60, but I simply couldn't find a spot where the oscillator wouldn't be subjected to heat and/or mechanical modulation by transformer hum; perhaps someone else will. The chassis shown in the photo is surplus, cast-aluminum and small enough to provide a maximum of rigidity without crowding. An OA2 with its six thousand ohm, ten watt resistor take up some of the extra space on top—where all good heat producers belong.

After warm-up, drift was checked at less than one hundred cycles in an hour. On-the-air requests to a reliably cynical local ham for critical appraisal confirmed the performance as clean and stable. That long axial machine screw looks out of place in the center of a VFO coil, but it doesn't mean you can't use a turret socket to achieve stability in a simple and compact package. . . . W7IDF

73 PARTS KIT

We have rounded up a complete set of parts for home construction of this unit. This consists of the tube, socket with turret, coil wire, resistor, condensers, and chokes. These catalog out at close to $8, the 73 Kit price is $6.50. Kit W7IDF-1, 73 Parts Kits, Peterborough, New Hampshire.

Wee Birdcage

The ultimate in limited space antennas

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How would you like a three-element beam for 80- or even 160? Sounds like a pipe dream, of course. But you *can* have an antenna, for somewhere between $5.00 and $20.00, depending on the band, that you can put together yourself, that will occupy no more than a 17 foot turning radium on 160 and correspondingly less on other bands, and that finally will give you a marked improvement over a full size dipole. Just how much improvement will be explained later, but it's well worth the little amount of trouble involved.

The solution is nothing radically new—it is simply an application of someone else's good engineering that went by practically un-noticed several years ago. I am referring to the G4ZU "Birdcage" antenna which appeared in one of the other amateur radio journals in April 1960,

