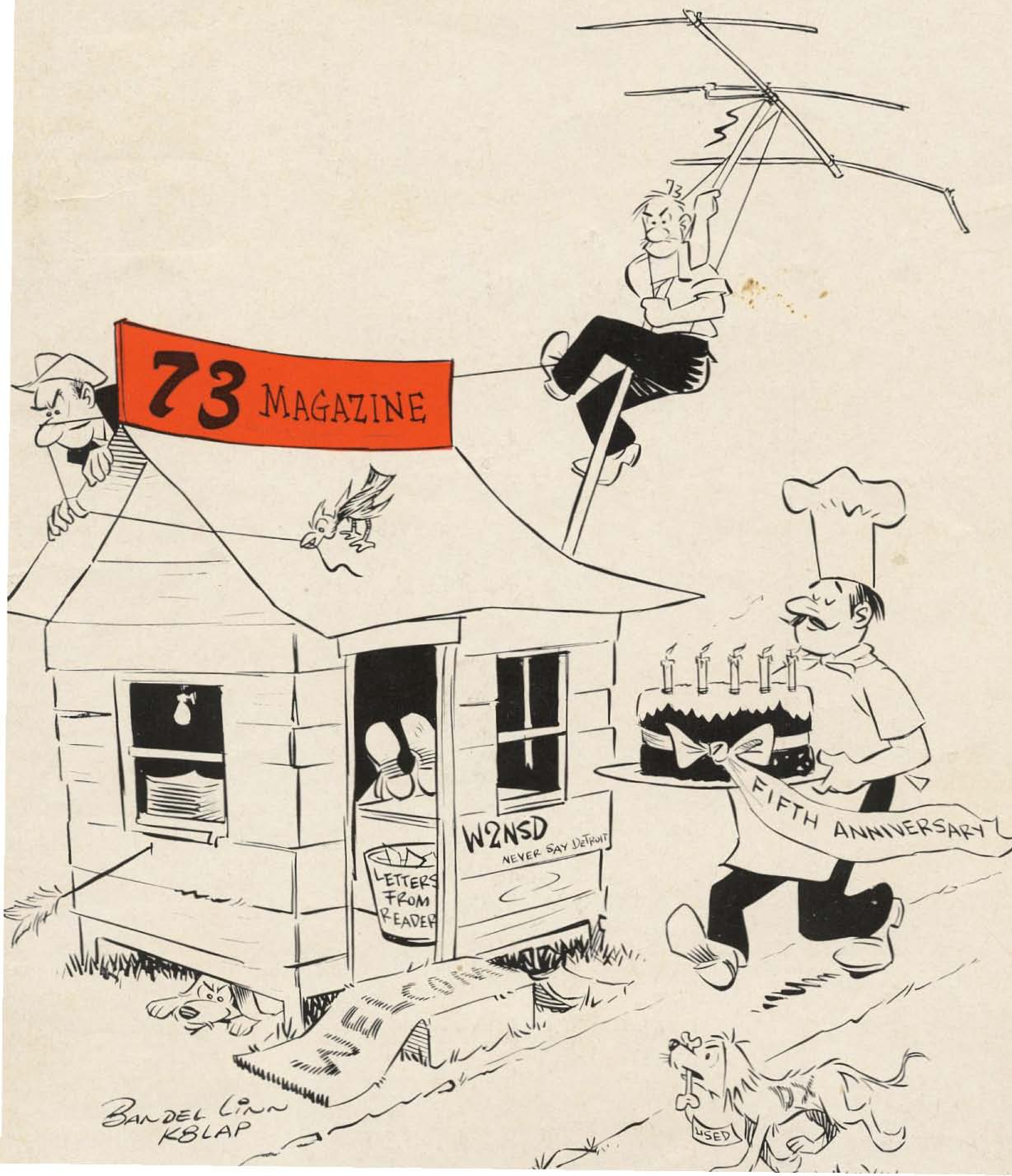
73

OCTOBER 1965
An anniversary 50¢

Amateur Radio



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FM-5000 with batteries, accessories and complete instruction manual, less oscillators, and crystals. Shipping weight: 18 lbs. Cat. No. 620-103 . . . . . . $375.00
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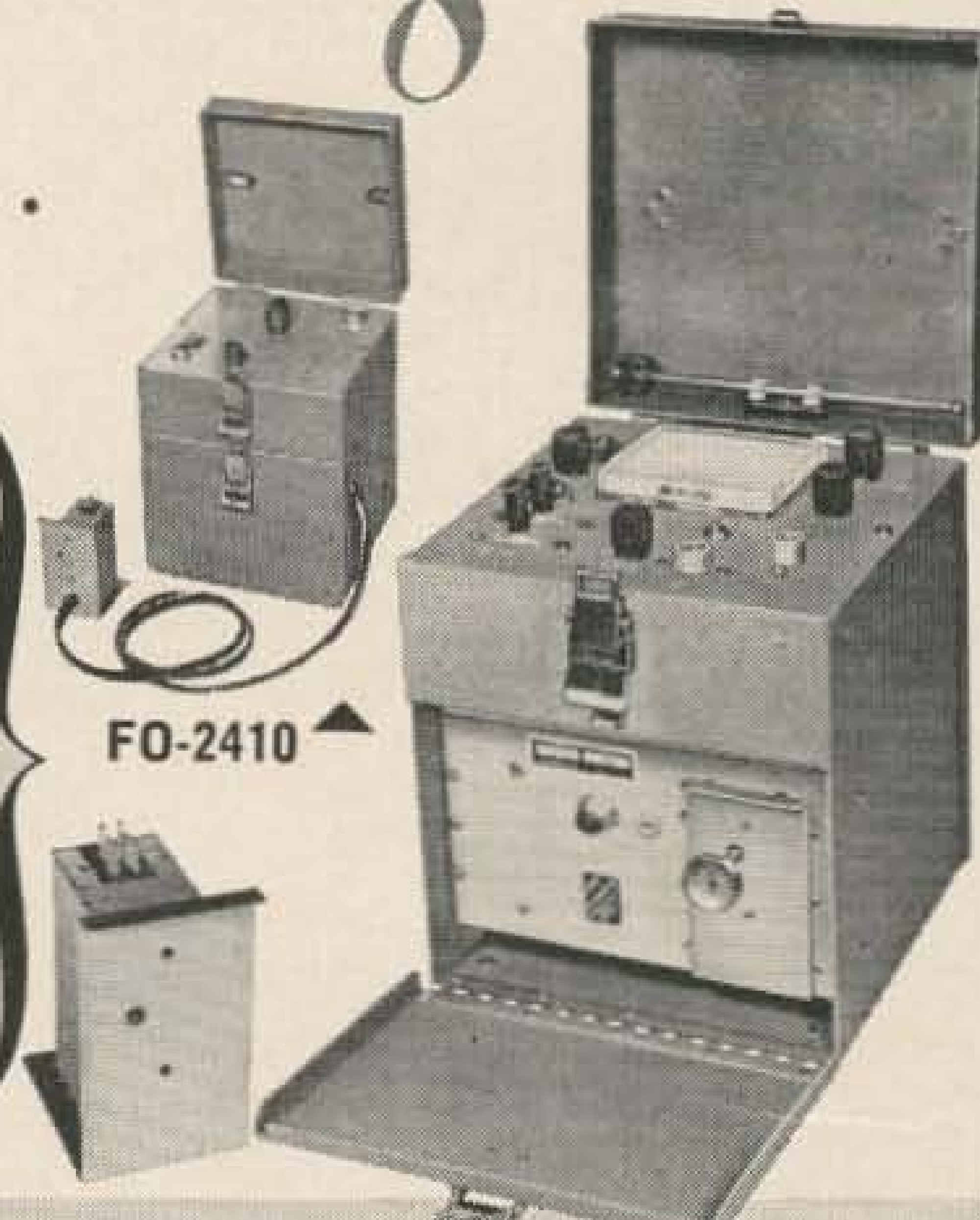

C-12B FREQUENCY METER For Citizens Band Servicing

This extremely portable secondary frequency standard is a self contained unit for servicing radio transmitters and receivers used in the 27 mc Citizens Band. The meter is capable of holding 24 crystals and comes with 23 crystals installed. The 23 crystals cover Channel 1 through 23. The frequency stability of the C-12B is ± .0025% 32° to 125°F, .0015% 50° to 100°F. Other features include a transistorized frequency counter circuit, AM percentage modulation checker and power output meter.

C-12B complete with PK (pick-off) box, dummy load and connecting cable, crystals and batteries. Shipping weight: 9 lbs. Cat. No. 620-101 . . . . $300.00

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18 NORTH LEE OKLAHOMA CITY, OKLAHOMA

73 Magazine

Wayne Green W2NSD/1
Editor & Publisher

Paul Franson WA1CCH
Assistant Editor

October, 1965

Vol. XXXVI, No. 1

2 KW Mobile .... W2DMK...... 6
PEP, of course.

Meterama .... W5GWF...... 12
Get some good use from those old air-speed indicators.

Six for Six .... WB2CQM...... 18
Six elements for six meters.

A State-of-the-Art Converter .... W3HIX...... 22
Integrated circuitry comes to hamdom.

Hamfest out on a Limb .... Margolis...... 26
A little step toward international hamming.

Are 20¢ Transistors Coming? ...... W7SMC...... 30
Apparently so.

The Lowly Coax Fitting .... W5VOH...... 34
A little picture article.

An Expedition to UJ8 .... UB5UG...... 38
20,000 feet up.

A Junk Box Power-SWR Meter ...... K4QYC...... 44
In case you missed the two SWR meters last month.

The Design Industries Diplomat ..... W2NSD...... 48
A fantastic new piece of gear.

A Ham Crossword Puzzle .... K1CLM...... 50
Unfortunately, we didn't have room for the solution.

Two Meter Transistor Transmitter ..... K1CLL...... 54
Get two watts out of a 2N107 on two.

A Reliable Audio Source .... Ives...... 62
A 7 lb generator that works as well as a two ounce transsistor one.

Improving the Heath Mohawk ...... W9ECQ...... 68
Pepping up the RF and audio.

Gus: Part VI .... W4BPD...... 76
Gus in Prague.

The National NCX-5 .... W5DWT...... 84
An amazing rig.

Testing the Heath KW Kompact ..... WB6KEH...... 88
The Little Bomb.

Improve your Monoband Swan ..... K6LGW...... 90
For better stability and class C.

That Unwanted Sideband .... K5JKX...... 92
Another in the 73 Sideband Series.

DC Transformers .... W6ANU...... 102
Need 28 volts in your car?

Getting the Most from your Two'er .. WA2QZH...... 111
A few more changes for one of the most popular pieces of ham gear.

Editorial 2
Operating Desk 72
EICO 722 on Six 116
Neater Decals 116
Transformer Tip 117
Letter from Gus 118
VHF 119
Letters 120
New Products 122
Caveat Emptor 126
Propagation 128
Index to Advertisers 128

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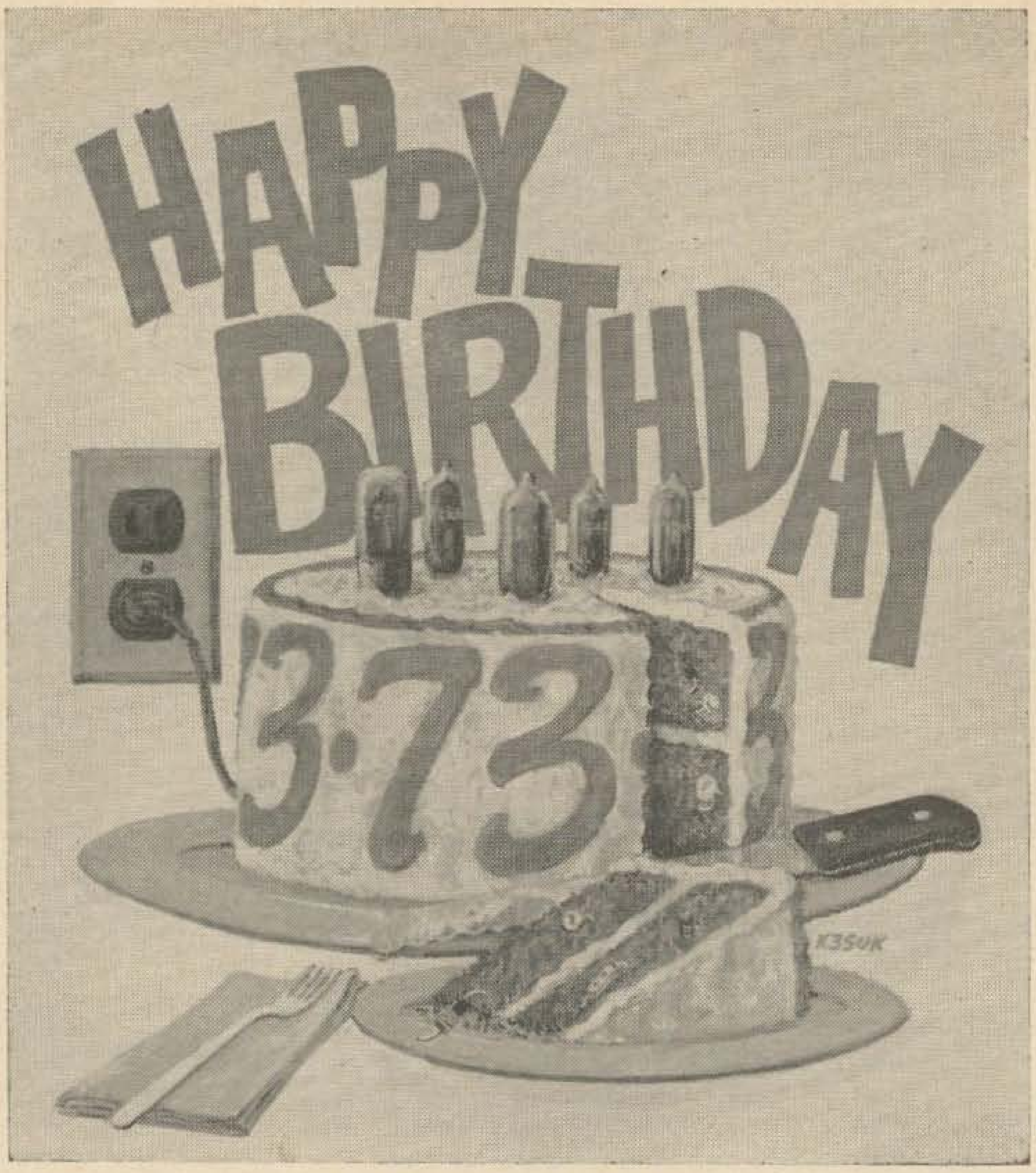


de W2NSD/1

never say die

Five years?
Oi.
Well, it's better than working for a living.

Interlopers

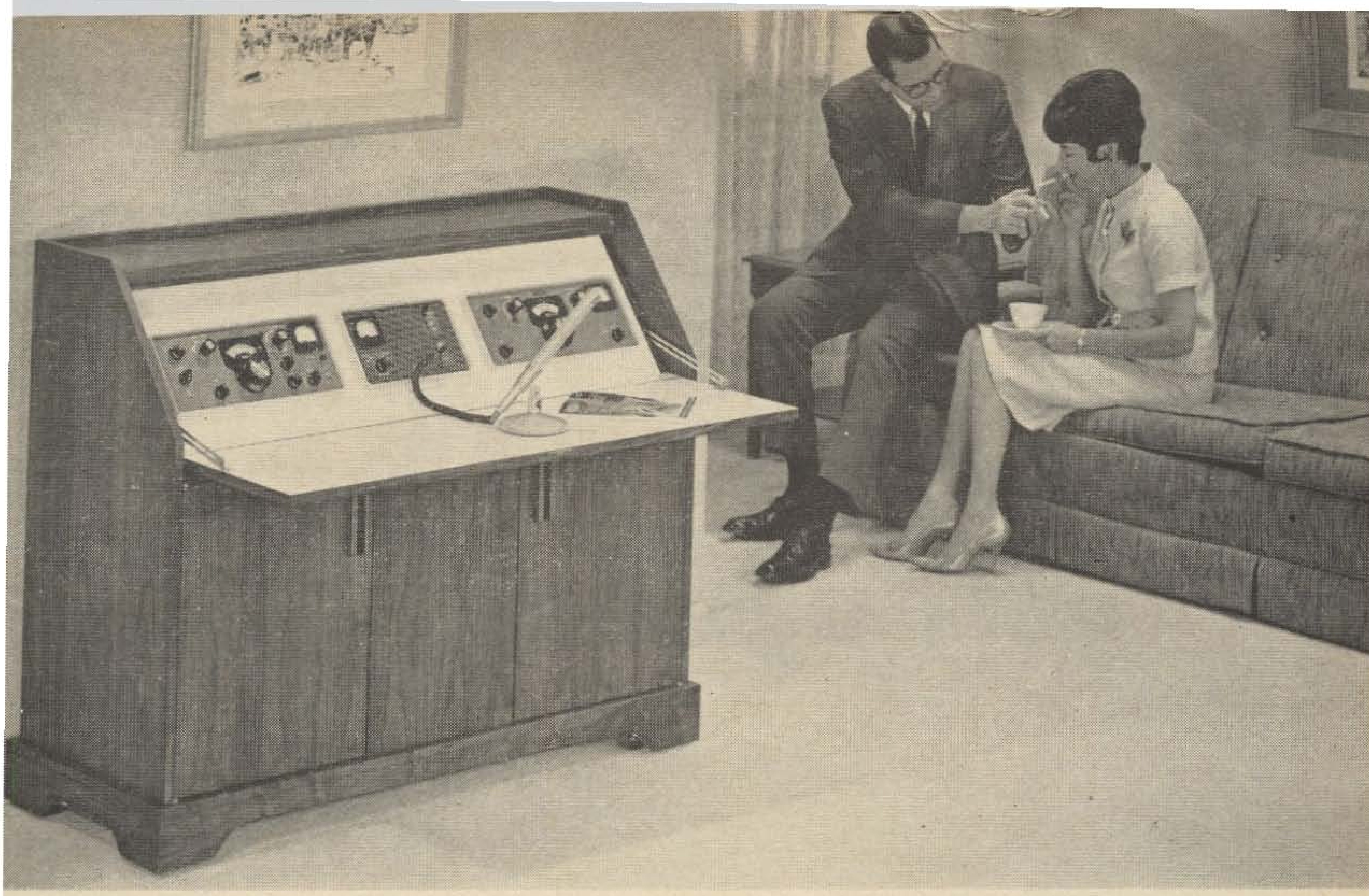
Perhaps it only seems as though there are more non ham stations in our bands? Well, if you are good at listening you will be able to log the following Voice of America broadcasts: 3965, 3980, 7105, 7110, 7115, 7125, 7130, 7135, 7145, 7150, 7155, 7160, 7170, 7175, 7195, 7200, 7205, 7235, 7240, 7250, 7255, 7270, 7275, 7290, 7295. The last copy of a complaint that I saw addressed to VOA brought the response that since all the other short wave broadcasters are in the ham bands they have to be too. But do they have to completely blanket the band like that? It looks like we are overwhelming them, not just keeping up.

Ham Hotel

Since I was going to Puerto Rico to write up the 432 test at Arecibo, I checked into what it would cost to add Curaçao to my itinerary. The round trip fare to Puerto Rico was $133, and the fare to Curaçao and back, with stops at Puerto Rico was only $150 on a 17 day excursion. For $17 extra I would be foolish to pass up Curaçao.

I dropped a letter to Chet PJ3CC, the owner and manager of the Coral Cliffs Hotel, telling

Continued on page 122



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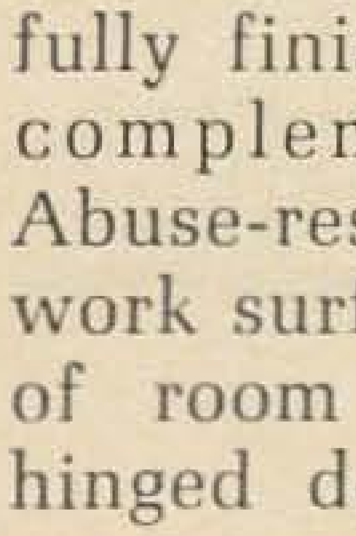

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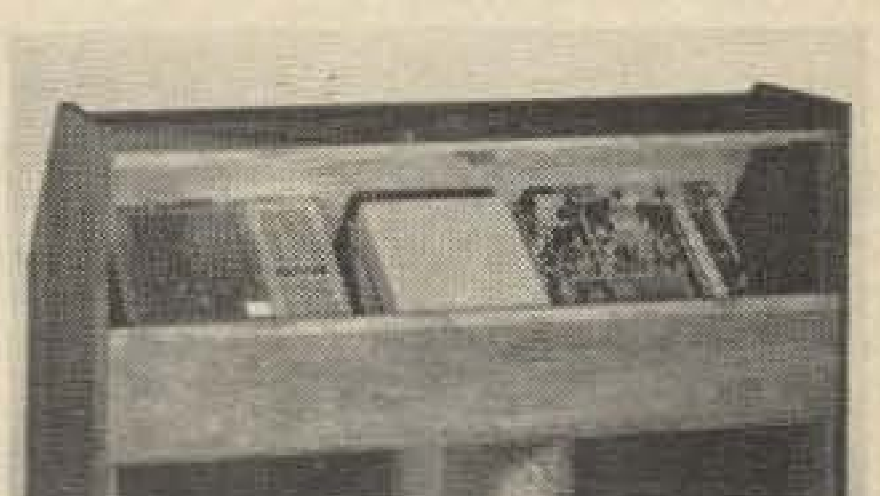

AC power supply compartment forms portion of air chimney.

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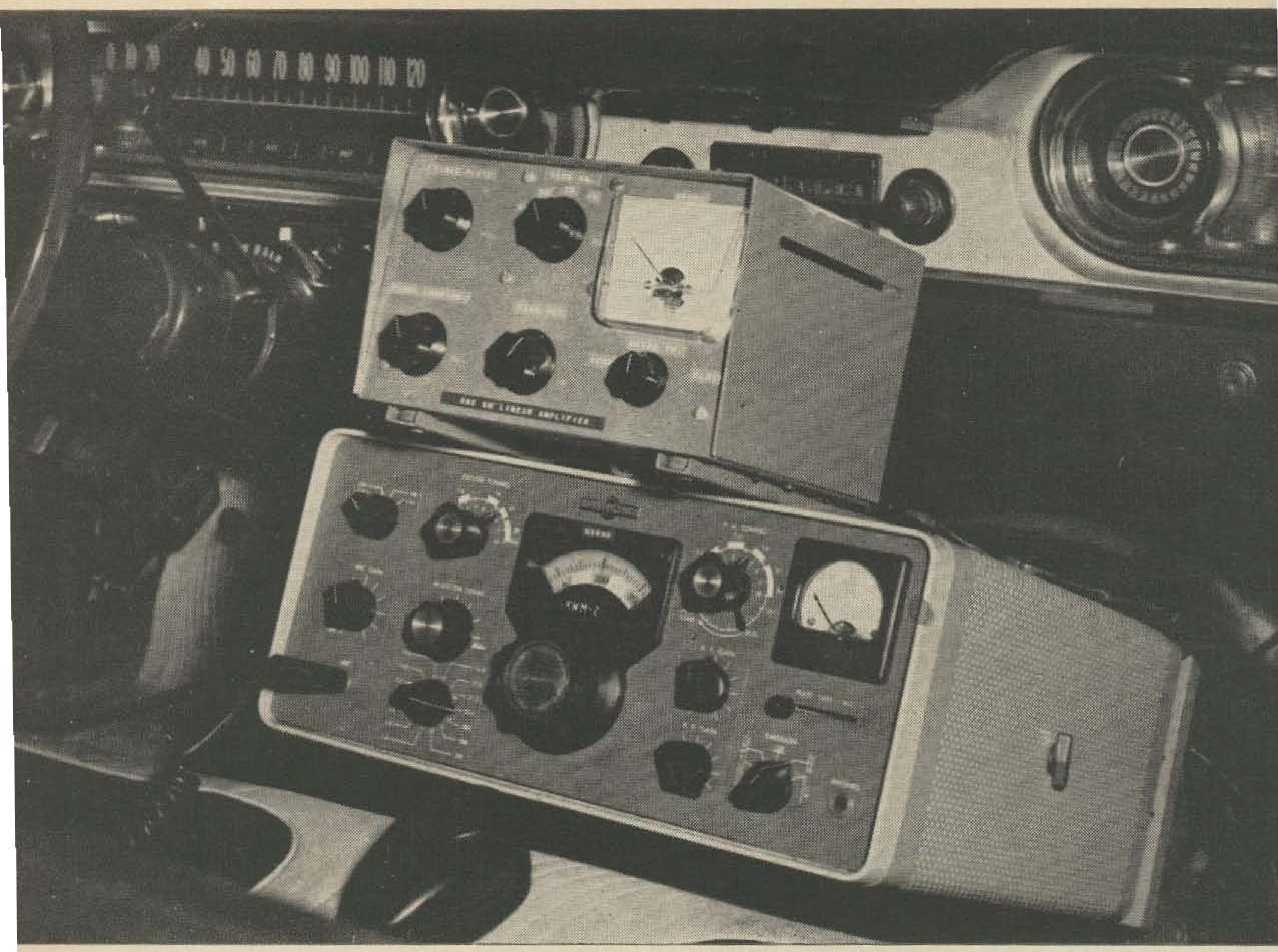


2 KW Mobile

For many years I've had to travel a lot. During this time, I've operated mobile with commercial and home-brew equipment in the 150 watt range—and with good results. But I kept wondering how it would be to run a full gallon in the car. So I tried it. To my surprise, it turned out to be well worth the time, money and effort I spent. Here's how I did it:

Richard Yeomans W2DMK
1243 Front Street
Binghamton, N. Y.

The Alternator

I am sure that we all know the limitations of car batteries and generators. They are only good for about 35 amp DC maximum. Subtracting required automobile needs leaves little for ham equipment. An alternator seems to be the only practical solution. My car, unlike newer ones, didn't come with an alternator. In fact, a stock alternator wouldn't have been sufficient for a kilowatt anyway. Even heavy duty truck alternators are only rated at about 60 amp DC.

So I bought a guaranteed used Leece-Neville alternator through a Ham Ad for $85 complete with regulator and copper oxide rectifier stack. It was rated for 100 amp at 14 volts DC CCS. The price has gone up since then, but they're still a bargain.

Alternators have many advantages over generators:

1. Small size, moderate weight, little maintenance required.
2. High output current even at idling speeds.
3. Excellent regulation of the output voltage.
4. Little RF interference.
5. High frequency output. For example, the frequency at 2500 RPM is about 250 cycles. This frequency is proportional to alternator speed. Higher frequencies are easier to filter than low ones (such as 60 cycles.)
6. Little chance of burning out. An overload will cause either a loud whine from a slipping belt or the output current will remain constant instead of increasing.

There were two things that I didn't like about the alternator I got, though. The copper oxide rectifiers deteriorate with age and develop a high back resistance. This causes the rectifiers to overheat. Since they normally run hot as it is, I replaced them with high current silicon diodes mounted on a good heat sink. This eliminated the heat problem.

Also the vibrating reed regulator was unreliable. When it was hot, the battery wouldn't stay charged. In cold weather, the battery was overcharged. All electrical-mechanical regulators suffer from temperature effects.

In looking for a solution to this problem, I came across an article by Harry W. Lawson in the August 1961 Electronics World. I built a regulator from this article and it worked like a charm. Temperature didn't seem to affect the output voltage of the alternator. The interference from the clicking contacts has been eliminated. But the biggest advantage was that the output voltage of the system could be set by adjusting one small pot. This regulator has been trouble free for three years.

Now that we have primary power, let's turn to the DC supply for the linear.

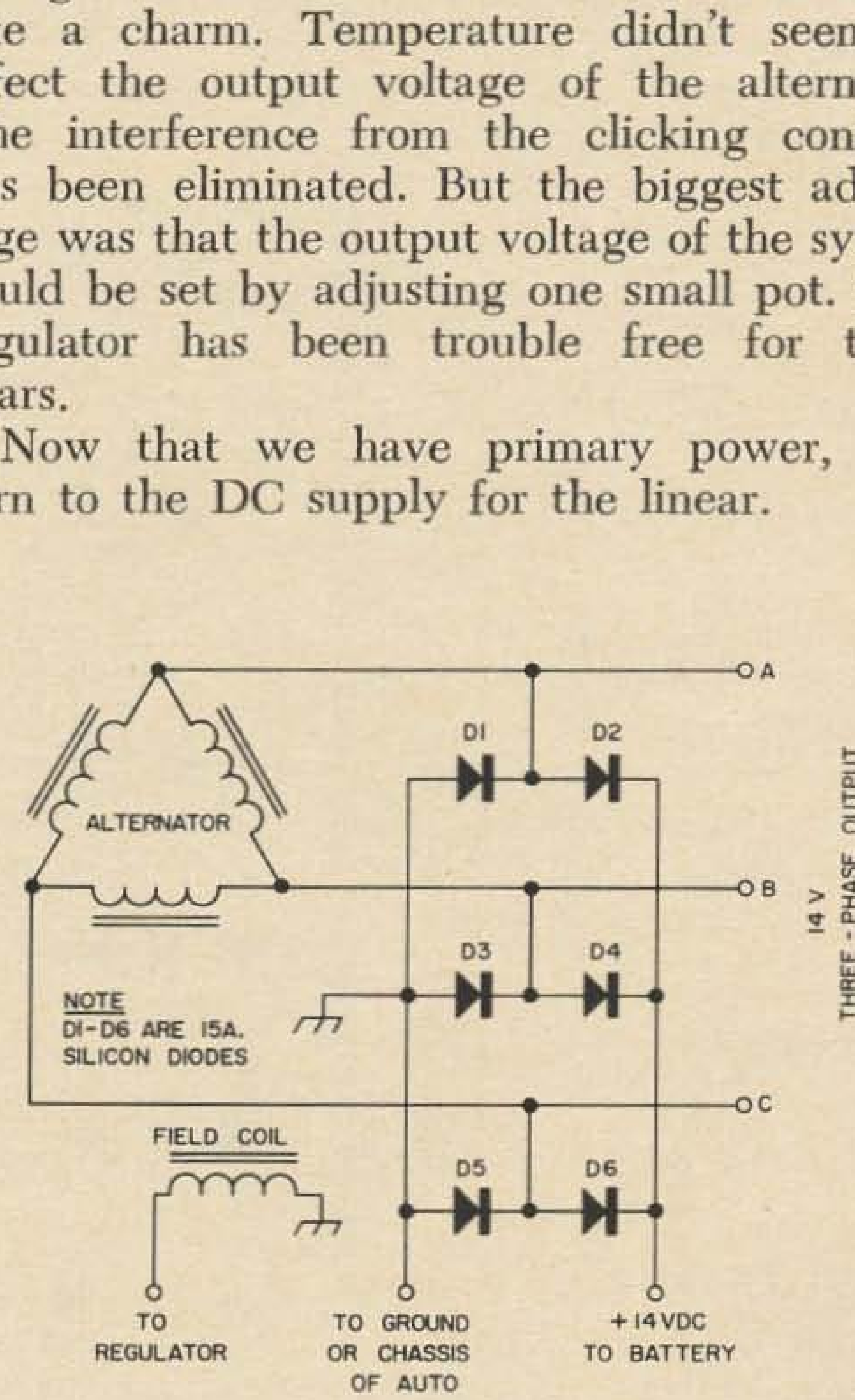
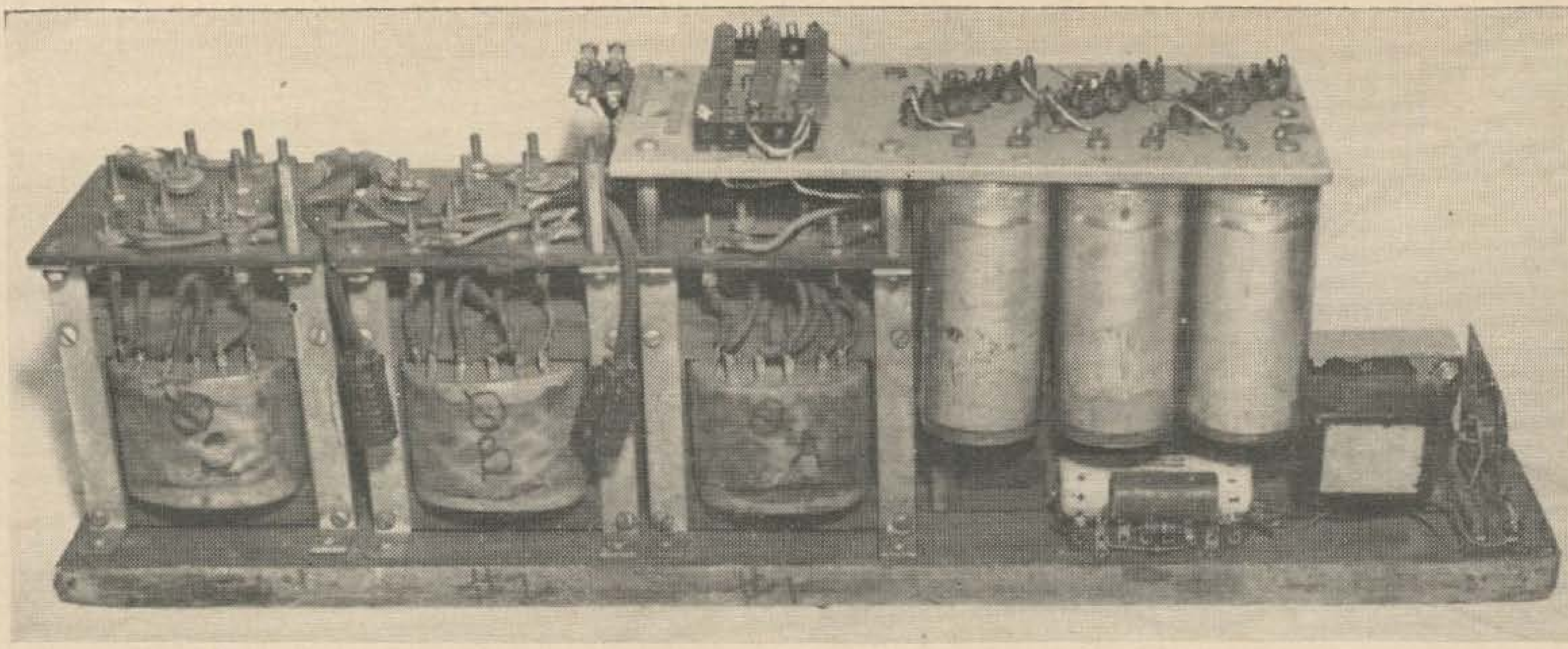


Fig. 1. The primary power system.



The power supply: Notice the husky filament transformers, the fuses, the bleeder resistors, the diodes, the voltage doubler capacitors, the bias supply and the bias transformer.

The DC Power Supply

The DC supply is conventional—but may be new to hams. As can be seen in **Fig. 2**, the three husky filament transformers are connected in reverse. The 12.6 volt windings become the primaries and are connected in delta fashion to match the output of the alternator. Each secondary uses a full wave voltage doubler and develops approximately 750 volts. The three outputs are then connected in series to develop about 2250 volts at 450-500 ma.

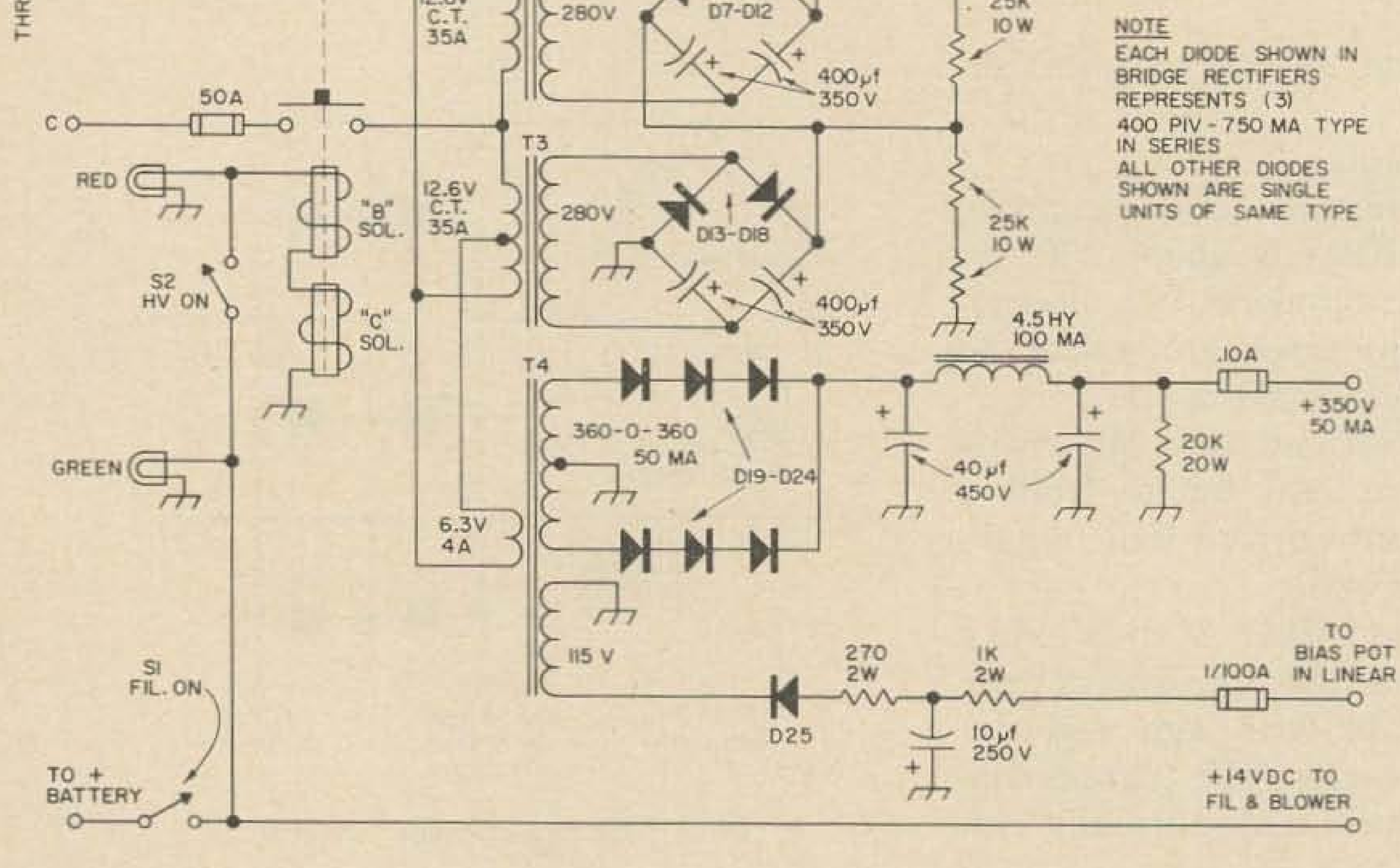


Fig. 2. The power supply for the linear. Note that input is three phase.

This voltage and current is maintained with a charging voltage of 14 volts from the alternator.

The transformers shown are surplus. There are many similar ones available from the surplus dealers who advertise in 73.

A small replacement transformer rated at 350 volts each side of center at 50 ma, 6.3 v at 4 amp and with a 115 v primary is used to furnish bias and screen voltages. The 6.3 volt winding becomes the primary and is connected to phase A at the center tap point of this transformer. The 115 volt winding becomes the bias source.

The diodes are standard TV replacement types. The capacitors in the voltage doubler are surplus. You probably could use 100 μf electrolytics with slightly poorer regulation. Each of the 750 volt outputs is shunted by a 50 k, 20 watt resistor that acts as a voltage equalizer and bleeder.

The high voltage supply is switched into action by energizing two six volt auto started solenoids connected in series. They complete the circuit of phase B-C to the transformer. Phase A leg will not supply any voltage without one of the other legs connected. I used six volt solenoids since they were cheaper than twelve.

The filaments and blower are designed to be switched on at least three minutes before the plate supply is energized.

The Linear Amplifier

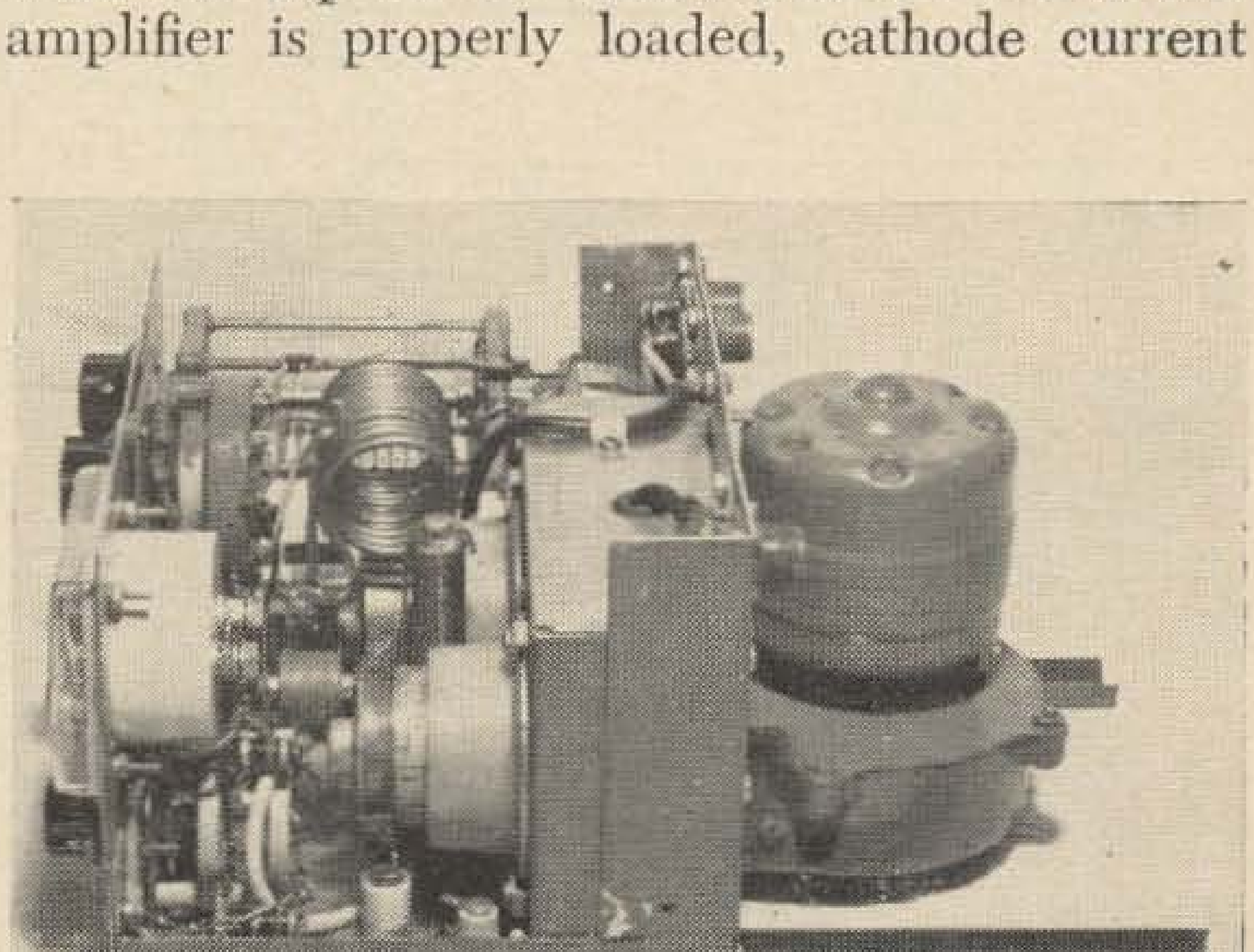
This amplifier is a little unusual. It is a grounded grid *tetrode* amplifier. The 4CX250B tube is not suitable for regular grounded grid operation (that is, with the control and screen grids both grounded), for screen and grid currents will run too high and ruin the tube. But they work fine as tetrodes with drive applied to the cathode, the grid grounded and the screen at about 350 volts. As in true grounded grid, about 80% of the drive shows up in the output. Drive required is higher than class AB, but less than grounded grid. An exciter with 65 watts output will drive the pants off this linear on all bands—even ten.

You've probably noticed from the schematic that I didn't include eighty meters in the linear. If you want to, you'll have to use larger pi network capacitors or switch in some extra capacitance on this band.

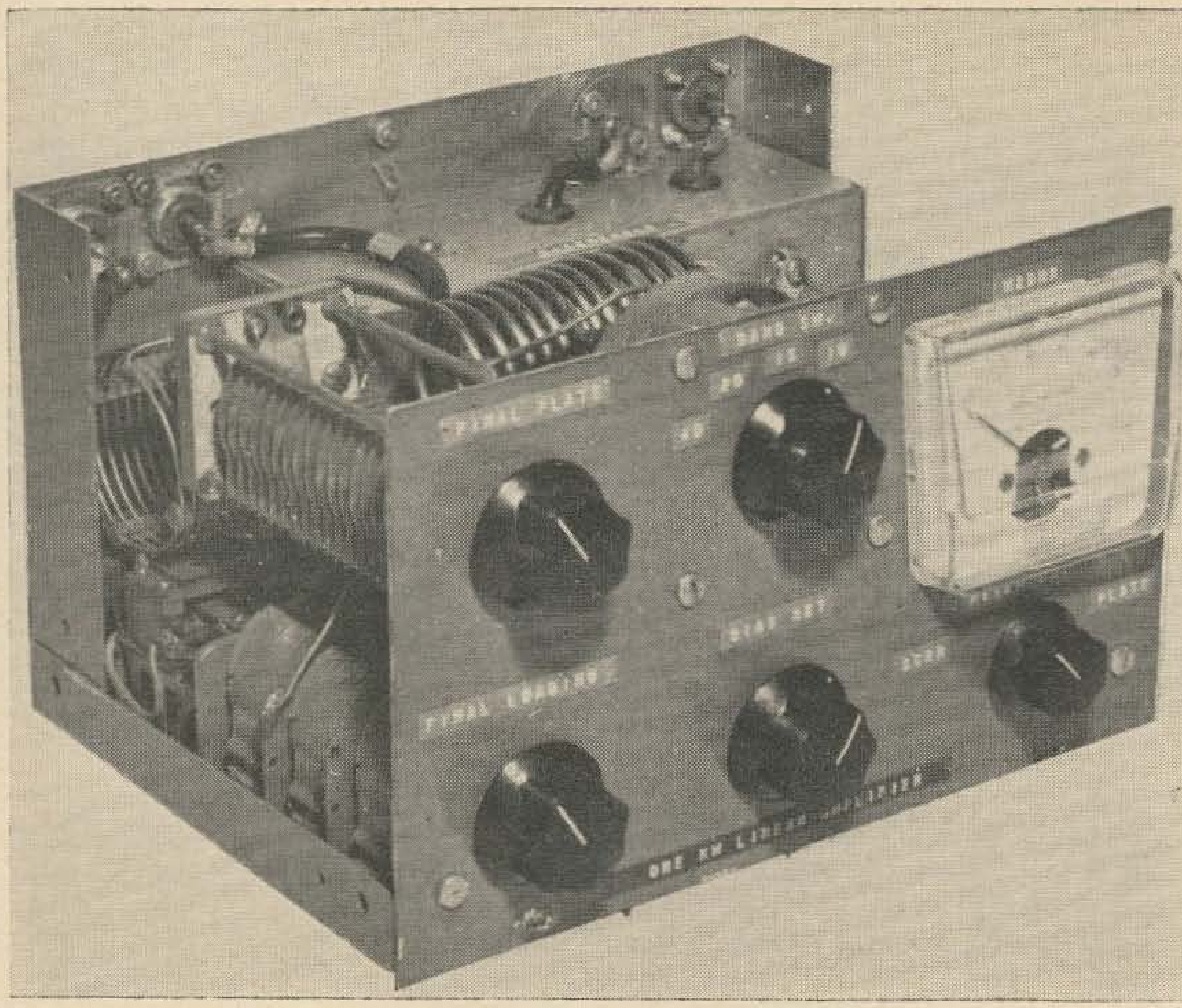
I didn't use on L network in the cathode circuit of the linear. An RF choke worked fine. If your exciter output is less than 65 watts PEP, you probably will need a tuned input.

The amplifier was neutralized to improve its stability, but this turned out to be unnecessary. The neutralizing capacitor is a piece of brass flat stock ¼" by 7" mounted ¼" away from the plates of the final tubes. It is supported by three steatite stand-offs one inch long.

The screen and cathode currents are read with the flip of the meter switch. When the amplifier is properly loaded, cathode current



The side view of the linear shows the 4CX250B's mounted horizontally with the blower fastened to the back of the cabinet.



The 4CX250B linear. Operation is very simple. The only controls are tune, load, bandswitch, meter and bias set.

is about 550 ma at 2000 volts. The screen current is 50 to 60 ma at 350 volts. This current should not be exceeded; if it is too high, increase loading. If the current is too low or negative reduce loading. These readings are with full carrier.

Bias should be set for about 100 to 150 ma resting current with 2000 volts on the plates. Once set, this current does not need adjustment.

The 40 cfm squirrel-cage blower is probably a little husky for this job, but the extra air helps to keep the tubes real cool. Incidentally, the amplifier helps heat the car on cold mornings with its 200 watt dissipation!

Checks with a Collins watt meter and the old fashioned RF ammeter and voltmeter shows that the amplifier gives excellent efficiency. One kilowatt DC in gives about 650 watts RF out.