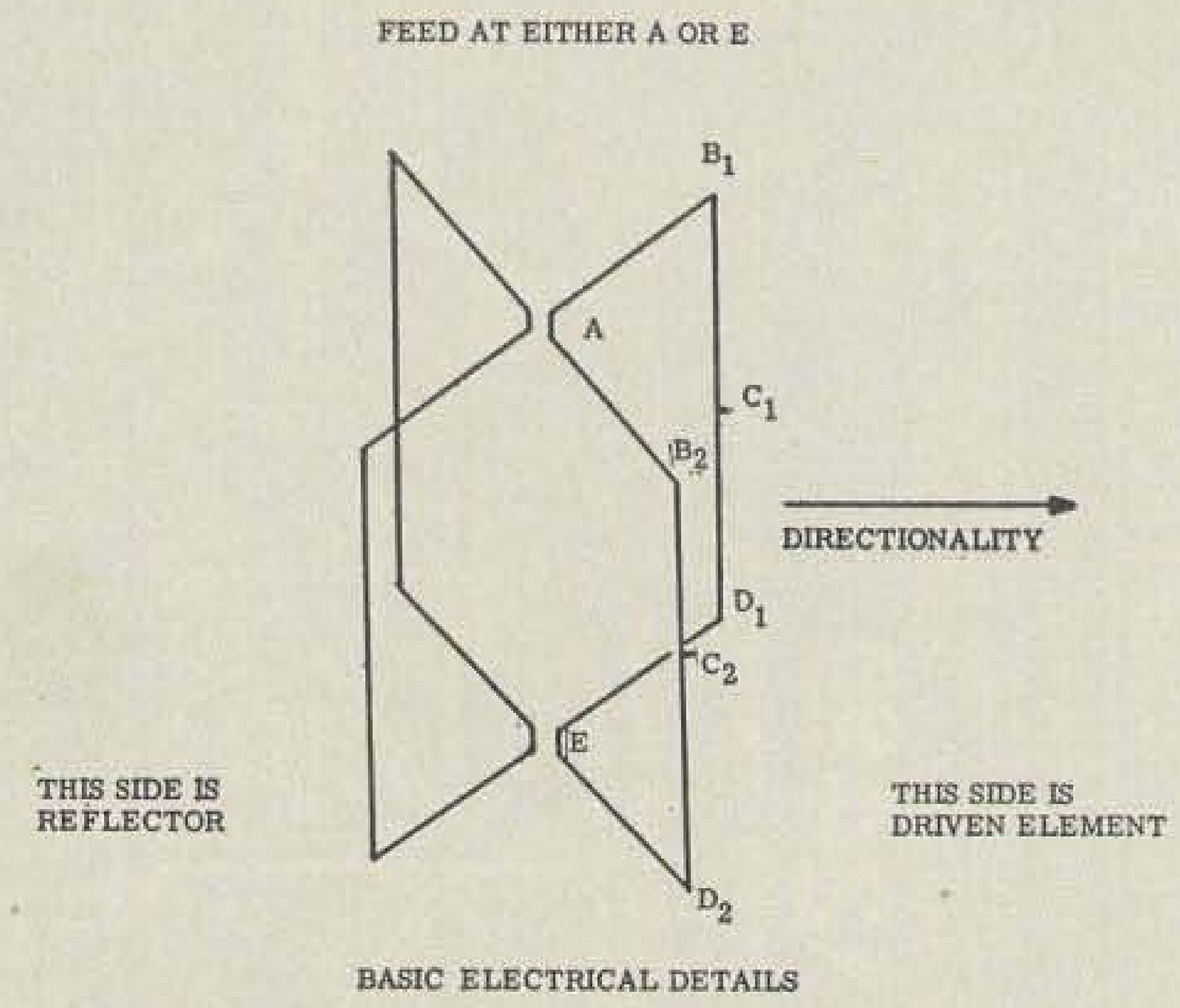


FIGURE 1

plus the additional information that one will work when cut to one-quarter of its original size. This author therefore claims no credit for anything more than sitting at the typewriter and presenting the facts (verified, on the air) and figures.

The basic principle of the Birdcage is shown in Fig. 1. A pair of V dipoles have center points at A and E. One dipole runs from C_1 through B_1 to the centerpoint A, and then on through B_2 to C_2. The other dipole goes around the other way through D_1, E, D_2 and back to C_2. These may look like funny dipoles, but they are merely bent toward the other dipole at B_1 and B_2 and at D_1 and D_2, and are connected together where the tips meet at C_1 and C_2. Assuming A is the feedpoint, if we follow our way around the circuit, we will find that we have one full wave before we get back to A again. This obviously will load up very well on the frequency for which it is cut. The theory behind it is that the inner portions of the two dipoles will radiate in a horizontal plane, and the portions that are bent up or down to connect to the opposite pieces serve merely as a voltage feed, so that one dipole can be fed at its center and then will end-feed the other one. Addition of a reflector constructed in the same manner balances it out mechanically, and gives us additional gain over that obtained by stacking the two dipoles.

When G4ZU's original article appeared, the writer took a quick look at the claimed gain (10 db) and what the size would be when scaled down to six meters, and went looking for materials. Results were very good without even bothering to measure SWR or feedpoint impedance. We just tuned the reflector for maximum forward gain and proceeded to work all the new signals we were hearing. About this time, we made the acquaintance of Skip W3CYT who was also intrigued by the original article. However, he had gone a step further and experimented around with half and quarter size models. Comparing notes revealed that less gain, but otherwise similar results, were obtained in the miniature models. Although no actual figures on gain were ever arrived at, comparison with standard dipoles showed definite improvements in signal strength, and an estimated figure of 4 db does not sound out of line. Fig. 2 shows the physical size of one element (A to B_1, or etc.) for the various bands, both in quarter-wave and full-wave models. It is obvious from this that a full-wave 40 meter model will work as a quarter-wave on 160, and likewise for other possible frequency relationships, up to the quarter-wave

Band	Full-Wave	Quarter-Wave
2 meters	10-5/16"	2-5/64"
6 meters	29-3/4"	7-3/8"
10 meters	4'-4"	13"
11 meters	See Note #1	See Note #1
15 meters	5'-10"	17-1/2"
20 meters	8'-8"	2'-2"
40 meters	17'-4"	4'-4"
80 meters	34'-8"	8'-8"
160 meters	See Note #2	17'-1"

Note #1: Details supplied upon request to other countries. Residents of U. S. need not bother asking.