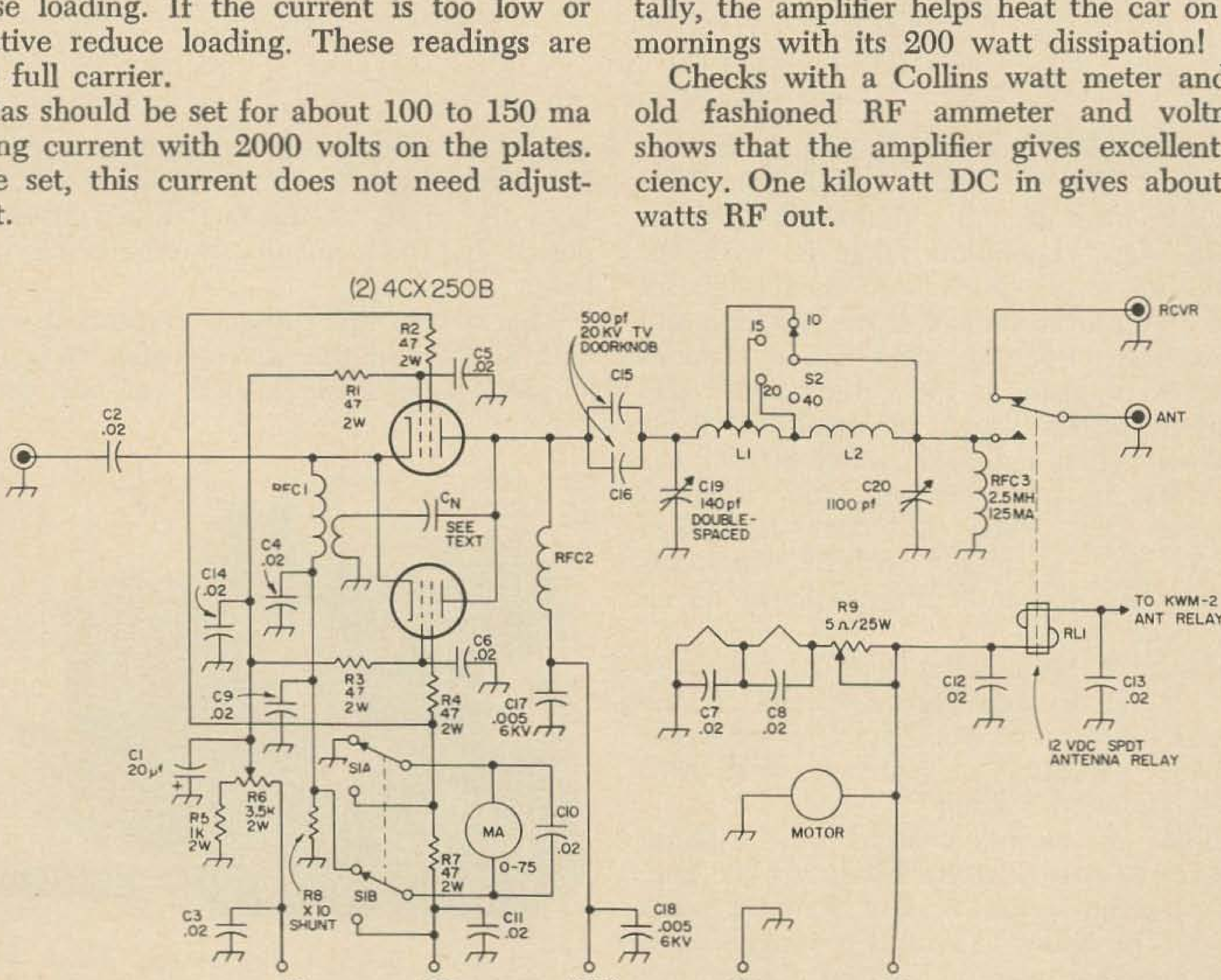
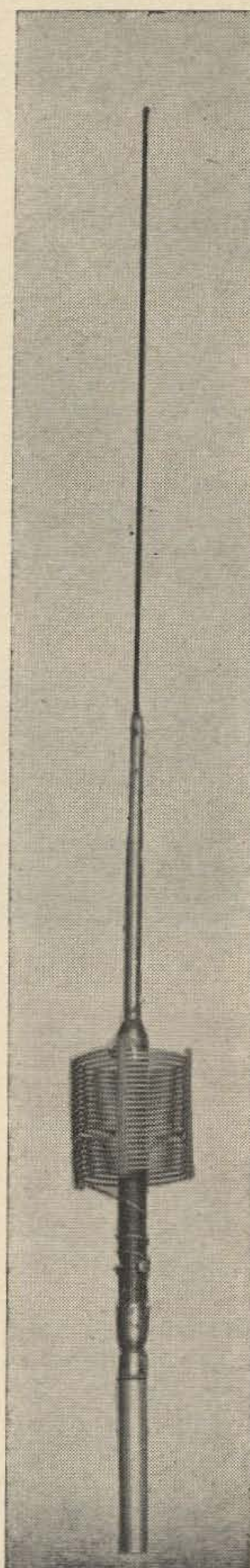


Fig. 3. The linear amplifier for 2 KW mobile.

The modified Newtronics top loading antenna. As mentioned in the text, commercial antennas for a full KW are now available.



The Antenna

Yes, you are correct in wondering what commercial mobile antenna will handle two kilowatts. I have tried a variety of commercial and home brew designs: helical wound, base loaded, center loaded, top loaded and trap. I found that the center loaded type with three foot base section, loading coil and five foot top section was quite effective. The loading coil was of heavy B & W stock two and a half inches in diameter. A separate coil was plugged in for each band. This antenna was used for about four years of mobile hamming.

But I am curious, so I wanted to try the Newtronics Hustler top loaded antenna. I did. But, as I feared, the loading coil was not designed for this power. The new high power coils would be fine, but this was before they were announced, so I made my own coil from more B & W stock. The one illustrated is for twenty meters. Be sure to coat the coil thoroughly with Krylon or epoxy if you make your own coil. Otherwise, water between turns will short out part of the winding with attendant loading problems and fireworks.

I made a few tests and found that the top loaded antenna seemed to increase both received and transmitted signals over a center loaded whip in the same position on the car.

It is easy to find resonance with this antenna. Just slide the top tuning rod in and out a quarter inch at a time while checking the SWR. I used a 20½ foot length of RG-8/U between the linear and the antenna.

Corona loss at this high power is high. Even so, all signal reports have proven to me that the extra power has more than paid for itself. I'm happy with my high power mobile. I think you will be, too.

. . . W2DMK

Photography by Don Abbott WA2MZQ.

Meterama

Howard Burgess W5WGF, 1801 Dorothy Street N.E. Albuquerque, New Mexico

Meters are one of the few electronic components that impress both technical and nontechnical hams. To the technician they show what is happening in a circuit. To the nontechnical person only a flashing red light outranks them as the sign of a true professional.

But meters have another feature that is less appealing. They are one of the most expensive parts in a circuit. If your use of meters is limited by their cost, perhaps you are overlooking a source of bargains that is passed up every day by many.

There is an almost endless supply of meters that no one seems to want. Thousands of instruments that originally cost as high as $150 or more apiece are available for less than 2¢ on the dollar. These are the meters with the oddball scales. They are calibrated in everything from "miles-per-hour" to "Degrees C." They can be found on bargain counters, in salvage yards, old military equipment, and all sorts of obsolete testers.

Perhaps you are wondering why a meter that costs as much as $150 may sell for as low as $2. The answer is simple. Who wants to measure plate current in "pounds-per-inch?" However, with a few simple tools and some spare time, most of these units can be converted into beautiful instruments. Even custom-tailored or personalized scales with professional quality are simple to turn out.

The first step in converting these meters is to find out as much as possible about the basic movement. The foundation unit, or movement, of almost all panel meters is either a microammeter or milliammeter. This applies even to voltmeters. Even though the scale may read in "gallons-per-minute," the chances are very good that it is still a DC meter.

To make good use of a meter it is necessary to know how much current is required to make it read full scale. Many times this information is simple to find; it may even by written in the very lower portion of the face plate in tiny figures. Figures such as "FS=100µa" mean that the meter is 100 microamperes full scale. Or, "1MAFS" means that "1 milliampere" will give a "full scale" reading.

If the meter happens to be one with the "0" in the center of the scale, the letters down in the corner may read ES=1MA. This says the meter will read full scale "each side" with "one milliampere."

If the meter happens to be one that was made for military use, you may find an odd assortment of numbers and letters on the face. A typical meter can have something like this on the face:

MR13S001DCMAR

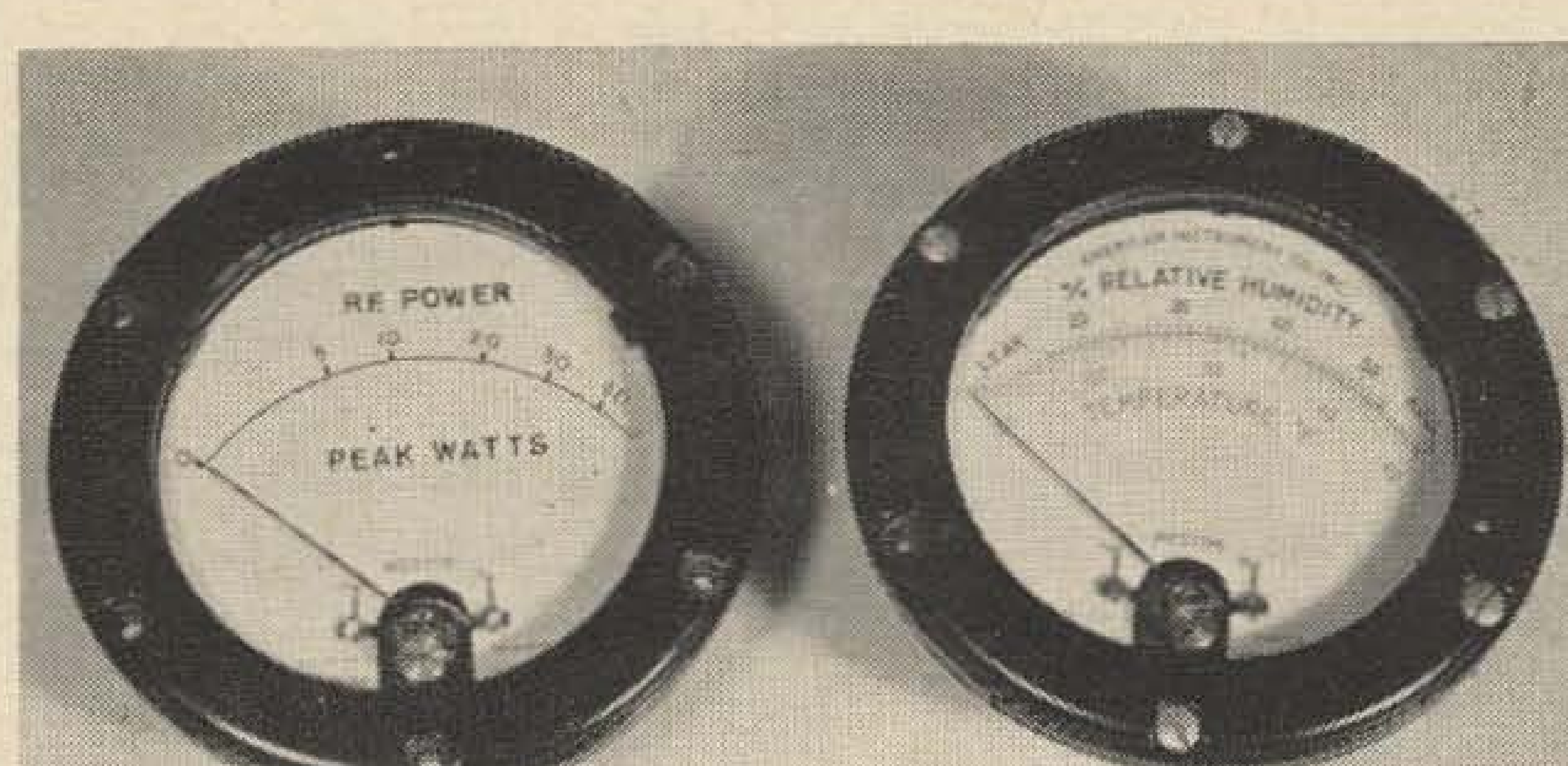
The first five places on the left can be disregarded. They are coded symbols that tell the size, shape, and color of the meter. You already know this if you have the meter. The eight places on the right carry the information that is important.

The three places in the center shown as "full-scale-value" tell what the meter reads full scale. In this meter it is 1. The next two places show what kind of current the meter reads and for this meter is DC. The two places following tell the electrical units in which the meter is calibrated and in milliamperes. The final R tells that the meter is ruggedized.

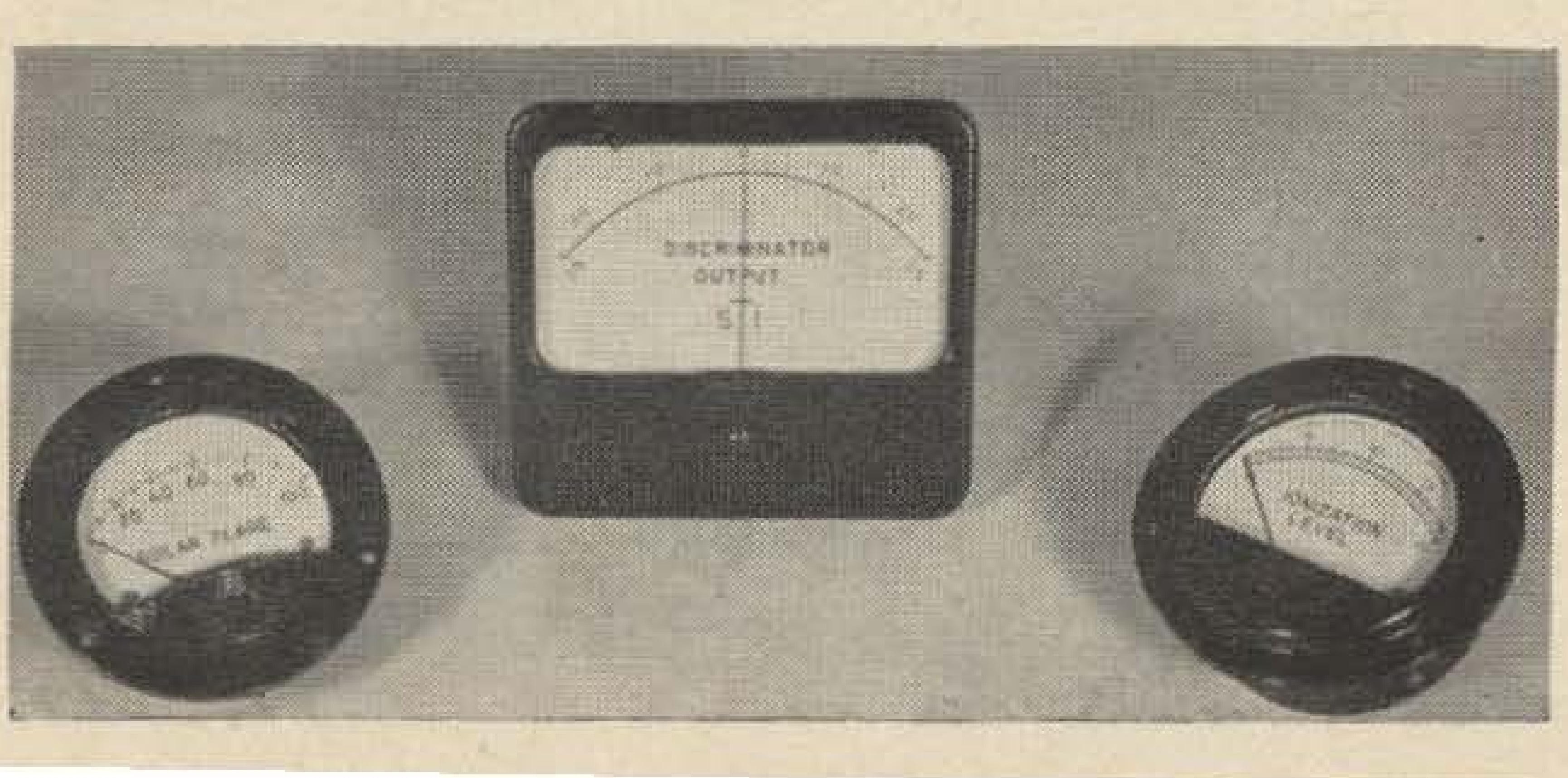
If the three places that are used to indicate "full-scale-value" happen to have an R in the center space, the R is read as a decimal point. As an example the figures 2R5 would indicate a full scale value of 2.5 units.

When the scale gives no clue to the meter's full scale sensitivity, it will be necessary to run a few simple tests. The circuit shown in **Fig. 1** can be put together in a few minutes for quick measurements. The resistor R3 will limit the maximum current that can be put through the meters. The meter shown as X is the one being tested. Meter S is a meter with known calibration and is used as a reference. The meter or meters used at S should be able to cover the range from 100 µa to 100 ma or more. This spread will accommodate most basic meter movements.

When the circuit is complete the resistors are adjusted until meter X reads full scale. The full scale sensitivity of the unknown meter is then read on meter S. As a precaution to safe-



Before and after. The odd temperature meter at the right was changed into the indicator for an RF power meter. In this case a full new scale was made.



Three old clunkers plus a few hours work produced these three custom meters for special test equipment.

The meter sensitivity is sometimes given inside the case.

guard the meters adjustments should be started with the largest value of R3 and decreased as required.

The accuracy of the calibration will depend to a large extent on the meter S. This meter should be the best available but even a volt-ohm-milliammeter can serve the purpose.

When the sensitivity has been determined, the uses to which the meter can be put is easily decided. We can now rework the scale accordingly.

Before opening the case pick a working area with good light and free of dust, *especially small magnetic particles* such as filings. The case is carefully opened (usually by removing the small screws around the outside of the case shell.) Remove the screws that hold the face on, being very careful not to touch the pointer. The face can then be *slid* out from under the pointer. A glass bowl should be turned upside down over the open meter to protect it while the scale is being reworked.

In some panel meters the scale is made of paper and glued to a metal plate. However in most cases it is a coating of white enamel on the metal plate. With the enamel scale unwanted lettering can usually be removed with a little careful rubbing and a small amount of cleanser such as Ajax moistened with water. A clean ink eraser or the edge of a razor blade can be used to clean up small areas.

If the divisions on the original scale can be used or adapted they should be left on the face. New scale divisions should not be attempted without some advance practice. Of course new scales can be made on paper first and then cemented to the face plate.

When a meter is reworked, even the best intentions and effort can end with poor results if crude lettering is used. If more than one or two meters are to be converted, it is well worth the investment to obtain a few simple lettering tools. For professional-looking work, we would suggest several pieces of *LeRoy* equipment. (LeRoy is a trade name used by the Keuffel and Esser Co.)

In the LeRoy method a special pen point is held in a scribing tool which follows a template. The template is engraved with the alphabet and numbers and is available to give all sizes and types of characters and numbers. With a few minutes of practice, perfect lettering is possible. A complete set of LeRoy equipment is far more expensive than most of us can afford. However, pieces can be purchased separately as needed for meter work and the total cost will be less than the price of a new meter.

In addition to their value in meter work the special pens can be used to letter panels, chassis, drawings, and almost anything requiring lettering. Various sizes of templates can be added to the collection as needed. As a start we would suggest a scriber (No. 3237-2), a size 120 template (No. 3240) and a size 0 pen. Larger or smaller letters can be had by using other templates. The pen size will determine the thickness of the line. Size 000 pen makes a very fine hair line and the width will increase with an increase in pen number. Size 6 will give a line almost 1/16 inch wide. Almost any good drawing ink can be used in the pen. This equipment can be obtained from stores selling engineering drawing supplies.

The meter face to be lettered should be fastened firmly to a flat surface or drawing board with masking tape. Before beginning on the meter face a few practice runs should be made on paper to determine the proper spacing. Be sure to use a light touch when working on the enamel meter face. This will keep the pen from scratching the enamel under the ink. If a mistake is made, the entire ink work can be washed off and a fresh start made with no scratch marks visible.

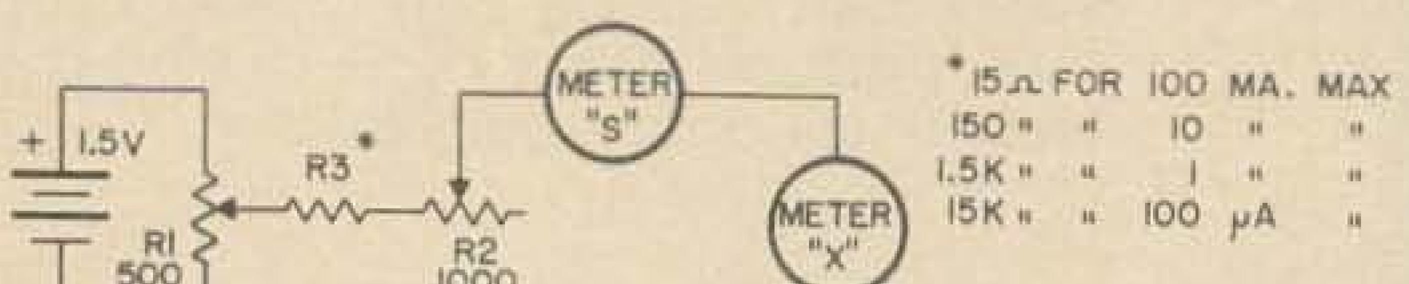
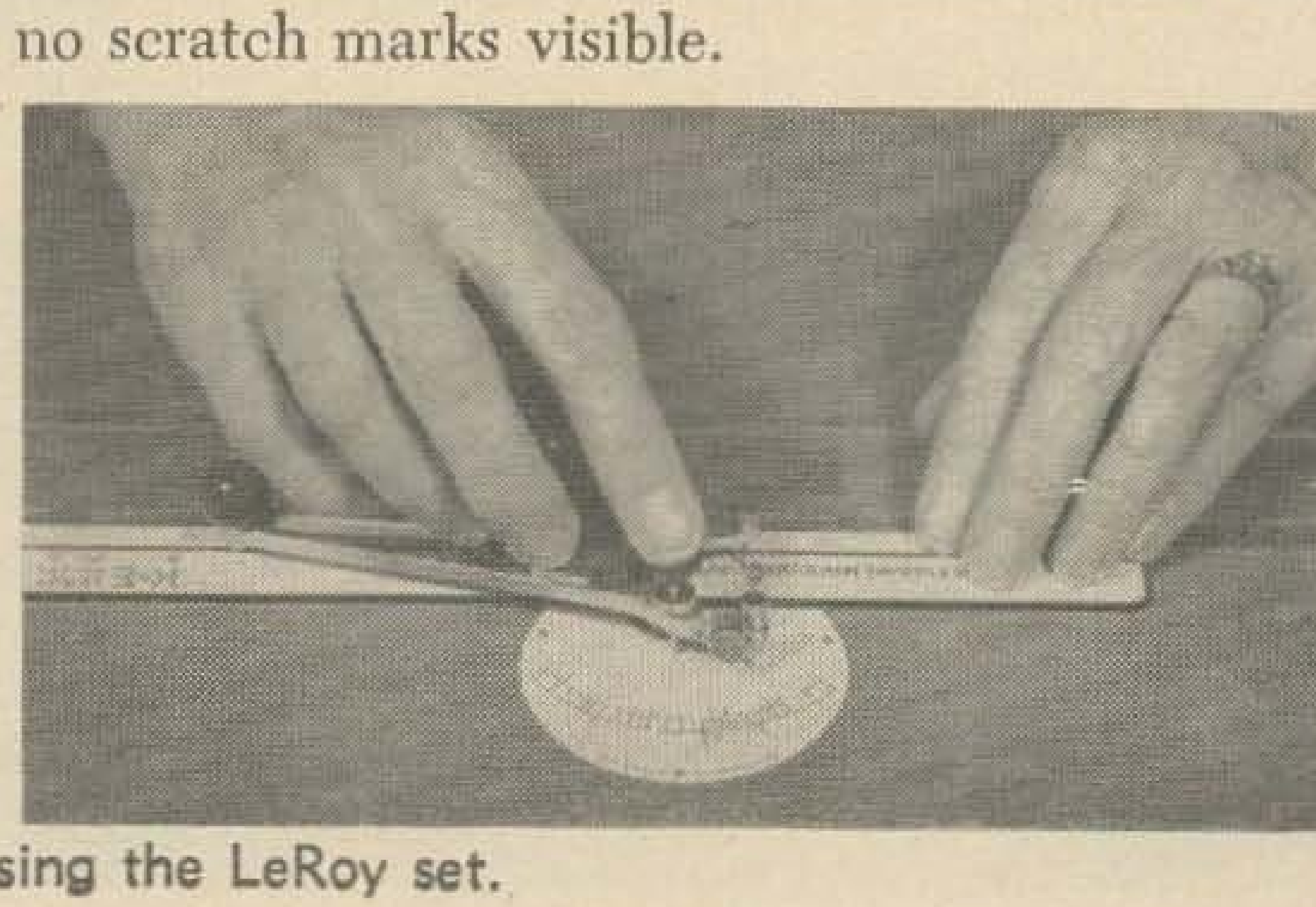


Fig. 1. Determining the sensitivity of the meter.



Using the LeRoy set.

After the face of the meter has been reworked and the meter reassembled, the meter can be given a complete calibration or the sensitivity can be altered by using shunts. The selection and use of shunts and dropping resistors will not be covered here as almost all radio handbooks carry a chapter on this subject.

The final calibration should be made by comparing the instrument with the best standard that you have available. If you plan to do a number of meters, a special calibrator is a great time saver, and the construction of such a unit is relatively simple.

And what if you do flub the first one, or even the second one? The next one will be a masterpiece. Just remember: *meters have a unique distinction!* Where else can you write off a $150 loss on a $2 investment?

. . . W5WGF

Silver Plating

Ever put off or forgotten about building a VHF or UHF tuned line tank circuit because construction techniques for optimum performance required silver plating? Well, no more is there need to evacuate the fish population from the aquarium for its use as an electrolysis tank . . . or turn your wallet over to a professional plating business.

A product is now on the market in a powder form which enables you to silver plate at home with only such simple articles as abrasive cloth and a slightly damp cloth pad! And it really works!

Known as "Cool-Amp Silver Plating Powder", it deposits a genuine coat of silver that will not peel off and is equal to electroplating. Simple instructions for use consist of only two basic steps:

(1) Polish the copper, brass or bronze surface.

(2) Apply the silver plating powder with a slightly damp cloth pad, about the size of a half dollar, by alternately dipping into the powder and rubbing firmly on the metal.

The silver plating powder may be ordered direct from the manufacturer, The Cool-Amp Company, 8603 S.W. 17th Avenue, Portland 19, Oregon. A pound bottle will silver plate approximately 6,000 square inches. The price is $13.50 for the pound, however in view of the large area which can be plated, the cost and the powder could be split between two or more of the local amateur radio gang.

. . . W3WTO

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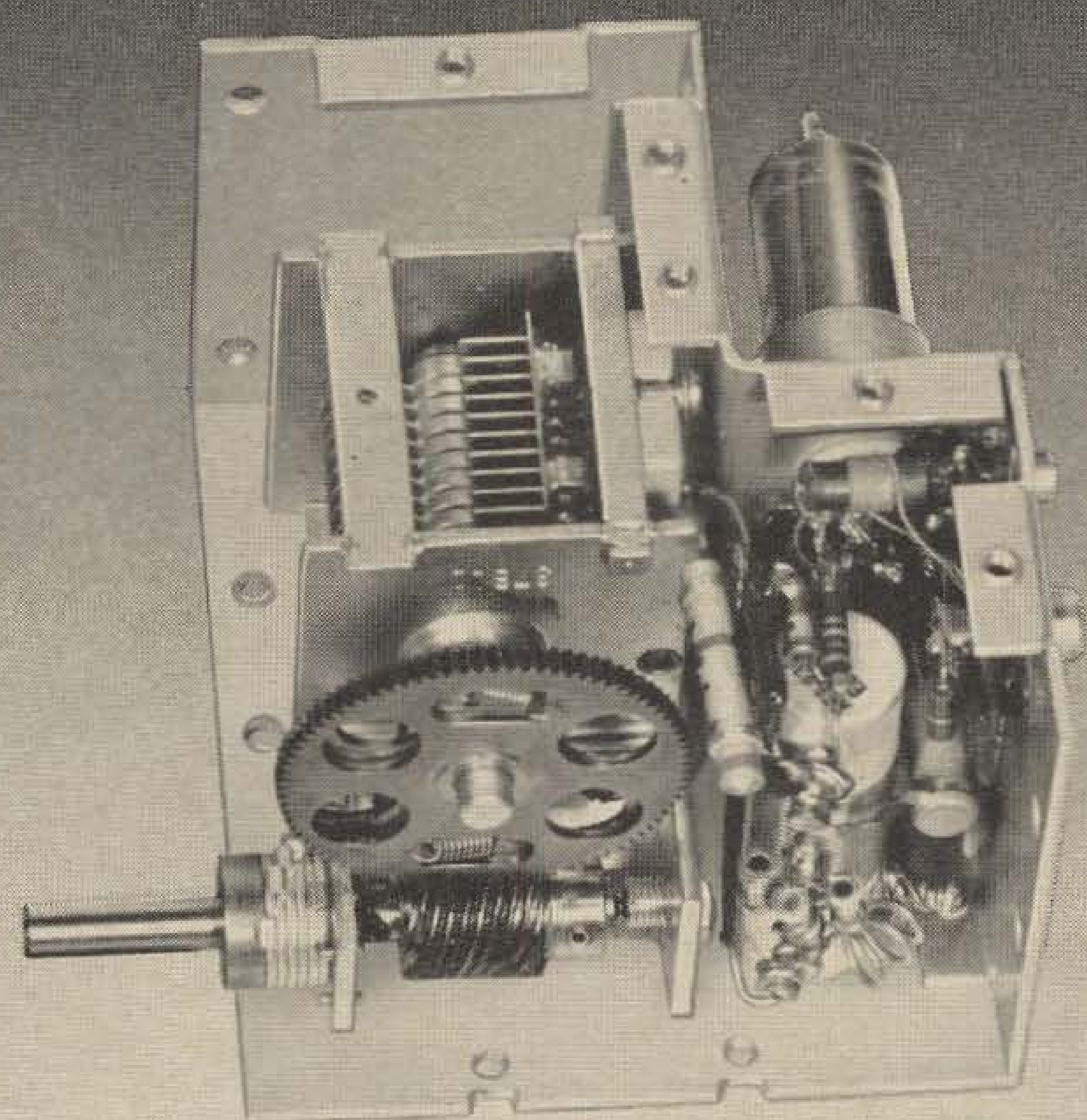

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Kit SB-300, less speaker, 23 lbs. . . . $27 dn., $22 mo. **$265.00**

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Kit SB-110, (less spkr. & pwr. supply), 23 lbs. . . . $32 dn.,

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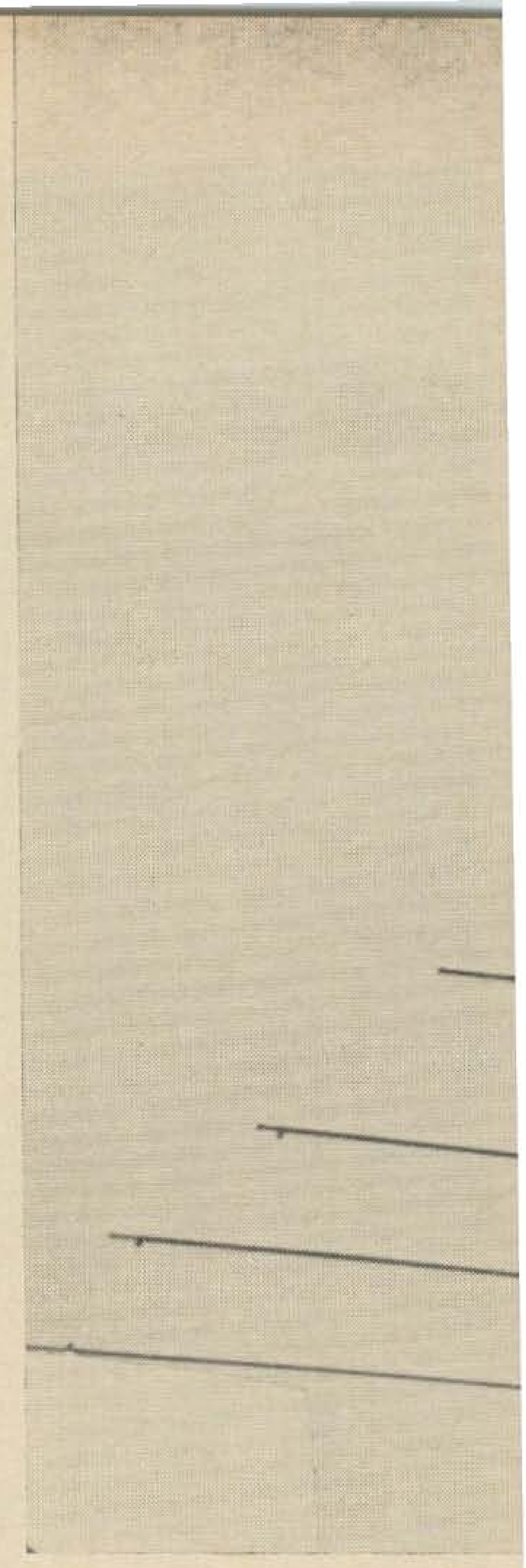
Six for Six



As all hams know, activity on six has been very high since the band was opened to Technicians. Any one who is determined can learn enough to pass a Tech license test in a fairly short time. So now this is the second largest class of licenses and most active Techs are on six. This has caused a lot of QRM on the band; only the best equipment is useful for fighting the other stations, particularly for DX.

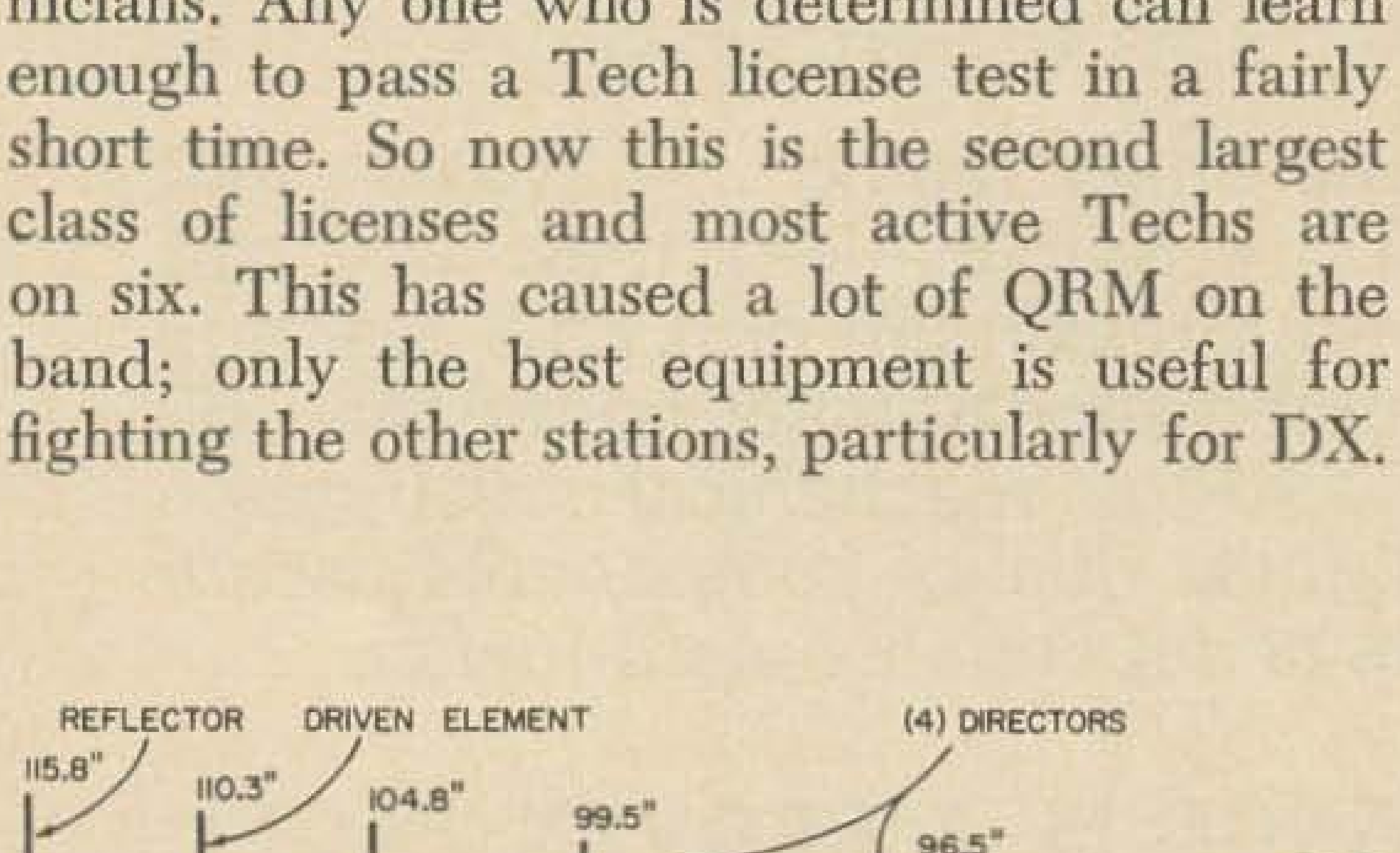


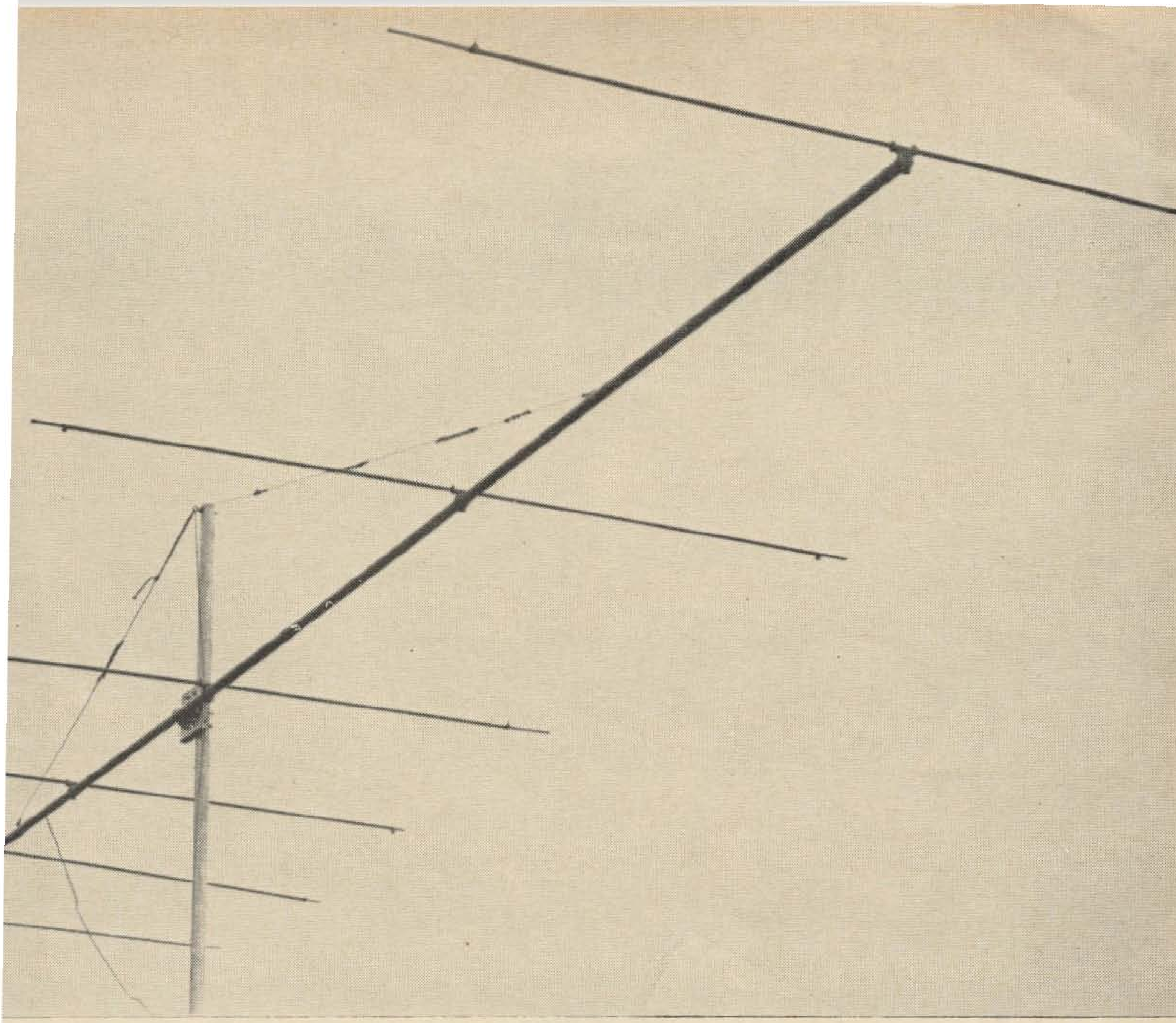
Fig. 1. Dimensions of the six element yagi.

This antenna was built for high gain to provide excellent performance on six. It's a wide spaced six element yagi on a 24 foot boom. It's made of aluminum for lightness, low cost and easy construction. The SWR is excellent over the most used part of the band.

Each element is about a half wave long. The exact length can best be found by experimenting. The distance between the elements can also be adjusted for best results, a compromise between gain, side lobes, front-to-back ratio, SWR, etc. The dimensions given worked very well for me and are a good starting point.

Unfortunately, 24 foot aluminum poles for the boom are hard to find. I used two twelve foot 1¼ inch 0.058 wall poles and butted them together with an eight foot 1⅛ inch dowel in the center furnishing strength. A short piece of 1⅜ inch tubing over the joint gives electrical continuity.

The elements are held on with Cesco Large Yagi Clamps. If you can't locate them, you might try improvising from broken TV antennas, etc. I made each element a little short and slid a length of ⅝ inch tubing in each end for accurate adjustment of length.



A wide spaced antenna such as this one has a fairly high feed impedance—at least compared to close spaced beams. There are a number of different matching systems that you can use. I used the Infinite Impedance Antenna Match which was described by W6NAT in the March 1963 issue of 73. It's very simple.

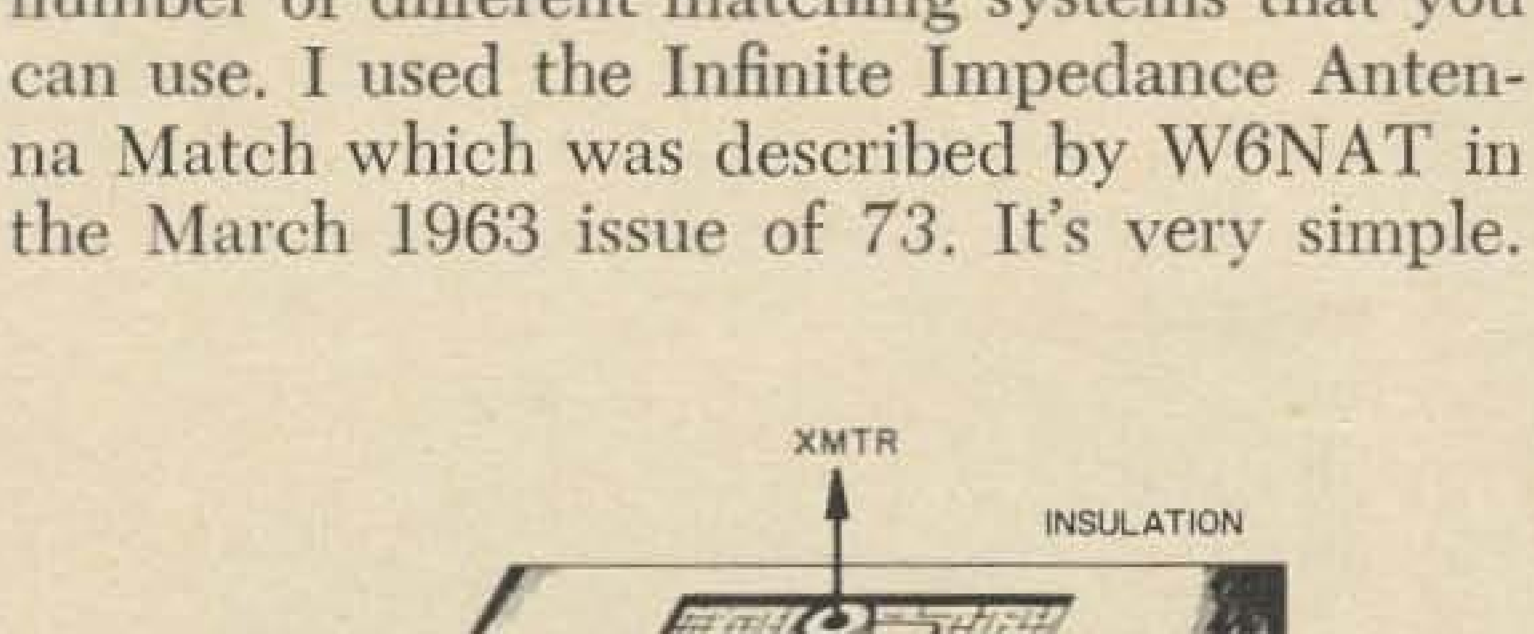


Fig. 2. Matching system.

Take a quarter wave length of RG-58/U. Find its center. Remove one inch of insulation at the center. Carefully cut the shield apart, but leave the insulation and center conductor intact. Gather the pieces of shield together and connect a coax connector to them with the center connector going to one side and the outside to the other. Tape the joint. Now short each end of the quarterwave and tape. This quarterwave dipole goes inside the driven element, which is cut in half and insulated from the boom with a piece of plastic. Notice that there is no direct connection to the driven element.

Mount the antenna at its center of balance with a home-brew wooden mast mount or with a Cesco mount. I added two wire supports from above the antenna to the boom to prevent sag. Break these cables with egg insulators to prevent unwanted resonances messing up the pattern of the beam.

Adjust the element lengths for minimum SWR and you're ready to go. I'm sure that you'll be pleased with the excellent results and long life of this antenna.

. . . WB2CQM

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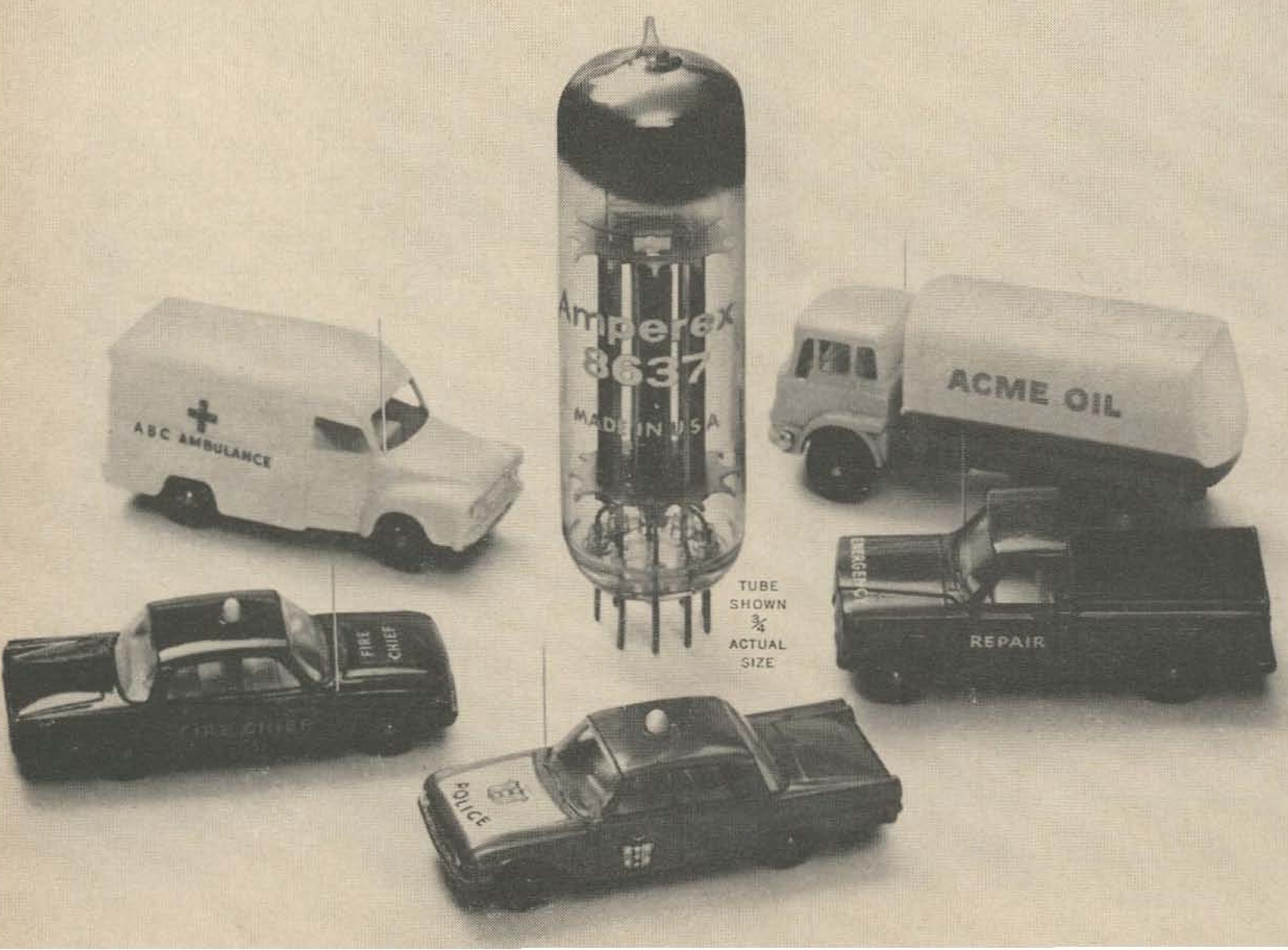

It's the new Amperex 8637, a long-life, radiation-cooled, beam-power twin-tetrode. It's the world's first JOB-RATED tube for 60 watt intermittent brief-talk, mobile transmitter service. (It delivers 72 watts from less than 3 watts drive power under PTTS* conditions.) Its quality is strictly in keeping with Amperex standards of excellence and yet it is only a fraction of the size of conventional tubes and costs only one-third the price.