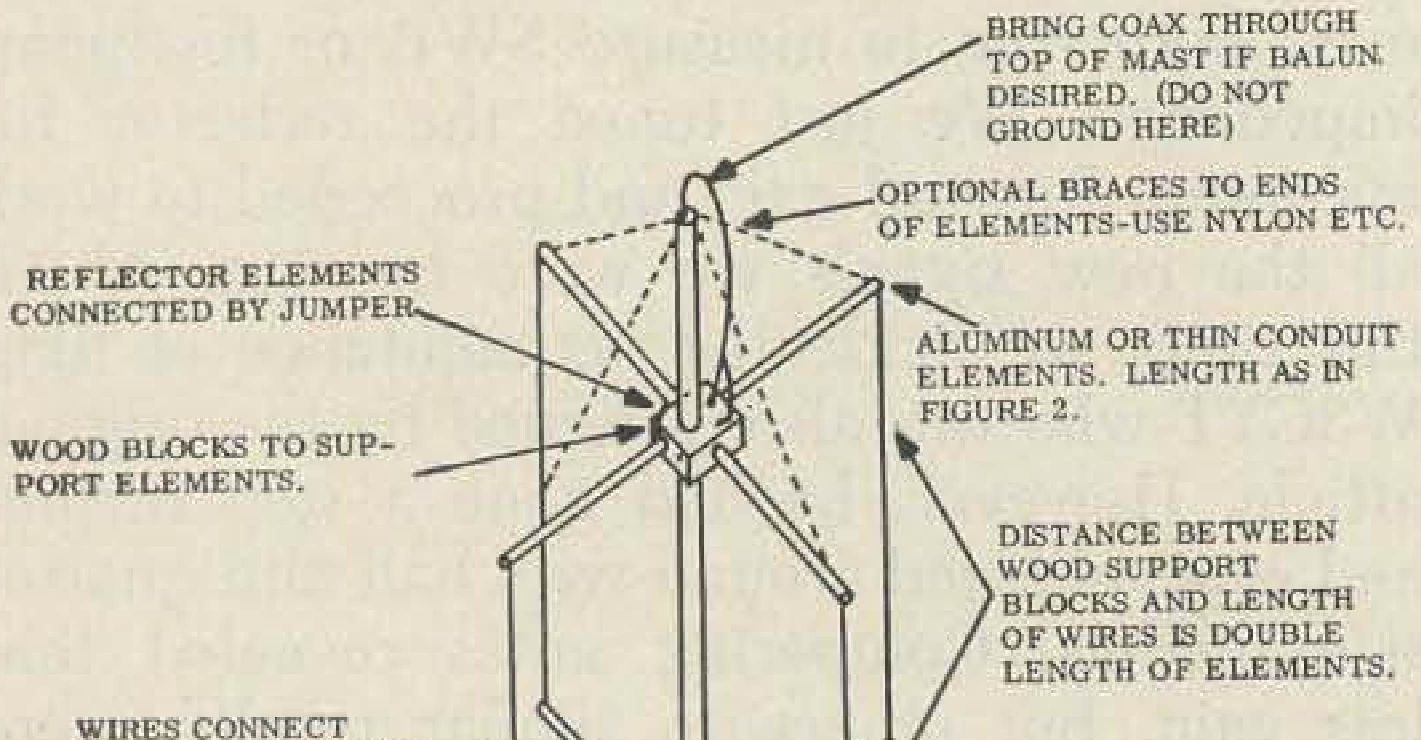
Note #2: Anyone this ambitious won't have any trouble calculating his own figure.

All lengths given are for one element (8 required), and also represent the turning radius of the antenna. All are given for the low edges of the bands.

Fig. 2—Sizes for Various Bands

six meter model which has a radius of less than 7½ inches!

The mechanical details are shown in Fig. 3. Simply obtain two suitable sized hunks of hard wood. Bore holes for the size of mast you wish to use, and mount them exactly twice the length of one element apart (either a quarter wave for the full-wave model or a sixteenth wave for the quarter-wave model). Next, bore holes for whatever diameter of material you have selected for the elements, which is simply whatever you have around or can purchase cheaply, such as half-inch inside diameter thin-wall conduit. The elements should come close to, but not touch, the center support, and should be fastened in with machine screws in such a way that adjacent elements can be connected electrically by jumpers. See Fig. 4 for details. In most quarter-wave models, no extra support is needed for the elements, nor will any be needed on the higher band full-wave models. However, if you think the elements will have a tendency to droop, simply run the mast a bit higher than the top wood block and run nylon, glassline, or what have you down to the ends of the top elements for support. Finally, connect vertical wires between the tips of the top set of elements and those directly below. These wires may be any size convenient or mechanically desirable, as they carry no current. Likewise, there is no appreciable rf voltage present at the wooden mounting blocks, so no special pains are required to use low-loss material at these points. Finally, element thickness, while theoretically tending to control bandwidth, is so much greater than any wire that might be used in a standard dipole that mechanical size alone should be the deciding factor.