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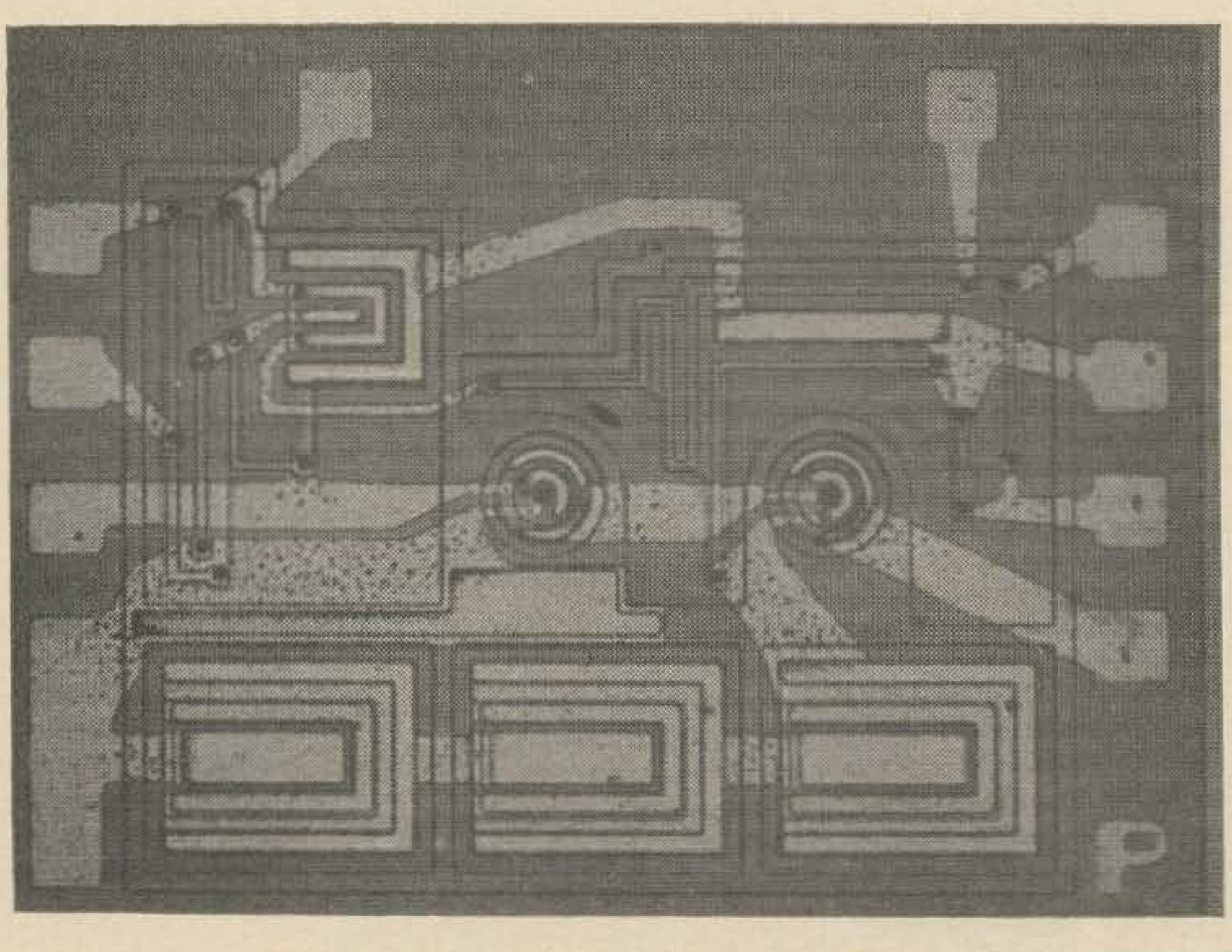
A State-of-the-Art Converter

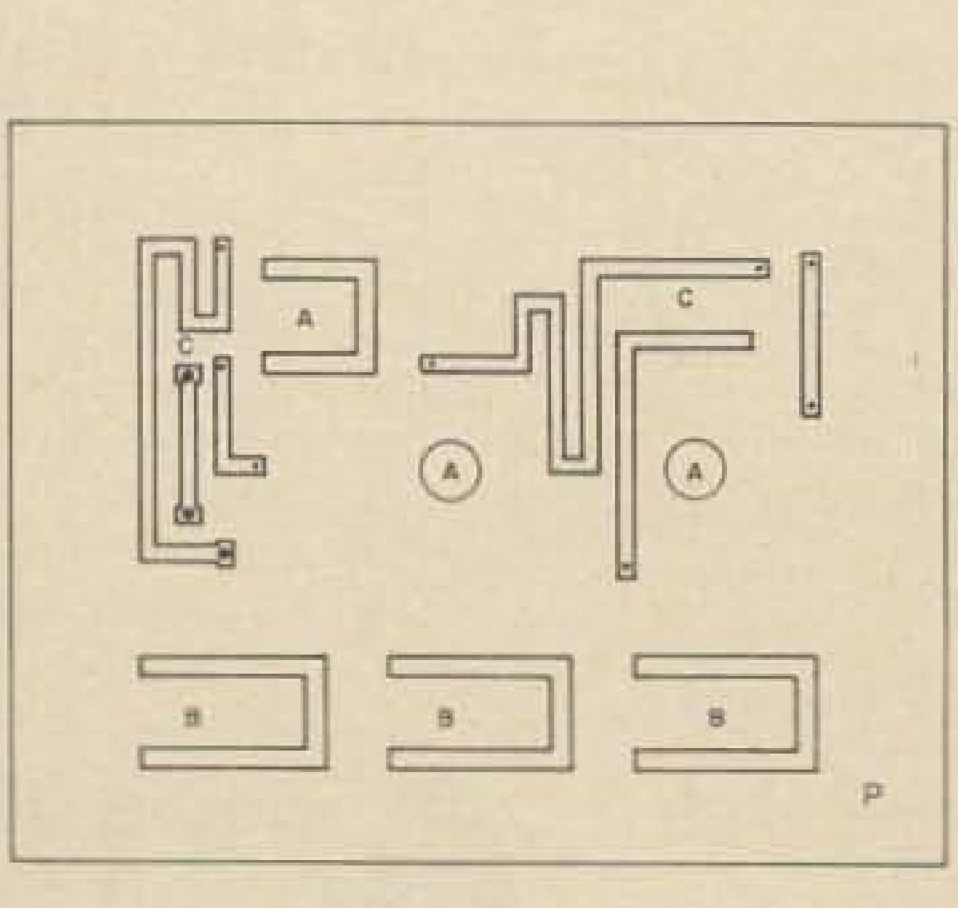
The ham who wants to keep abreast of new developments and uses of semiconductors will find this converter interesting—though the cost is likely to discourage any desire to build it. This six meter converter uses three Philco PA713 silicon integrated microcircuits. It consumes about 66 mw at 6 volts and provides a 7 mc *if* output. Overall power gain is 40 db and the noise figure is a not-to-outstanding 7 db.

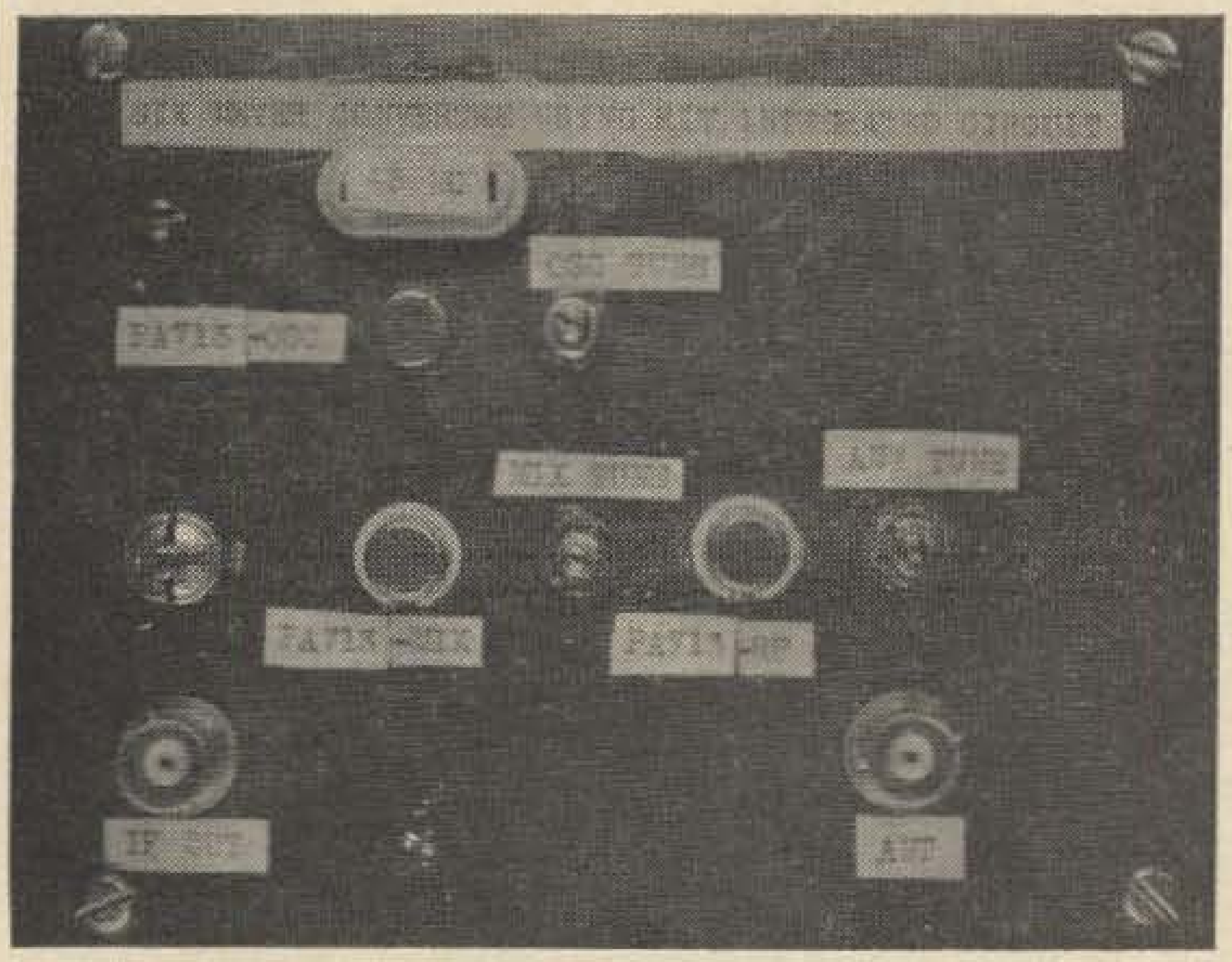
An integrated circuit is a circuit which has its passive and active components combined in a thin block of single-crystal silicon. The circuit components (resistors, transistors and diodes in the case of the PA713) are formed in the silicon by correct programming of p-type and n-type impurity diffusions. This programming includes the use of silicon dioxide (SiO_2) as a mask for controlling the geometry of components. SiO_2 is easily formed on the surface of silicon by high temperature oxidation techniques. In areas where diffusion of an impurity is desired, the oxide mask is removed by a photoengraving process. Narrow p-n junction channels surrounding the circuit components are formed simultaneously with the fabrication of the components. Proper biasing of these p-n junction channels achieves the required electrical isolation of components. Many microcircuits are fabricated simultaneously on a single silicon wafer of 1" to 1½" diameter and then separated into individual circuit chips.

The PA713 microcircuit is a low power, direct coupled amplifier intended for rf, *if* and video service. The locations of the transistors, diodes and resistors in the photomicrograph are indicated by the letters A, B and C

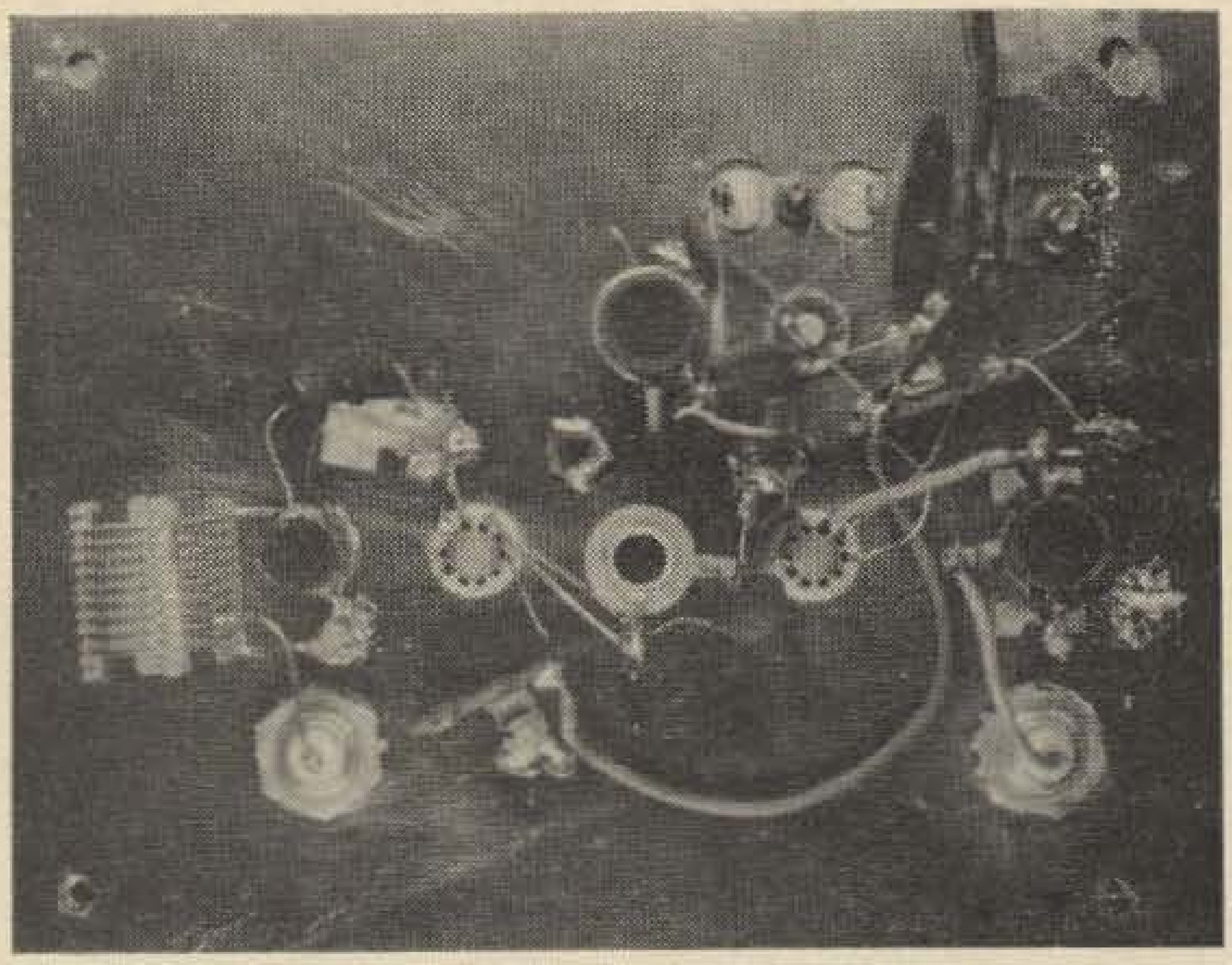


Photomicrograph of the PA713 silicon integrated microcircuit. The drawing below gives the locations of the parts referred to in the text.





Top view of the microcircuit converter.



Bottom view of the converter.

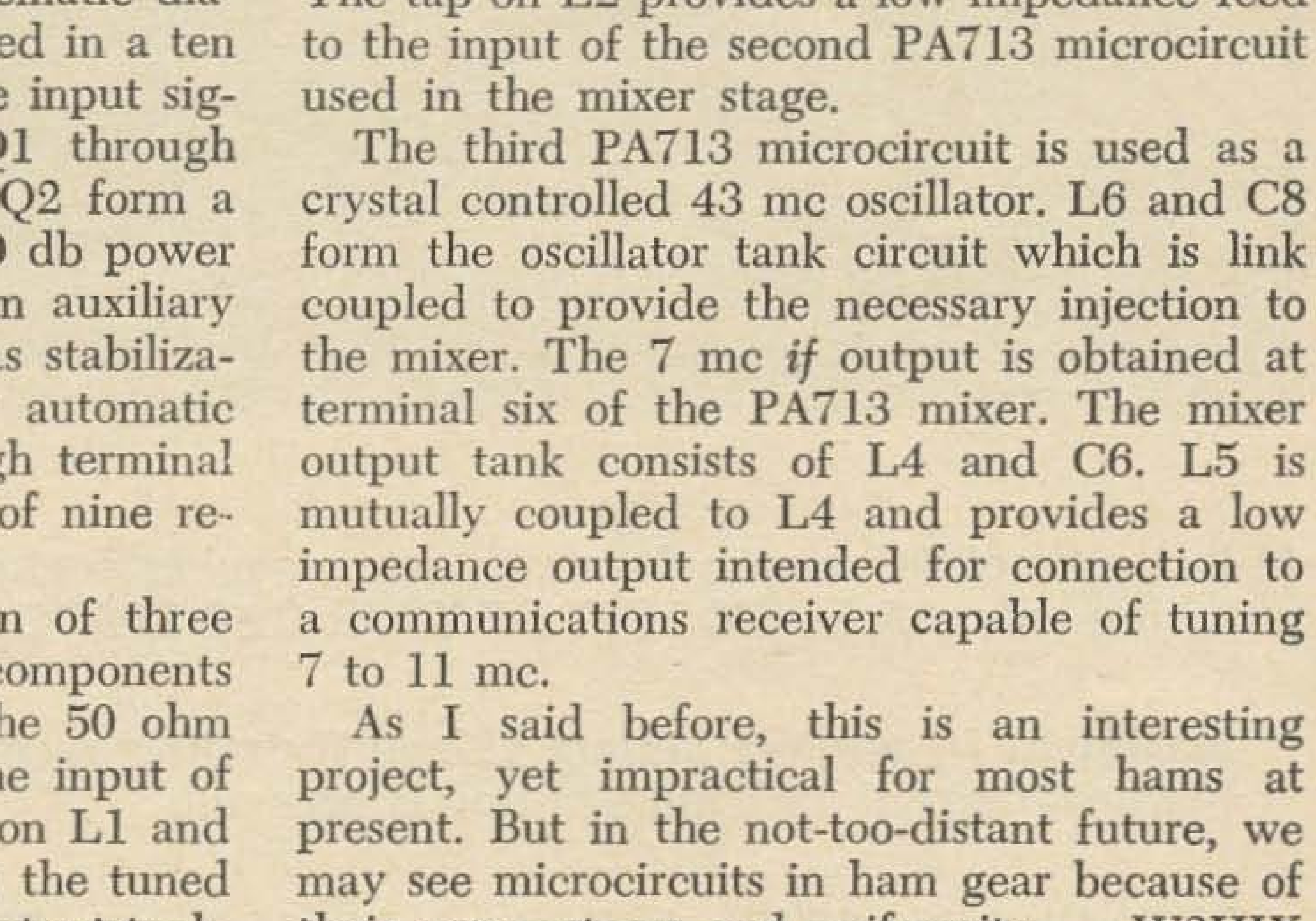
respectively. **Fig. 1.** shows the schematic diagram of the PA713 which is enclosed in a ten lead low profile TO-5 package. The input signal is applied to the base of Q1 through terminal four. Transistors Q1 and Q2 form a cascode circuit capable of about 20 db power gain at 50 mc. Transistor Q3 is an auxiliary emitter follower which provides bias stabilization and bias control. Manual or automatic gain control can be applied through terminal one. The biasing network consists of nine resistors and three diodes.

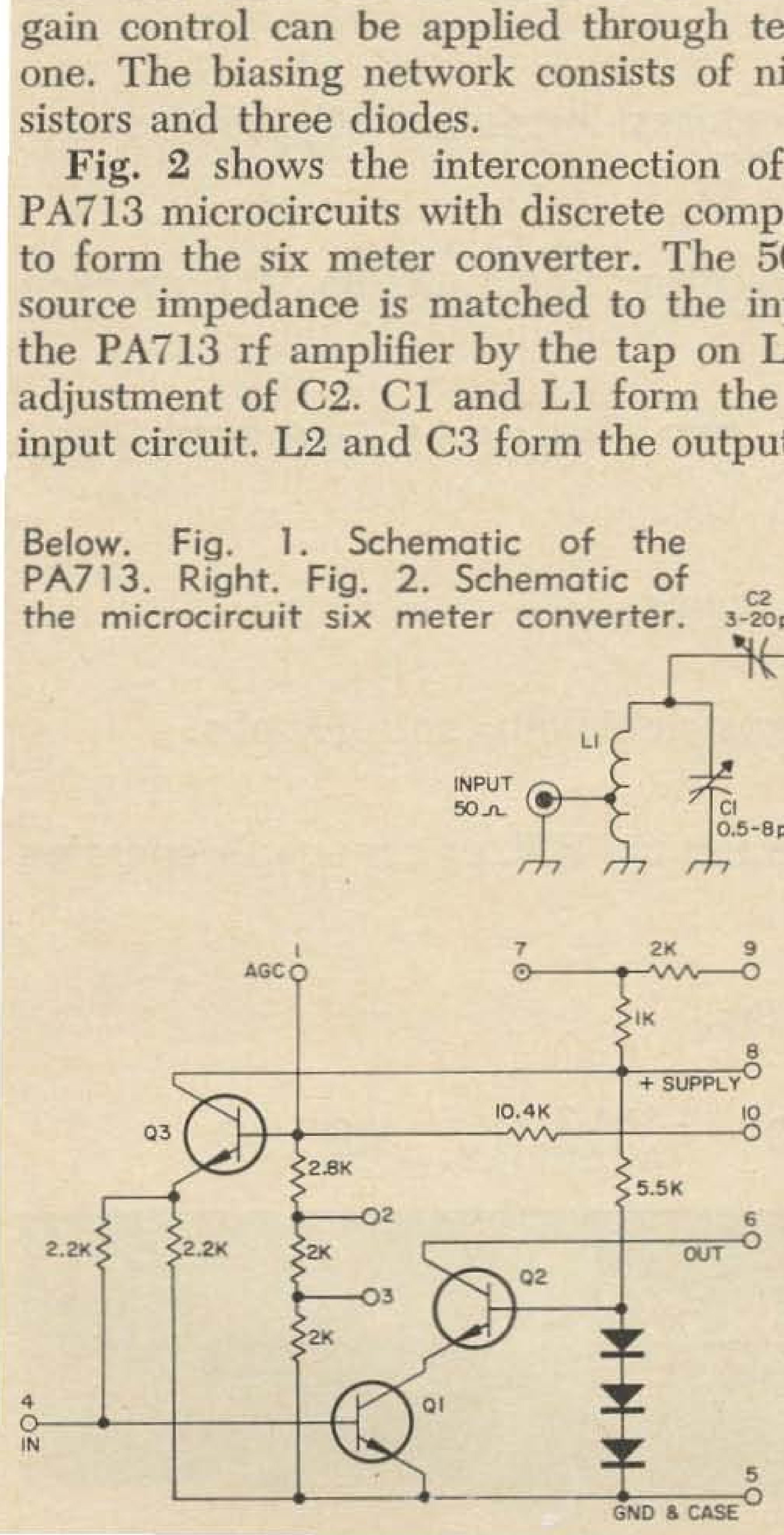
Fig. 2 shows the interconnection of three PA713 microcircuits with discrete components to form the six meter converter. The 50 ohm source impedance is matched to the input of the PA713 rf amplifier by the tap on L1 and adjustment of C2. C1 and L1 form the tuned input circuit. L2 and C3 form the output tank. The tap on L2 provides a low impedance feed to the input of the second PA713 microcircuit used in the mixer stage.

The third PA713 microcircuit is used as a crystal controlled 43 mc oscillator. L6 and C8 form the oscillator tank circuit which is link coupled to provide the necessary injection to the mixer. The 7 mc *if* output is obtained at terminal six of the PA713 mixer. The mixer output tank consists of L4 and C6. L5 is mutually coupled to L4 and provides a low impedance output intended for connection to a communications receiver capable of tuning 7 to 11 mc.

As I said before, this is an interesting project, yet impractical for most hams at present. But in the not-too-distant future, we may see microcircuits in ham gear because of their compactness and uniformity. . . W3HIX

Below. Fig. 1. Schematic of the PA713. Right. Fig. 2. Schematic of the microcircuit six meter converter.





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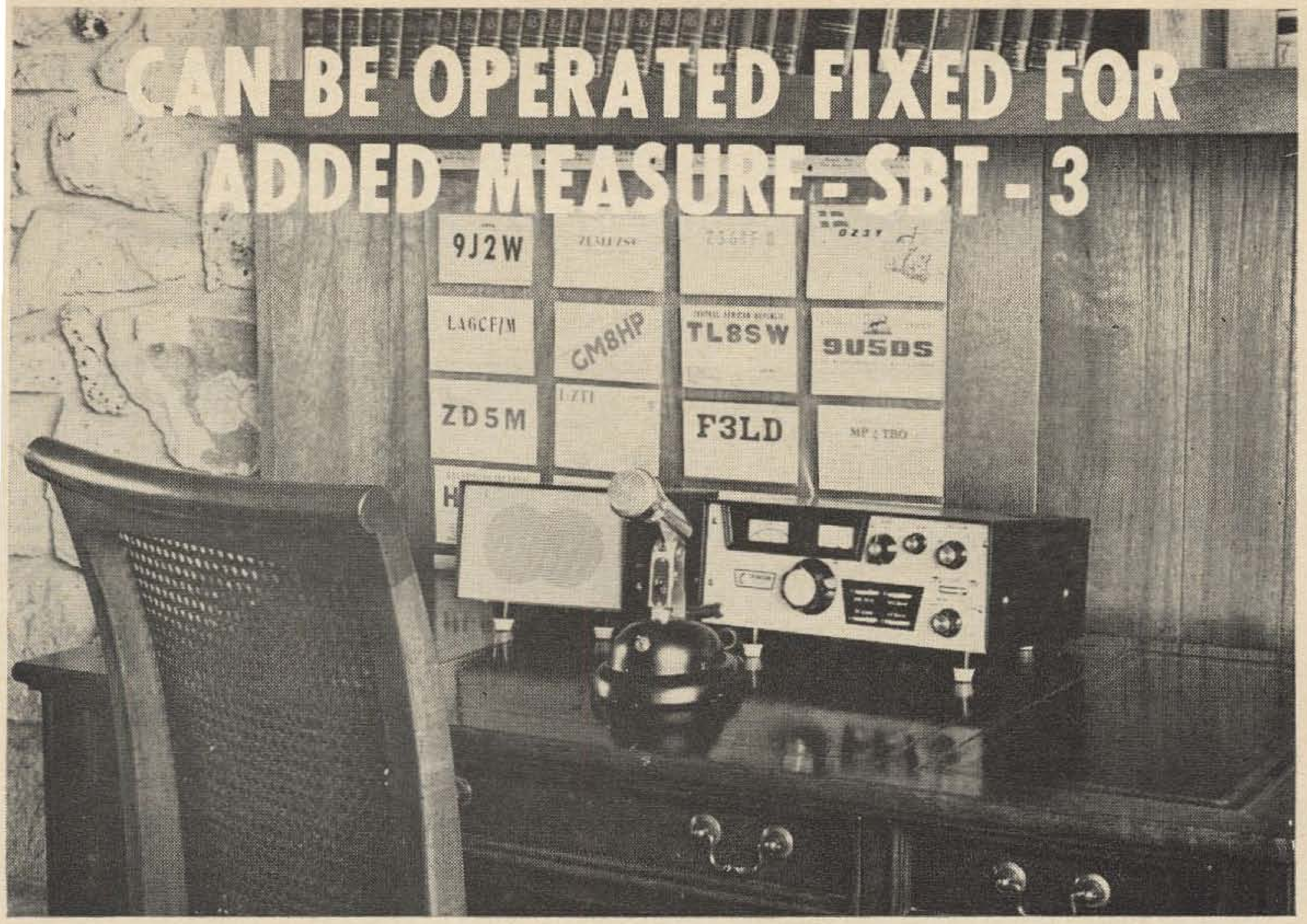

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Semiconductors: 2—8042 instant heating tubes, 18 transistors, 2—varicaps, 1—zener, 9 diodes

TRANSMITTER

Power Input: 165W pep

Carrier Suppression: —45 DB

S.B. Selection: 80-40M lower, 20M upper

Unwanted SB: —40 DB

Ant. Imped.: 30-100 ohm adj.

Power Consumption: .5 amps Receive, 12-15 amps SSB XMIT.

Operation: P. T. T. No tube filament on in rec.

RECEIVER

Sensitivity: .5μv for 10 DB S + N/N

Selectivity: 3 KC @ 6 DB

Spurious: Image better than 60 DB

Stability: Less 100 cps in any 15 min. period under normal ambient conditions

Audio Output: 2 watts

SBT-3 $299.50 | **SBD-3A DC SUPPLY $99.50** | **SBA-3 AC CONSOLE $99.50**

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Sylvia Margolis

Hamfest Out on a Limb

To us they looked like Americans—crewcut, iced coke, T-bone steaks—the lot. They talked like Americans and the hospitality they gave us could have originated only in God's own country. The gear was American, lush Collins, slick Johnson, snazzy Drake. The names were American—Bill, Scotty, Ray, Chuck. As for the dinner—who in Germany BUT Americans would serve thick slices of roast beef WITH fried chicken at the same meal? And on a patio too, already!

Yet the Daves and the Franks and the Toms had one bitter complaint. "O.K. So we're Americans with DL calls. But as far as the ham publications go we might as well be foreigners. Nobody wants to know what or how we are doing!"

True, it was only a chance snippet in the British ham press that drew us to Heidelberg for the Fourth Annual DL4/DL5 Hamfest. On vacation in Europe from our home near London, we planned to take in this little bit of the U.S.A. as part of the trip. We'd sent them a wire from our previous campsite, 70 miles away, but were not certain that it would be delivered in time, so there was no surety that we were expected.

Because no reciprocity exists yet between Britain, Germany and the U.S., we had had to strip the mobile gear out of the car. The most glamorous woman caught without her girdle wouldn't know the extent of that caught-with-your-pants-down embarrassment of the keen mobile who is forced to go naked, so to speak! Roll on reciprocity.

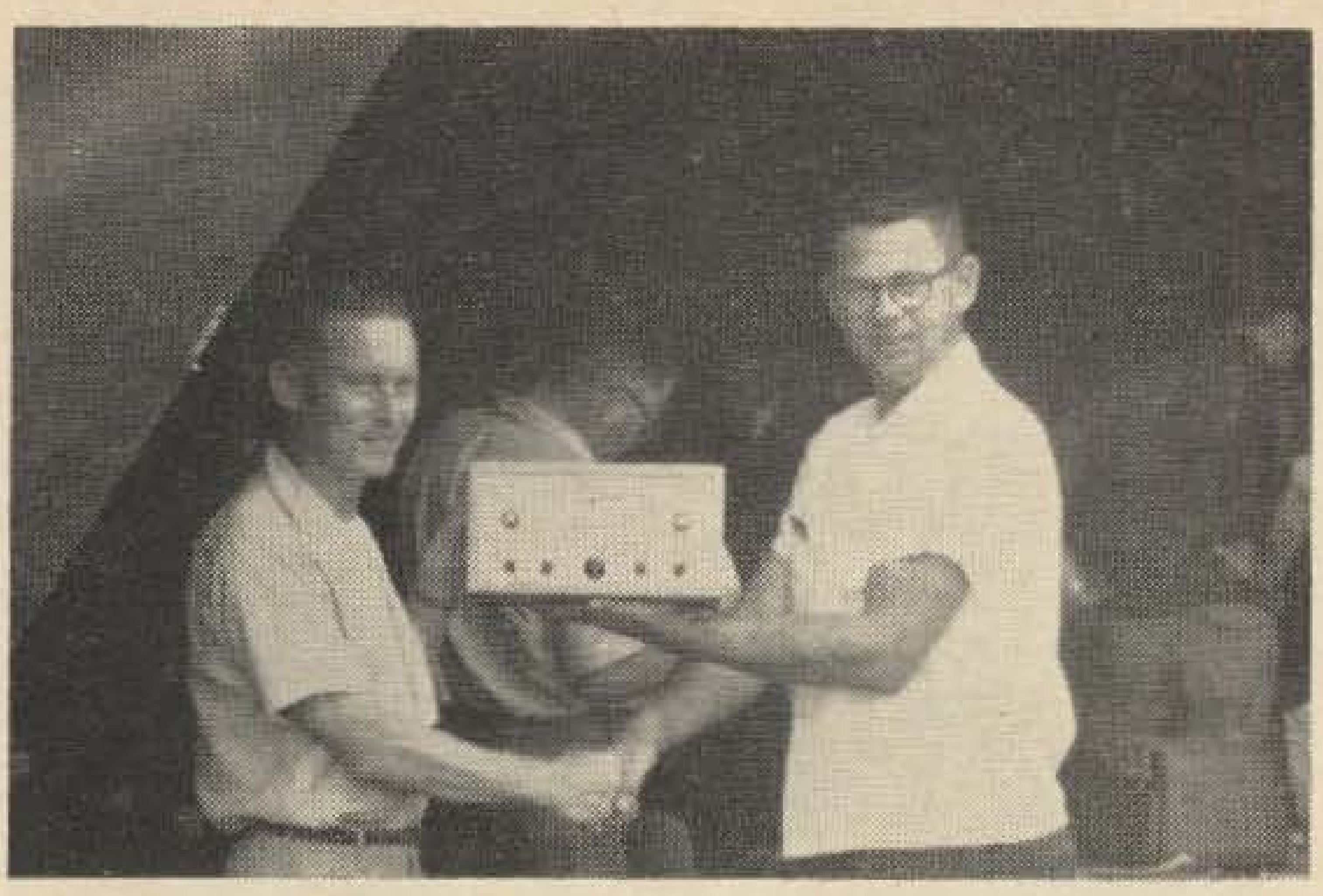
a) Group of DL4/5's at the Hamfest dinner, held at the NCOs' Club at Patrick Henry Village August 3. Group includes DL4BS, DL4ZY, DL4YM, DL4ZD, DL5GV.

b) DJØBS, Bill Symons, at the DL4/5 Hamfest. Bill is Chief Engineer of Radio Free Europe.

We arrived at noon, in 95° of heat. Pulling the housetrailer in the Friday chaos on the autobahn, with two hot, sticky children enquiring punctually every five minutes how far it was to the nearest ice cream, isn't the easiest way of spending an August day. So it was with some trepidation that we swung off the turnpike, onto the quiet roads of Patrick Henry Village. We had seen a big beam and made for it like homing pigeons.

Patrick Henry Village lies at the side of the autobahn, just north of Heidelberg, on a hot, flat plain, with mountains shimmering in the distance. Gaunt rows of what turn out to be luxurious apartments stretch for acres along avenues with nostalgic names—North Gettysburg, Lexington, Alamo. In the center is a village green, with cinema, school, bowling alley, theater, a fine inter-denominational church, shops, clubs and the Community Center. On this last building was erected the sixty foot high beam and here the hamfest was to take place.

Three hundred yards away the autobahn traffic roared and blustered and screeched and smashed its way between Munich and the north. But this was American territory in every respect and it was into America that we British



c) Scotty, DL4ZD, organizer of the Hamfest, presenting one of the prizes.

d) The author, extreme right, with her husband, G3NMR, and family.

had penetrated with brash, wide-eyed optimism.

A dozen men were putting up tents and unpacking ham equipment. Twelve pairs of eyes focussed on us in unspoken challenge, much as the eyes of the local Indians (or was it turkeys?) must have met those of the Pilgrim Fathers. Come to think of it, they were British pioneers too, so who were we to worry?

We switched off the engine and sat there and looked at them in dead silence. Then somebody noticed the British registration plates and realised who we were. They swarmed round us. "Have a coke!" We were home.

Callsigns, greetings, backslappings, reminiscences. With the eternal magic of amateur radio as a link we were able to put faces to voices we had known for years. "How about that, you old buzzard! Why don't you clean up that signal of yours?" and "Still on AM? Get with it, man. Help stamp out carrier!" and all the silly, esoteric nonsense that joins 300,000 of us in a chain of human sympathy throughout the world.

First—where to put the trailer from Friday through Monday? Why not right here? Here? Won't the General mind? Hell, no—you're hams, aren't you? So we dropped anchors, put up our elegant canopy, which we use as a patio for the trailer, tastefully arranged the outdoor furniture to please the General and made a nice pot of tea.

They gaped at us in horror, ceremoniously drinking this fearsome hot brew *with* milk, keeping our stiff upper lips, with the mercury in the late nineties. So had we conquered (and lost) India! But once we had established our British eccentricity, we compromised by making great pots of good English tea, then diluting it with great chunks of good American ice. Eureka! We had discovered that most civilized of American traditions—iced tea. Best of both worlds!

That night we were invited to dinner by Scotty, DL4ZD, the hamfest organizer. Oh that American hospitality! Oh that baked ham! Oh that ice cream! Oh blessed, blessed ham radio!

Next morning the hamfest stations were set up, including two complete Collins rigs, and 36 hours of hamming began. The thermometer climbed. At lunchtime we were handed sandwiches loaded with inch-thick steak, barbecued Hawaiian-Chinese style, by Frank, DL4DM, who comes from those parts.

Came the dusk and girls and men who had been lolling around all day in Bermuda shorts, re-appeared spruced up for the Hamfest Dinner. Relaxed and laughing we strolled over the Village Green to the NCOs' Club, on whose patio the dinner was to be served. By now great black clouds were queing up for their big laugh and it was a race between them and the delicious meal as to who would get down first! The dinner won by a minute or so and we rushed inside the Club to have us a ball.

The Hamfest Station operated all night, in a tremendous storm. I remember waking to hear the rain doing a cha-cha on the trailer roof and thinking, "I hope they've had the sense to lower the tent flaps, so that the gear doesn't get wet. Doesn't matter about the operators. Just look after the rigs!"

This hamfest was no different from scores of amateur radio events all over the world. But the DL4 boys resent strongly this feeling that they are out on a limb, cut off from the rest of American ham activity. An ocean and half a continent lie between them and home, yet they sense that physical distance is not the only obstacle that prevents them from being part of the American radio amateur world. It has taken a purely chance visit by British amateurs to put their hamfest on the map at all.

Isn't this taking isolationism a bit too far?

. . . Sylvia Margolis

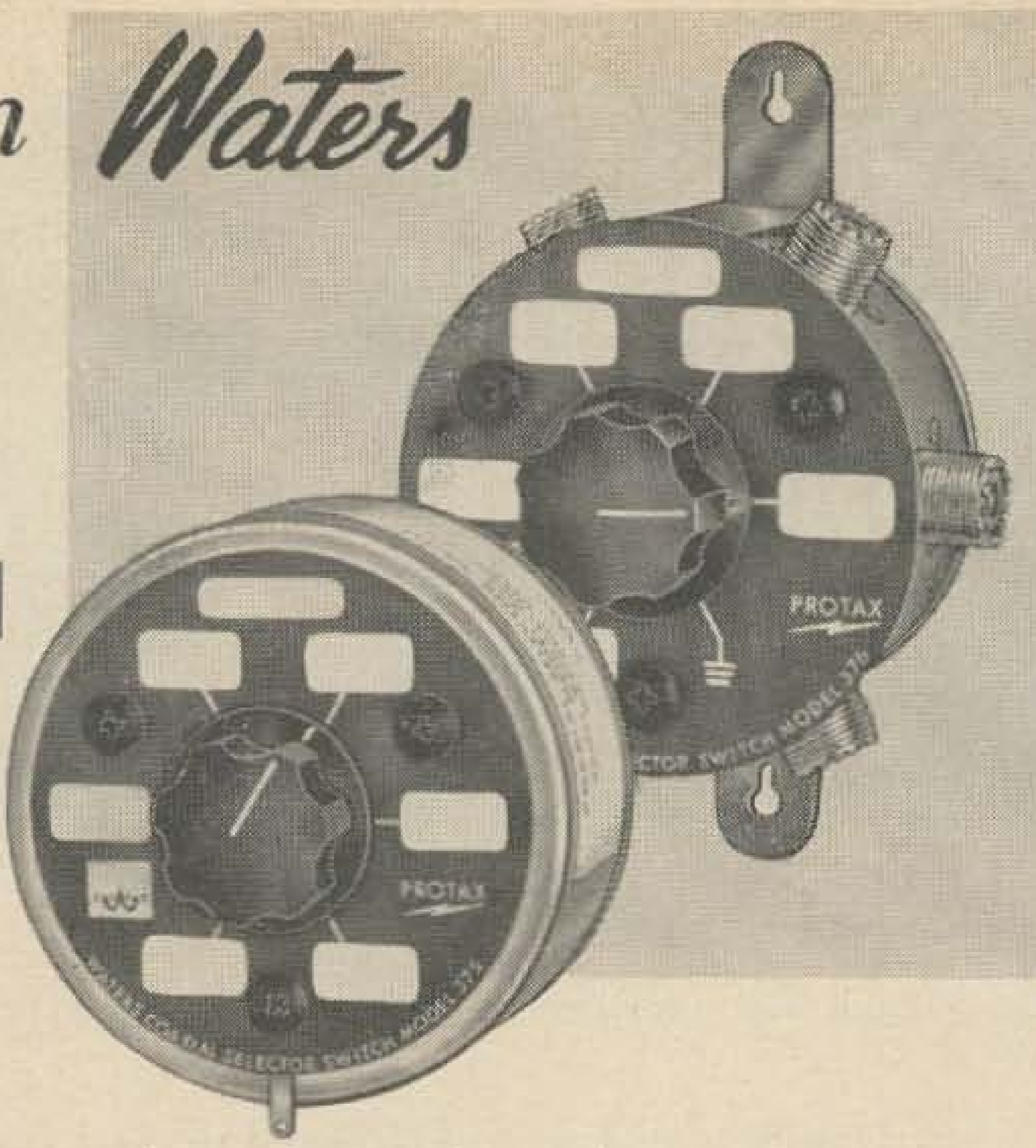
Another NEW from Waters

PROTAX™

COAXIAL ANTENNA SWITCH

With

AUTOMATIC GROUNDING



Another first from Waters! Now, as easily as you switch from beam to dipole . . . from 40 meters to 75, you can switch your entire antenna system to ground with the newest addition to our line of coaxial switches, PROTAX, automatic-grounding coaxial antenna switch! Designed with the same advanced engineering skill that outmoded all other coaxial switches two years ago, PROTAX is another giant step forward in "Convenience Engineered" ham gear by Waters. In effect, PROTAX is two switches in one . . . a regular antenna-selector switch with power-carrying capacity of 1,000 watts that becomes a grounding switch for all antennas (leaving the receiver input open) when the rig is not in use. In two distinctive models: #375 — six position and ground with back connectors; #376 — five position and ground with connectors in radial arrangement (#376 has its own wall-mounting bracket).

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BOB WATERS W1PRI

THEODORE F. BRIX
FRESNO, CALIFORNIA

August 21 1965

Waters Manufacturing, Inc.,
Wayland, Massachusetts.

Dear sirs:

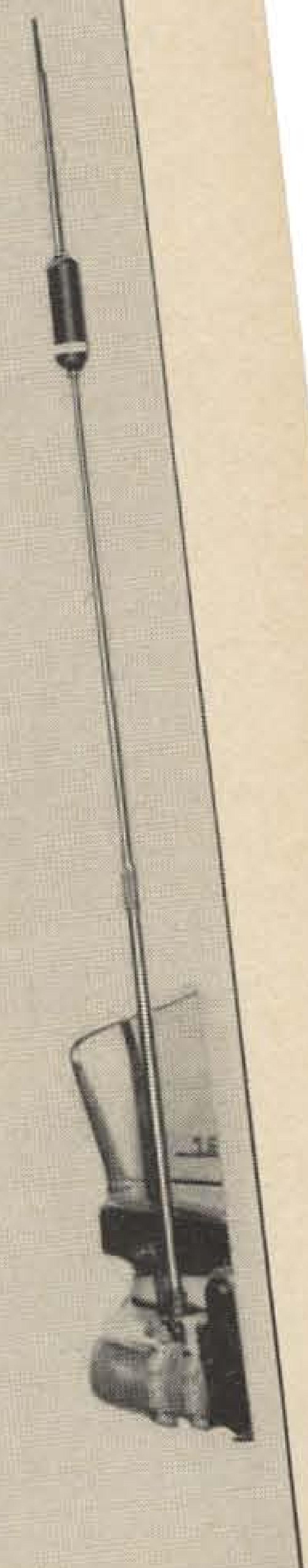
I have just purchased one of your Model #370 Auto-Match antennas for my mobile and have been very pleasantly surprised. The antenna which I previously was using was impossible to load without some form of matching device; I used a "Z" match with a condenser combination. When I installed the Waters, and after reading the literature I noted that you stated that it woul match into 50 ohms. This I could not believe however I decided to give it a try, so I removed the matching network and connected the 21' 52 ohm cable directly to the antenna base. Not only did it match perfectly but I also picked up slightly over 2 volts of r. f. measured on the field strength meter. Also I found that the transmitter tuned (final tank) exactly the same position as when the transmitter was used in the shack against a dipole fed with 52 ohm line. Now what puzzles me is; how you able to construct such a coil which will match into 52 ohms where most antennas require some sort of matching section? I have operated mobile for many years having been on the air for over 30 years. Without wanting you to give away some "trade secret" and so I won't have the coil x-rayed, I would like an answer. It really has me puzzled. Needless to say I am more than pleased with the performance which is much better than three other mobile antennas which I am comparing yours against - its far superior by actual measurement.

RECEIVED
AUG 27 1965
WATERS

Thanking you, I am

Respectfully yours
Ted Brix

Theo. F. Brix W 6 gfr
5573 No. Van Ness Blvd
Fresno 5, California



WATERS
MANUFACTURING INC.
WAYLAND, MASSACHUSETTS

Robert N. Tellefsen W7SMC/6
277B Tyrella
Mountain View, California

Are 20¢ Transistors Coming?

The 20-cent transistor may not be far off, now that American transistor manufacturers are beginning to compete with European and Japanese imports. In recent months, special lines with many transistor types priced at less than a dollar have been introduced.

The primary market for these inexpensive transistors is the electronic entertainment industry. For example, some economy transistors made by Fairchild are used in the tuner portion of the new GE 9-inch portable TV set.

Although these economy transistors are intended for use by manufacturers, they are also readily obtainable by the average ham. Several interesting devices can be found in this low-cost field. Within the Fairchild line, for example, there are very-low-noise audio amplifiers, a low-noise VHF RF amplifier, and RF power transistors. These transistors come in two case sizes, TY and TZ, similar to TO-18 and TO-5 cases (**Fig. 1**). So far, the Fairchild line, listed in the table, appears to be the only one to include both NPN and PNP silicon transistors. These devices are available through any Fairchild distributor.

The low cost of Fairchild's line is due to three things, an international production system, an unusual type of transistor construction, and the wide tolerances permissible in entertainment devices. The silicon transistor chips are made by the planar process to obtain good high-frequency characteristics and uniformity during volume production. The headers on which these transistor chips will be mounted are made of a black ceramic material and have the emitter, base, and collector leads imbedded in them. These headers and the basic silicon planar transistor chips are shipped to Hong Kong where the actual assembly and testing take place.

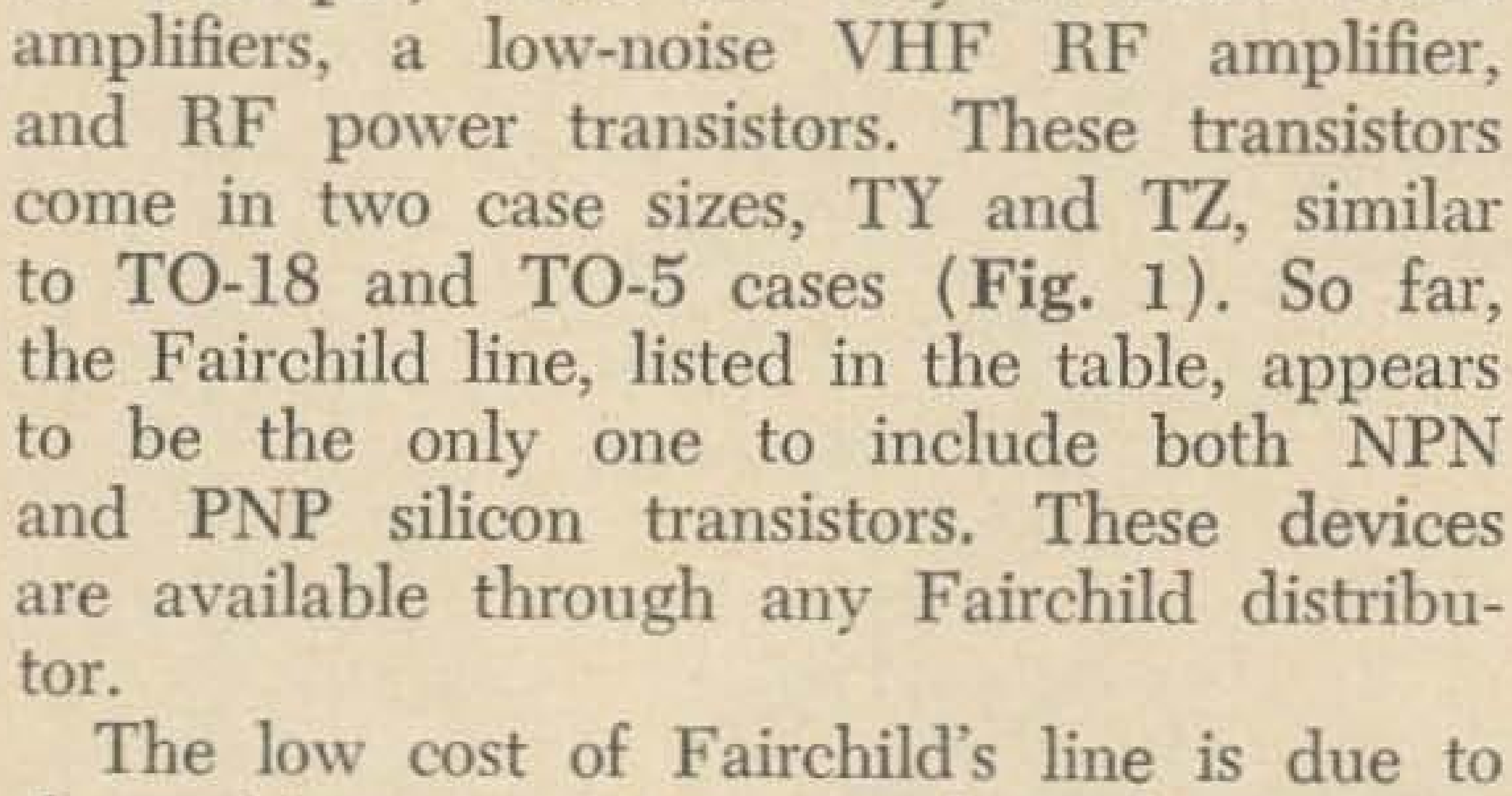


Fig. 1. Size comparison between Fairchild TY and TZ cases and standard TO-18 and TO-5 cases.

Fig. 2. Construction of Fairchild TY and TZ transistors.

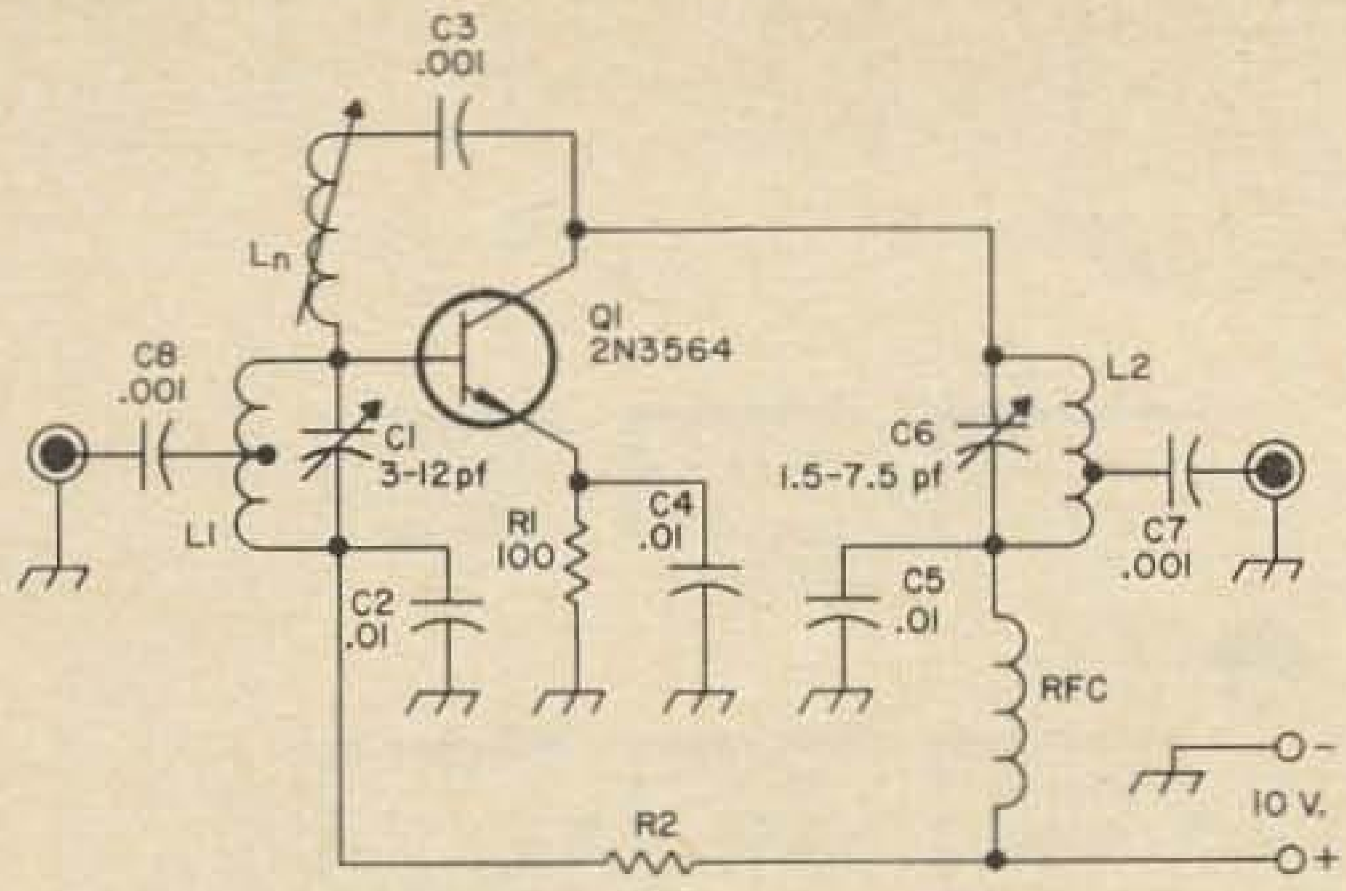


Fig. 3. 200 mc RF amplifier. L1 is 3½ turns no. 16, center tapped, ¼ in. dia., ½ in. long. L2 is 8 turns no. 16, tapped 1 turn from cold end, ⅛ in. dia., ⅞ long. Ln is 0.4 to 0.65 uh. The RFC is an Ohmite Z-220.