CONSTRUCTION DETAILS

FIGURE 3

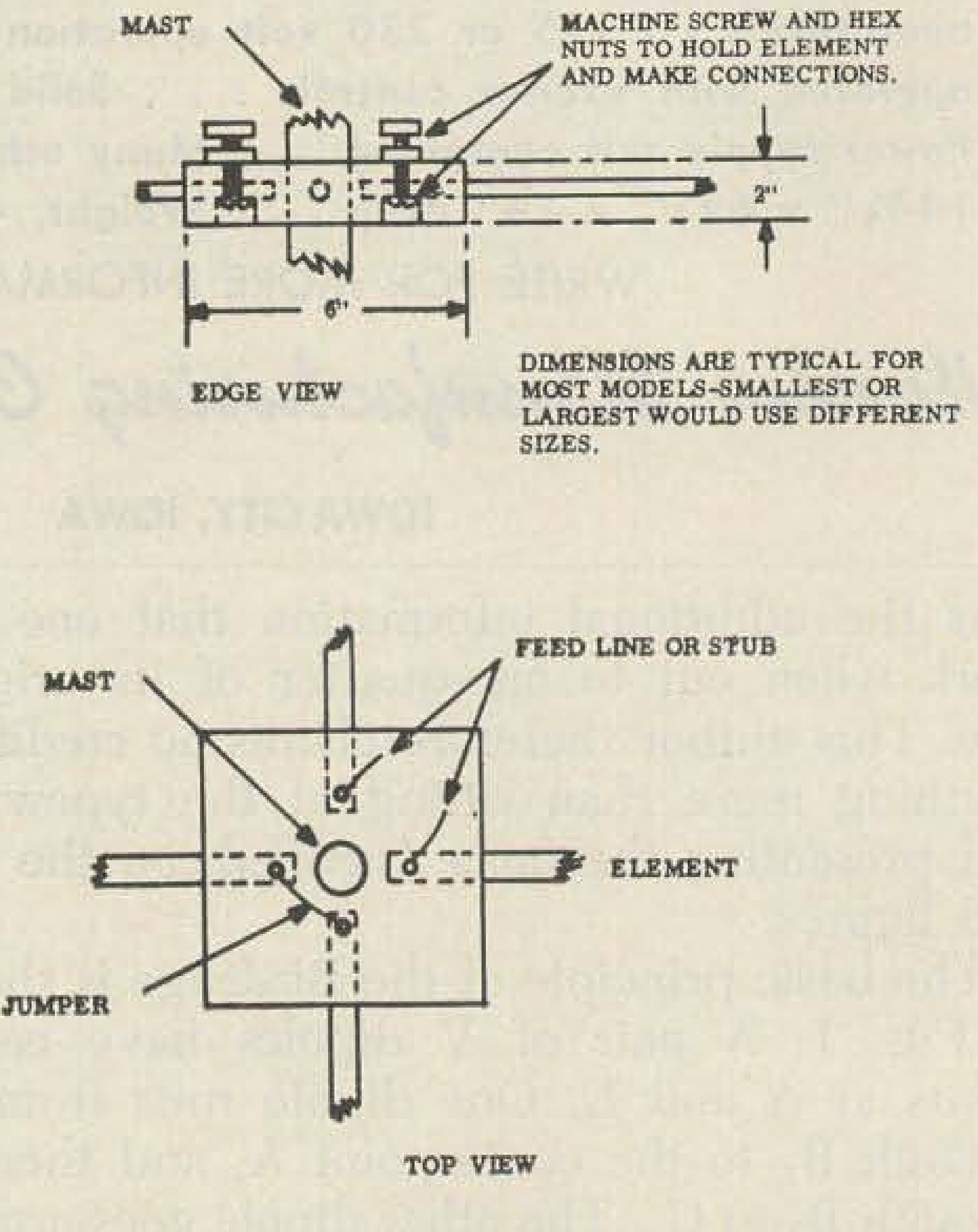


FIGURE 4

To feed the thing, connect a jumper between the two driven element sections at the bottom block, and tap the feedline out from the inner ends of the top elements to obtain the desired impedance (50 ohms will be close in, and higher impedances further out, just as in a "T" match). Now adjust for best SWR by shortening or lengthening the vertical wires slightly. At this point, it would be best to mention that a balanced feed is required. This can be obtained through the customary half-wave loop of coax if 200 or 300 ohm feed is desired. It can also be obtained by using the mast as part of a 1:1 ratio "balun." Run the coax into the mast, grounding the braid as you do, at a point exactly one-quarter wave below the top of the mast. This will be the same distance as between the wooden support blocks for a full-wave model, or four times this distance in a quarter-wave model. Do not ground the coax anywhere above this point. Separate the braid and the inner conductor where they come out the top, and you will have a balanced feed at the same impedance as the transmission line.

Now connect a jumper between the two top elements of the reflector, and insert a stub of twin-lead the same length as an element between the two bottom reflector elements. This gives us one-sixteenth, or about 6%, of the total reflector length, which we know is too much as 5% is the theoretical figure for how much longer than the driven element it should be. Prune this stub, keeping the far ends shorted, until maximum forward gain is achieved. You can now go back over the two adjustments (driven element and reflector stub) as many times as it takes to make you happy with the SWR and FB ratio if you are of a mind to squeeze out the last milliwatt of power, although the average guy will probably be contented to let things as they are after the first basic adjustments, and won't lose an awful lot by doing so, either.

Several things that should be borne in mind when using this arrangement are that two-band operation is quite practical, as long as there is a 4:1 frequency ratio—that is, operating quarter-wave on 80 and full-wave on 20, or etc. Also the elements can be cross-connected (both halves in series) to make a half-wave (or is it really full-wave?) bi-directional model on the "in-between" band (40 in the last example) although the gain is no better than with quarter-wave operation due to neither side being larger than the other, and neither serving as a reflector. Finally, either the feedpoint or the reflector tuning stub can just as well be either top or bottom, whichever suits your convenience. If you use open line, bottom feed would obviously be more convenient than coming up through the mast as with coax.