In Hong Kong, a transistor chip is first mounted on a small metal plate, and then the plate is mounted on the header surface and spot-welded to the collector lead. Fine wires are then spot-welded to the base and base lead and the emitter and emitter lead. This completes the connections to the transistor chip. The top surface of the assembled transistor is then potted in a shallow dome of black epoxy to protect the chip from mechanical damage. The chip is protected from electrical change by a silicon oxide layer which closely resembles quartz and is formed during the manufacture of the chip. The construction of these transistors is illustrated in **Fig. 2**. When the completed transistors have been tested, they are returned to the U. S. for quality control checks and sale.

The low-noise VHF RF amplifier transistor mentioned earlier is the 2N3564. Intended as an RF amplifier for transistor TV receivers, it performs well throughout the VHF spectrum, especially at 50 and 144 mc. At these frequencies, Fairchild claims a noise figure of 2 to 3 db. A maximum gain of 25 db is available at 150 mc, decreasing to about 10 db at 500 mc.

Table I

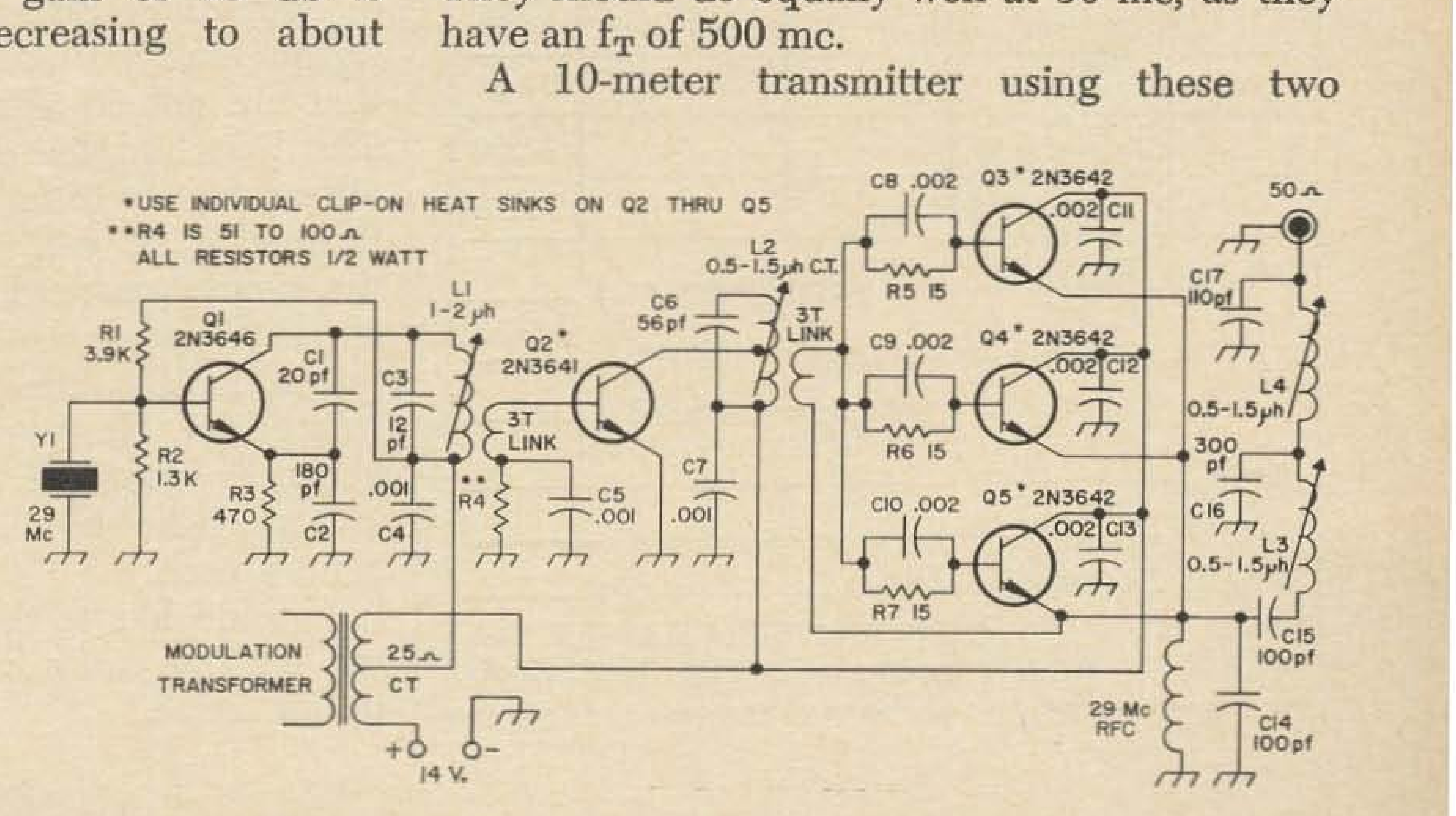
Type	Application	Case	Approx. Cost
2N3563	*if* amplifier to 100 mc, oscillator to 1000 mc. NF at 60 mc = 4 db, P_T = 0.5 w max.	TY	$1.20
2N3564	Low-noise VHF RF amplifier and mixer. NF at 60 mc = 2 to 3 db, P_T = 0.5 w max.	TY	.90
2N3565	High-gain, low-noise audio preamplifier. NF at 10 kc = less than 1 db, P_T = 0.5 w max.	TY	.90
2N3566	Audio driver, RF oscillator to 30 mc. P_o at 30 mc = 100 mw, P_T = 0.8 w max.	TZ	1.50
2N3567	High-frequency amplifiers and switches.	TZ	.90
2N3568	h_{fe} at 20 mc = 3, P_T = 0.8 w max.	TZ	1.30
2N3638	PNP high-current switch and audio amplifier. f_T = 200 mc, P_T = 0.7 w max.	TZ	.46
2N3639	PNP *if* amplifiers to 100 mc.	TY	.65
2N3641	Class C RF amplifiers.	TZ	.90
2N3642	f_T = 500 mc, P_o at 30 mc and 15 volts = 1 w, P_T = 0.7 w max.	TZ	.95
2N3640	f_T = 500 mc, P_T = 0.5 w max.	TY	.70

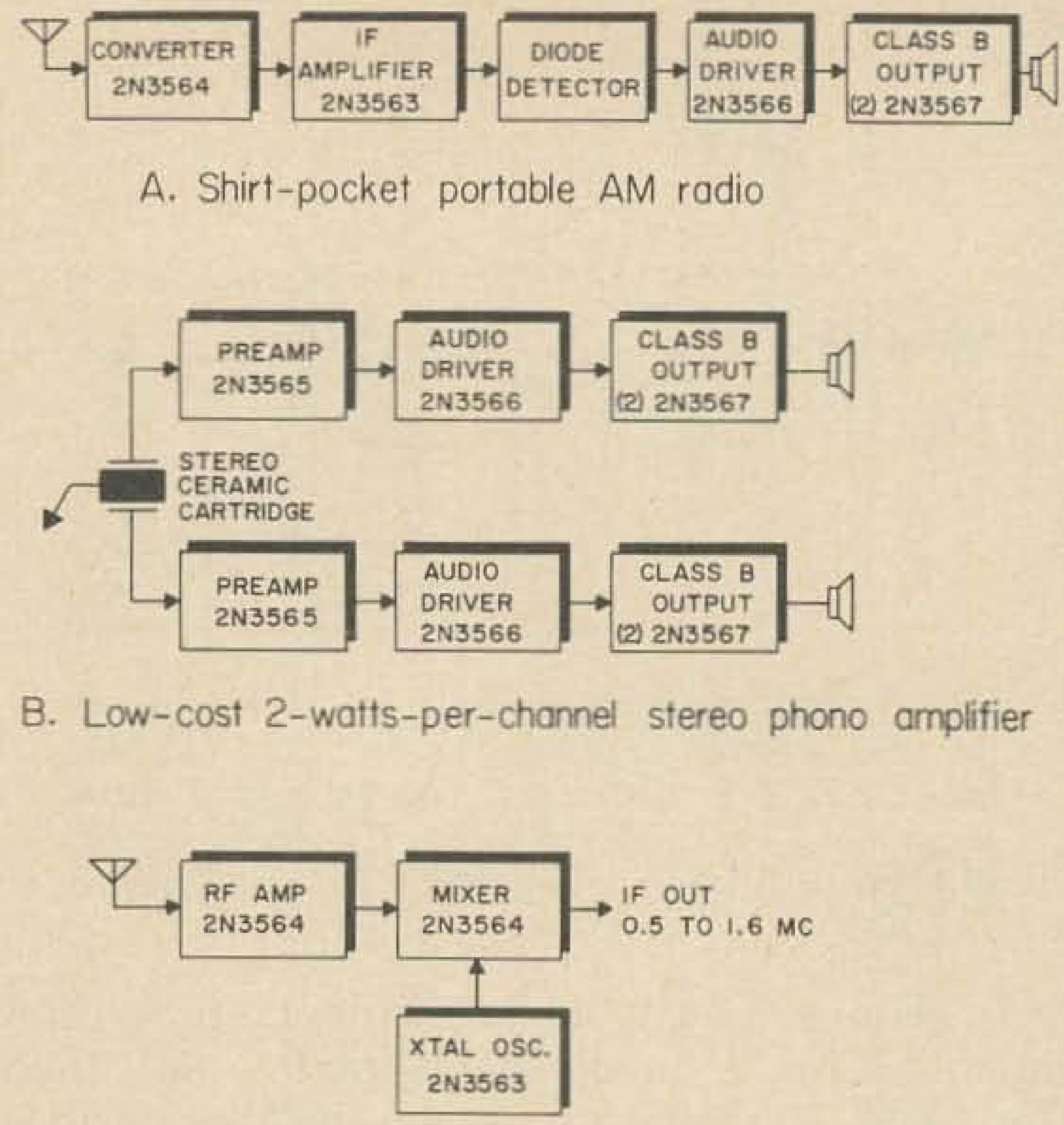
A VHF RF amplifier using the 2N3564 is shown in **Fig. 3**. At 200 mc it has a gain of 14 to 17 db. for the best noise figure it should be operated with a collector voltage and current of 6 volts and about 1 milliampere, or for the best gain at 10 volts and about 8 milliamperes. This transistor is a good oscillator up to 1000 mc and has been used in experimental UHF TV converters.

Transistor types 2N3641 and 2N3642 are also useful in ham applications. The 2N3641 is used as a 400-milliwatt-output RF driver, and the 2N3642 as a 1-watt-output class C RF power amplifier. Three 2N3642 in parallel can produce 3 watts output at 29 mc with a 15 to 18-volt supply, and 2.25 watts at 13 volts. They should do equally well at 50 mc, as they have an f_T of 500 mc.

A 10-meter transmitter using these two

Fig. 4. Three watt output 10 meter transmitter.





A. Shirt-pocket portable AM radio

B. Low-cost 2-watts-per-channel stereo phono amplifier

C. Short-wave crystal-controlled converter

Fig. 5. Possible uses for low cost transistors.

transistors is shown in **Fig. 4**. An alternate to the 2N3642 for use at lower frequencies is the 2N3568. Its capabilities are similar to the 2N3642, except for a slightly higher P_T and a lower f_T.

The ceramic headers used in these transistors do not dissipate heat as efficiently as metal headers, so when these devices are used as power amplifiers, heat sinks are a necessity. They must be of a type which clamps firmly around the perimeter of the transistor, such as those made by Wakefield Engineering. Silicon grease should be used between the transistor and heat sink for maximum heat transfer.

Uses for some of the other devices listed in the table are suggested in the block diagrams of **Fig. 5**.

Transistor prices are definitely coming down, most noticeably in entertainment lines that are not advertised to the general public. The Fairchild line is readily available, as are others, but a little sleuthing may be needed. Generally, it will not be available through the nearest parts house but will have to be obtained from the closest Fairchild distributor. A look in the Radio Master will usually locate him. However, the little effort involved generally pays off. Who knows, before long you may be buying your transistors for 20 cents apiece.

I would like to thank Fairchild Semiconductor for the information and materials used in this article.

. . . W7SMC/6

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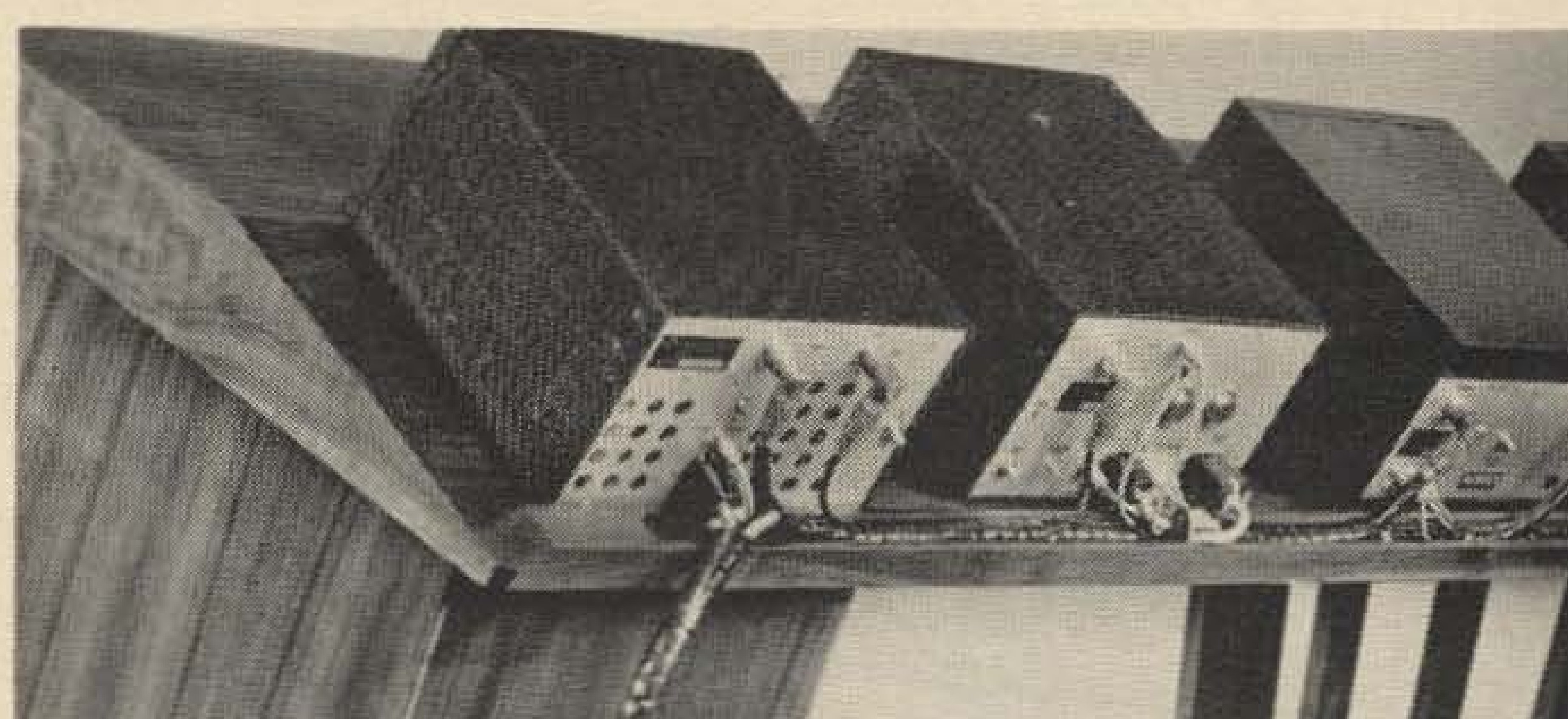

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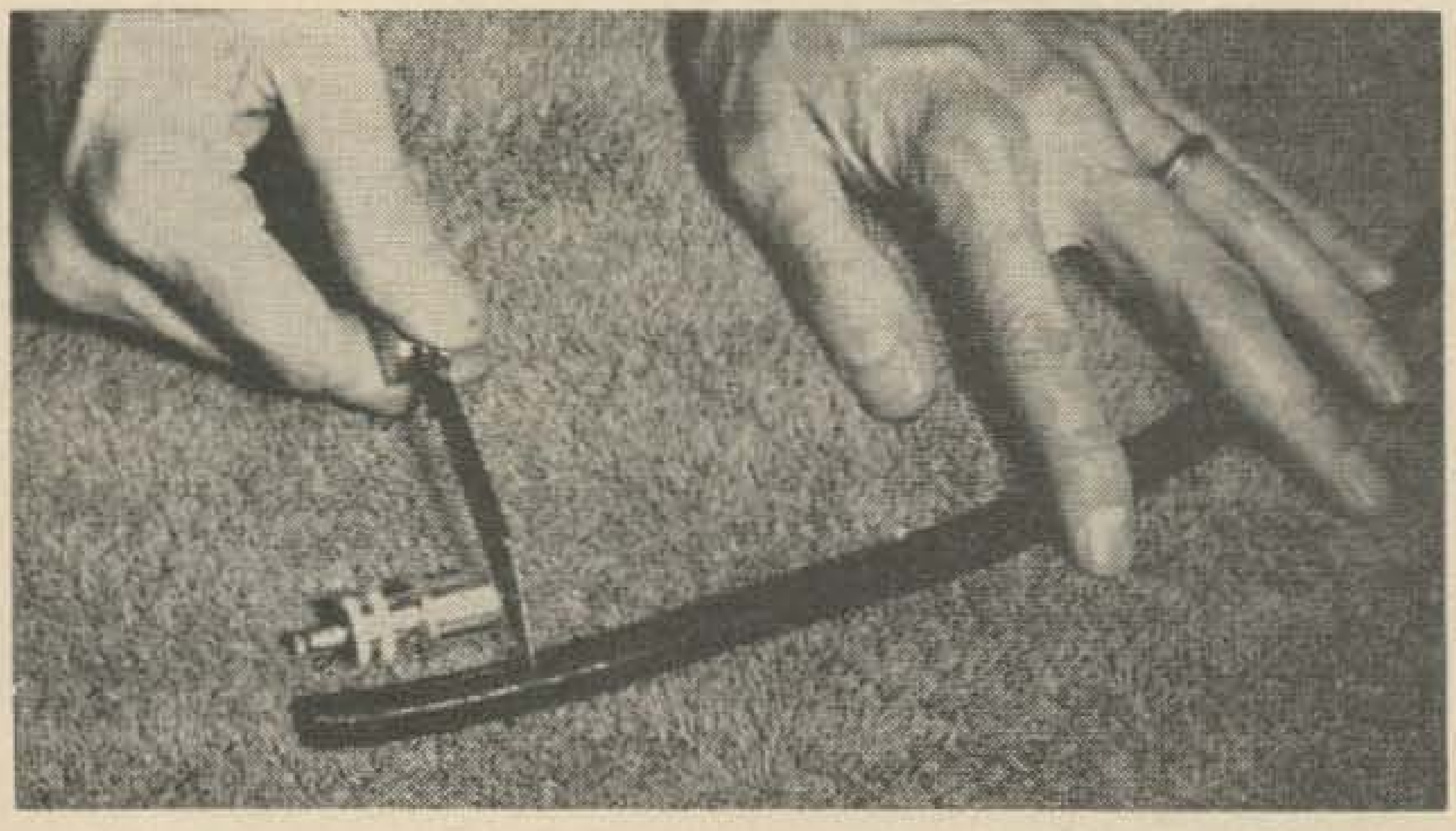
F. R. O'Kelly Jr. W5VOH
418 E. Hickory Ave.
Midland, Texas

The Lowly Coax Fitting

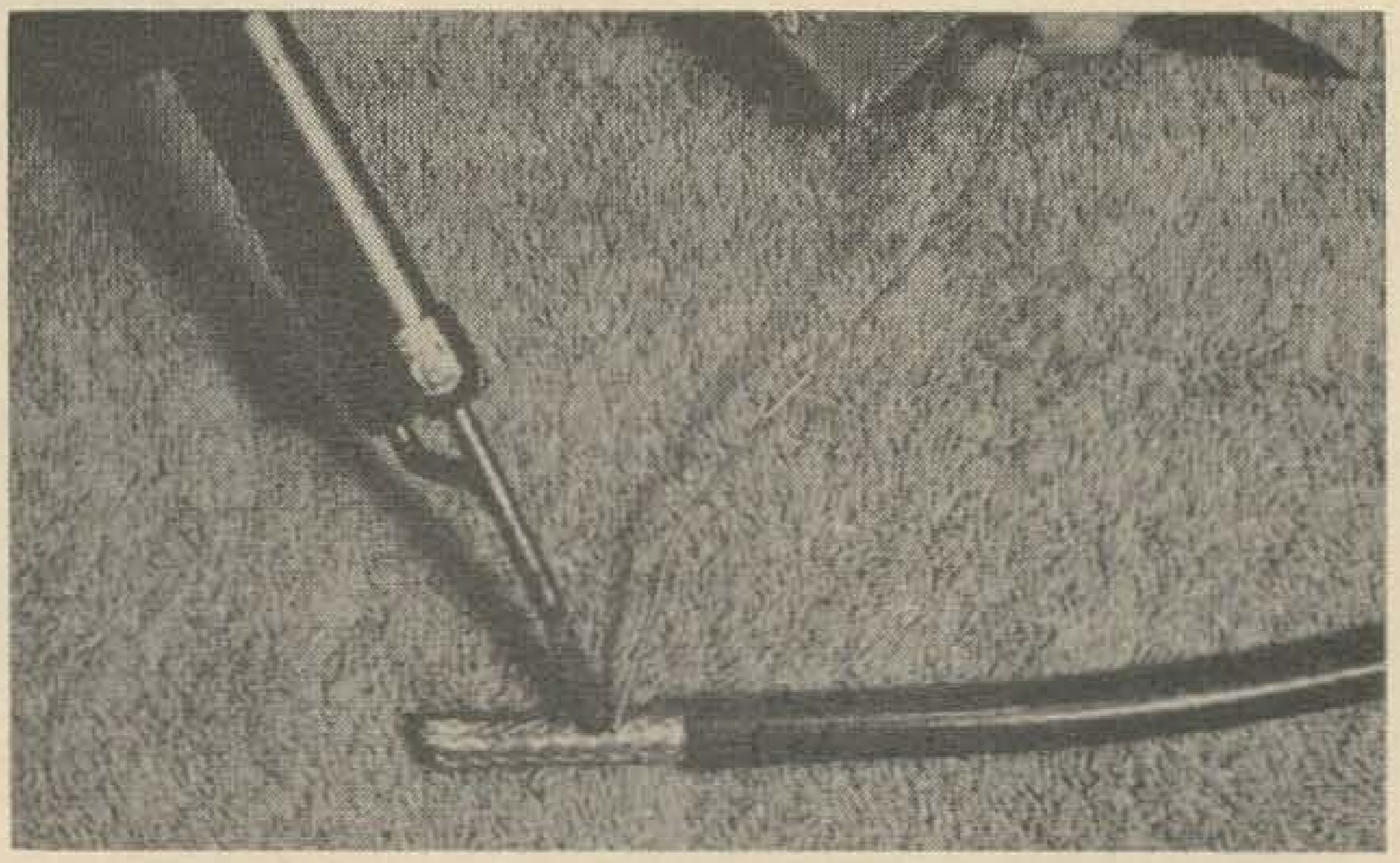
The old saying—"A chain is no stronger than its weakest link" is doubly true in radio. One minor short circuit, bad component, or poor connection can upset the proper operation of any station. One of these connecting links in our ham station chain that has attracted very little attention and is usually installed as a hurried-up after thought is the lowly coax fitting. Improper installation of this little unit can cause malfunctions in your transmitter that will make you pull your hair out (if you have any). The final tube's face can get red and even stick out its tongue and blow its plate suppressors. The resultant poor signal reports and operations do not stop with the transmitter, but will cause a good receiver to perform like a mediocre one. Endless time and undue expense can be spent in searching in the receiver for a problem that is hidden on the outside.

There are many different approaches, techniques or procedures, gimmicks or alternate methods to obtain the end result of marrying the coax cable to a coax fitting. However to avoid confusion a method is presented here that has been used by the author for many years with success every time. The procedure may appear to be more involved than some but I assure you if the following instructions are properly followed a coax connection will never be the source of transmitting or receiving problem.

The Chinese proverb—"A picture is worth a thousand words" is followed here augmented by only a few comments to fill in the background of each photograph.