As stated before, several of these antennas were built and tried out on six meters. Results were, as close as can be "guesstimated" with nothing but S-meter readings and comparison with dipoles, close to G4ZU's claim for the full-wave model, and a conservatively estimated 4 db gain for the quarter-wave miniatures. Results on receiving tend to back up these figures rather closely.

Lastly, do not expect either (1) a sharp directional pattern, or (2) a large front-to-back ratio. After all, one driven element and one reflector wouldn't give you these in beam configuration either. The side nulls are deep, however, and overall performance is well worth the small effort and expense required to construct one. . . . **K3LNZ**

Protect Your Investment

Roy Pafenberg W4WKM

ANY amateur who desires to pursue his avocation and at the same time is interested in keeping his kids in shoes and a few cold ones in the box must necessarily be concerned with the trade-in or resale value of his gear. This applies equally to commercial and converted surplus equipment. In order to avoid an expensive turnover of the station with each real or claimed state of the art advance, many amateurs find it desirable to modify their commercial equipment to gain the advantages of new techniques. Of course, extensive modifications are the rule in most surplus conversions.

How do you modify and still not lower the value of your equipment? The Golden Rule applies in this area and results in a very tangible increase of cash in pocket. The potential buyer of your equipment probably desires what you yourself would want. This boils down to new appearance and performance along with detailed instructions and service information. This is a tall order but it can be filled.

A few simple precautions, religiously followed, will insure top market value of modified commercial and converted surplus equipment:

1. Make the minimum modification required to gain the desired performance objective. Plan the modification so that the equipment may be restored to the original condition if things don't pan out. It is sometimes difficult to accomplish the desired modification without punching additional holes in the panel of the equipment. In this connection, new components can be of great value. See "Versatile Control Techniques" in the Aug. 61 issue.

2. First impressions are important and appearance, internal and external, should be up to par. The quality of workmanship in the modification or conversion should at least meet the same standards to which the equipment