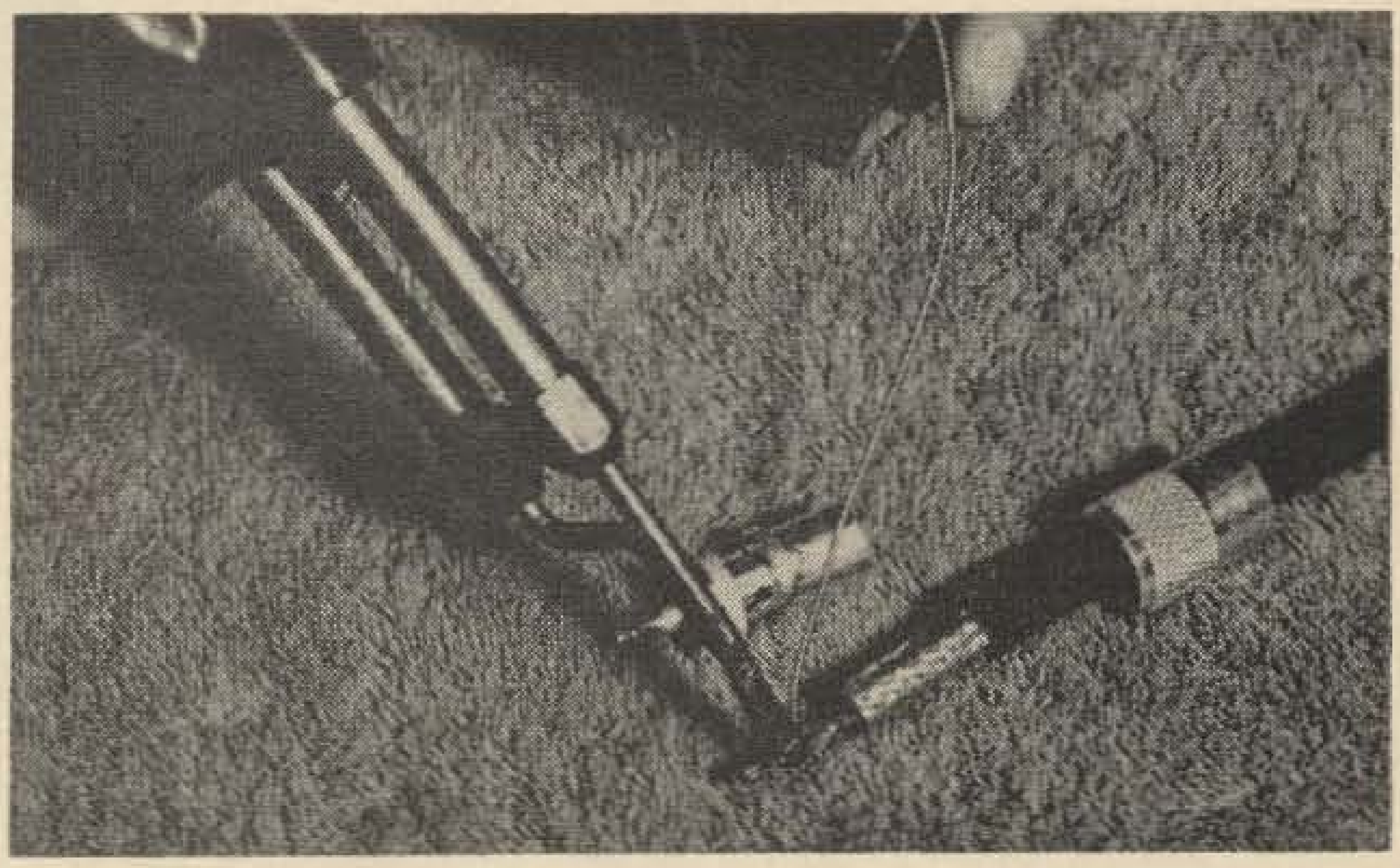
A length of the vinyl cover equal to the total length of the coax fitting is removed from the cable.



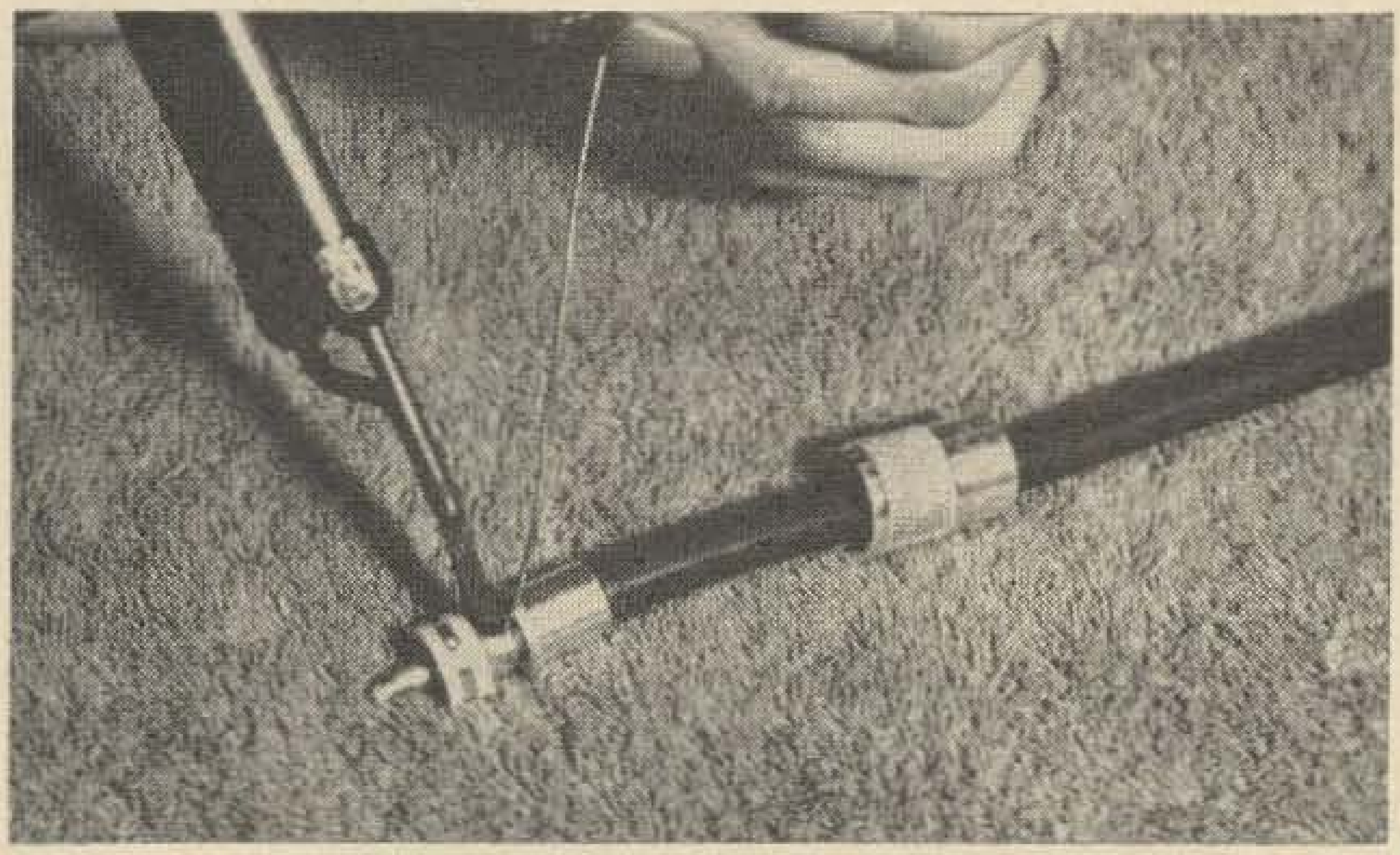
The exposed braid is then tinned very rapidly and thoroughly with a good **hot** iron. A two hundred fifty watt soldering gun is used and performs better than a gun of smaller wattage. The soldering gun is moved back and forth in a smooth, slow movement. Hesitation in any one area is avoided to prevent damage to the polystyrene insulation and possibly shorting the braid to the center conductor.

Allow the tinned braid to cool and **scribe** a line around the cable at the location shown in the photo. Do not try to cut completely through the tinned braid, but only scribe a line as shown.

Apply two or three good solid, quick twists to the braid with pliers and it will break with a smooth even edge. Cut through the polystyrene to the center conductor with a slightly dull knife leaving a shoulder of polystyrene approximately 1/16 inch wide.



Tin the center conductor carefully and place the coupling ring on now and facing in the proper direction. It is very embarrassing to complete the assembly and discover the coupling ring has been forgotten.



Place the plug assembly on the prepared coax observing that the tinned braid is covering the soldering holes in the side of the plug assembly. Solder the center conductor first with a clean iron. Allow sufficient time for this job to cool and judiciously apply solder to the soldering holes in the plug assembly. Screw the coupling ring onto the plug assembly and the job is completed.

Always check for possible mistakes with an ohm meter, but if the above procedures are followed and normal care is observed you'll never be caught with your coax fittings down.

. . . W5VOH

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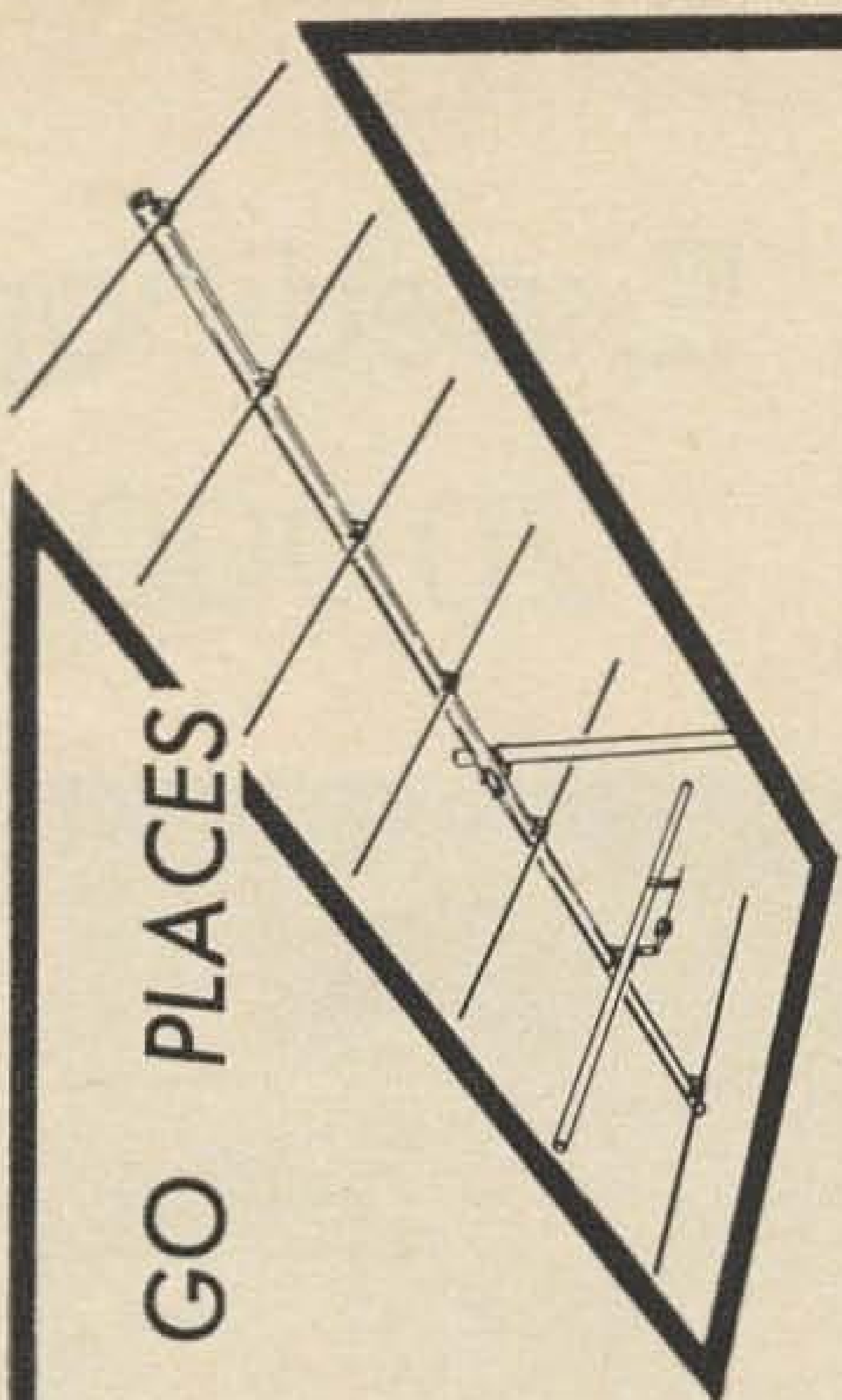

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A220-11	1¼ meter	11 element	11.95
A430-11	¾ meter	11 element	9.75
A144-20T	2 meter	Multi polarized	29.50
A50-ZP	6 meter	Portable	10.95
A26-ZP	6 & 2 meter	Portable	15.95
A50-3	6 meter	3 element	14.95
A50-5	6 meter	5 element	21.50
A50-6	6 meter	6 element	32.50
A50-10	6 meter	10 element	49.50
A26-9	6 & 2 meter	10 element	27.50

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Cush Craft

621 HAYWARD ST. MANCHESTER, N. H.

Yuri Medinets UB5UG

Expedition to UJ8— 20,000 Feet Up!

Semenov Bashi Mountain

This expedition was organized and completely paid for by Trade Unions. Its goal was quite sportful: to make a high altitude ascent, taking part in a competition Championship of Mountain Climbing (Alpinism) of the U.S.S.R. I took part as a radioman, thanks to my two hobbies—mountaineering and short waves.

For the first leg of the journey we flew to Tashkent (Fig. 1), into terribly hot weather. I visited the local radio club and met UI8KAA, Swetlana, who was operating at the time. The station is badly equipped with a BC-312 receiver in bad condition, and a BC-610 transmitter. The antenna is an ordinary Windom hung low, and a ground Plane. Almost all of the contacts are local; I tried to work from that station, but the reception was poor, and it is no wonder that UI8KAA does not hear our calls (from Kiev).

A few other hams wandered in, but most of them were hurrying to go out of Tashkent ot take part in a Field Day—and that in such awful hot weather! I tried sounding them out about I.H.H.C.*, but most of them were too young, except for UI8AM, a joyful Uzbek, but he lives too far from Tashkent.

In Tashkent I visited an amateur, an old man, who operates a very elaborate station. He has a separate flat, and a separate radio shack (a very rare thing here), and seems to have all the tools and devices one could want. The station is a 200 watt commercial type transmitter, a good receiver with two conversions (very stable commercial type), another receiver: NC-200; the antennas are ordinary: ground plane and a jumble of other poorly understood wires. His cottage is surrounded by greens and looks very nice. This would be an ideal place for the visit of a Ham-Hop guest, but . . . the owner of this tiny cottage and station holds a high post and therefore is reluctant to give attention to IHHC. He knits his brows: his reputation is spotless and he does not want to spoil it.

There are many enthusiastic and well equipped UHF hams in Tashkent. It was a pleasant surprise for me, because I had not realized what UHF radio amateurs could do in Asia with its wide open spaces. On the day I visited they abandoned Tashkent and made their Field Day by sitting in a circle around the city in mountains at a radius of about 250 miles, at an altitude of 11-12,000 feet.

From Tashkent we flew to Osh, the last town before the mountains (Fig. 2). Osh is more colorful than Tashkent, and less Europeanized.

Fig. 1. Location of Tashkent

* I.H.H.C.: The International Ham-Hop Club. This is a non-political organization which arranges travel between radio amateurs of different nations. Headquarters are in Great Britain, and membership extends through 50 countries. Write to G3CED or W4WHN for details.

Yuri UB5UG

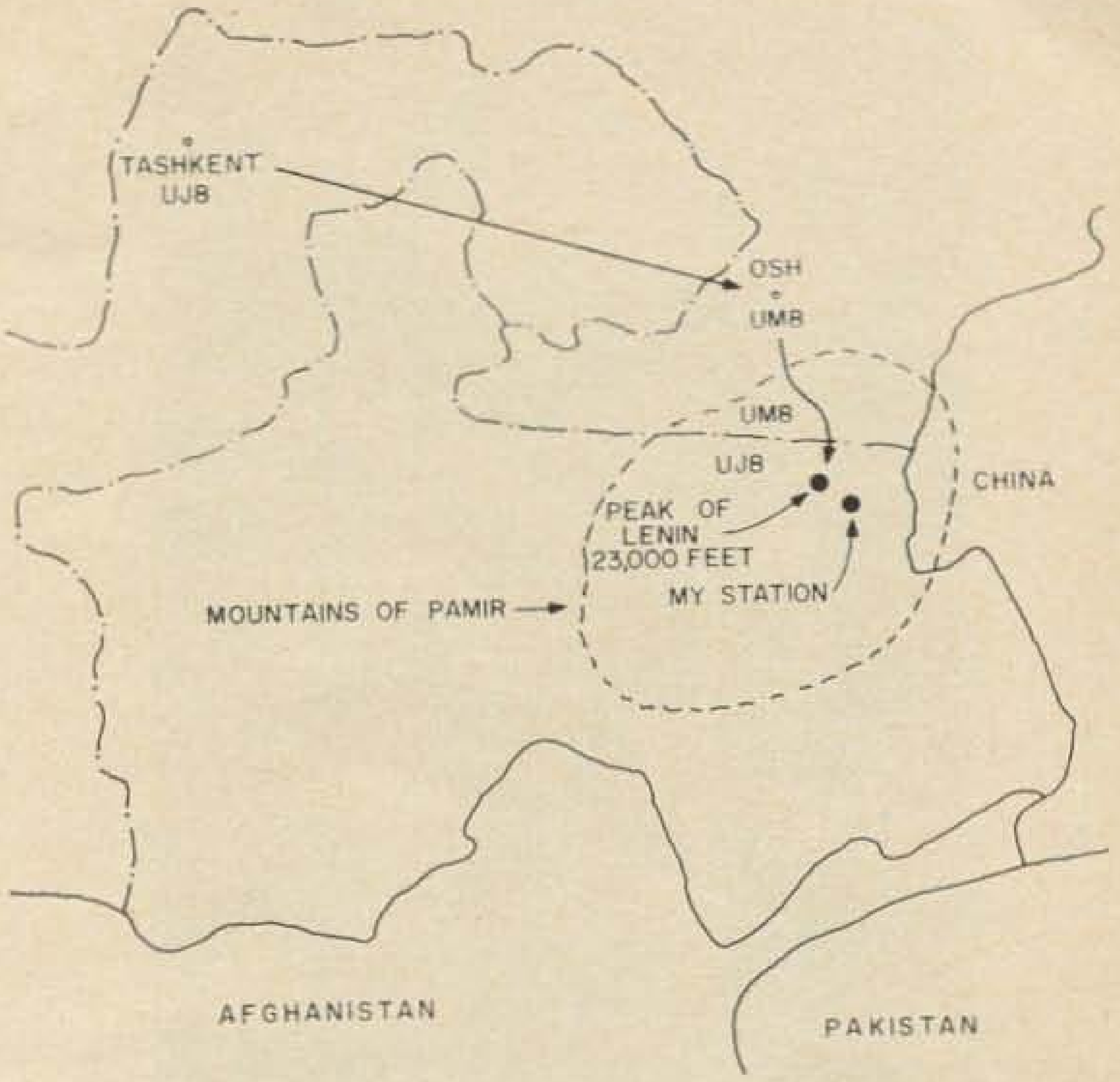


Fig. 2. Area of DX-pedition

Most of the population in Osh are Uzbeks, though the town belongs to Kyrghyzia. Uzbeks are eternal agriculturists and strongly Moslem, at least among the old people. Their culture is interesting; I could write a book about what I saw, and that would leave no space for our amateur activities.

From Osh we got automobiles and carried ourselves and all loads through the mountains: 3 passes to the glacier Oktiabrskv near Lenin Peak, about 200 miles from Osh. We were disturbed when we found that there were no helicopters in Osh, but all went well thanks to the very adequate automobiles "Uralzis" which took us to the Oktiabrsky Glacier, about 12 miles from the Peak. There at an altitude of about 13,000 feet above sea level we built a base camp. Pamir is very much less pleasant than the Caucasus. There is no grass, to say nothing of trees. There is much grey desert. The grey becomes white, then snow, snow, and more snow at 18-20,000 feet. All of mountaineering consists of hard work; someone has said that alpinism is the carrying of big loads to long distances at high altitudes, and without much necessity . . . . The aim of our expedition was to climb to Lenin Peak at Pamir (Fig. 2). It is the third highest mountain in the U.S.S.R.

Other than the main team of climbers, there were the serving personnel—a cook, a doctor, a radioman (me) and so forth . . . . In addition there was one YL from Kharkov, the official delegate from the Sports Society—but more about her later. The various jobs fitted oddly on some of us. For example, Nicolai the cook, is the chief scientist of the Botanical Institute of Kiev . . . When I asked him what he had in common with cookery, he replied that he likes very much to eat . . . Although he is a bachelor and had never cooked much before, to our surprise he did very well—perhaps because of his Hungarian descent. We complained only that there were too many peppers in the meals!

In the beginning, the Ukrainian Federation of Alpinism had made a weighty decision in preparing for this trip: don't take women on the expedition. They figured that the work would be too hard for women. Therefore it was with considerable consternation that we spotted four YLs in the group from Kharkov. All our beggings and threats did not help, and we had to take them with us. The fact is that the girls were plenty strong, and 3 of them made it to the summit. That is pretty good if you take into account the fact that there are only 10 women in the U.S.S.R. (and maybe 15-18 in the whole world) who have climbed higher than 20,000 feet . . . . The fourth YL, Valia, had a lion's body and a lamb's soul, and helped us in base camp. Usually she did something in the kitchen with, and even instead of Nicolai, but when my voice sounded at the microphone, she

Cottage we stayed in

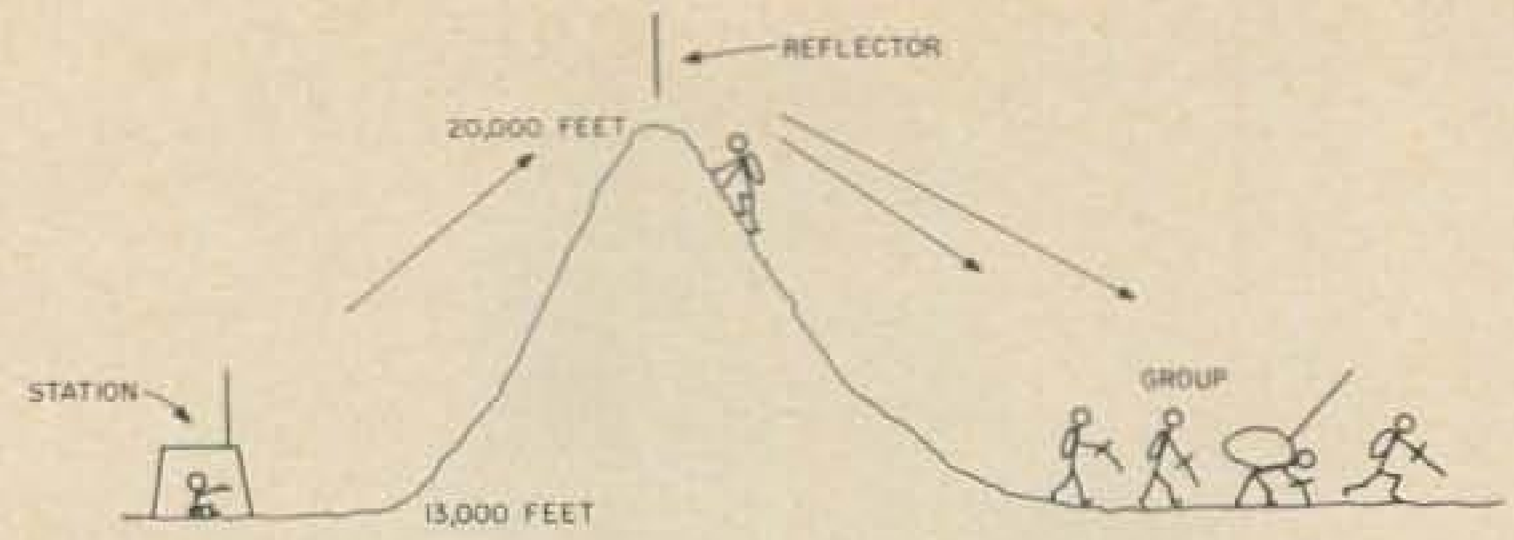
A parasitic reflector

bounded along and sat beside me with open mouth, catching my every word.

For the radio installation, I built a box from wood, covered it with two tents, locked it with guys, and installed my station into the "shack". There was an old aircraft Tx reconstructed and completed with SSB (813 in the final), the receiver was the RCA AR-88, and a home made high voltage rectifier unit. The antenna was a ground plane made from aluminum tubing which we had carried strapped right to the fusilage of the airplane. The whole station was powered by a gasoline motor generator.

I had never touched a power supply like that before, and therefore fell into the top of delight when I heard it working. From time to time I had to repair it. I do not understand anything about such motors, I separated all possible parts every time and then put them together. In spite of some extra parts left over after such experiments, the motor was always working.

Sometimes the equipment went bad, but we got it repaired one way or the other. My first contact was with UM8KAA who came in 5 and 9+. Then a 5Z3 went bad from vibration suffered in travelling. I replaced it by a few germanium diodes, but lost the SSB mode of operation. To make things worse I could not contact Osh during the first days. Well, finally I contacted a VU who called a UA3 station for me, and that ham sent a telegram to our base in Osh: "we need a 5Z3—urgently". The next auto caravan carried the tube to me, and I finally appeared on SSB. The boys were very happy, and I gave the country to many



Reflecting system used to extend our range

of them. Unfortunately, conditions were bad. Nothing was heard from Western Europe for most of the time. And only 6 hams from the U.S.A. are in my log for the whole two months. Three of them were caught the last day (all W5s) when an unexpected opening occurred. Operation was closed by lack of time at my end.

Instead of the W's coming in well enough to contact, I contacted a lot of Japanese hams. Every day I heard signals from the Pacific. Lots of KR6, KX6, KM6, etc. But I have to say that these hams seemed to be entirely deaf. They all use good equipment (S-lines, etc.) and all the time chatted between themselves. To break them it is needed to be +10 db over S-9. Sorry, but I could not put in such a signal from the Pamir Mountains.

The operation of the Japanese was very different. They were very kind, sensitive, and responsible DXers. And despite their low watts, it was always very easy to contact them. There in the mountains I found an extremely low noise level, and that helped.

Amateur radio had occasion to help us with various kinds of information. At one time I called W2PTQ/MM but as usual he did not hear. Then Raju, VU2NR called him and said "that is station UB5UG/UJ8, where two British mountaineers died." Immediately I cried out "Who died? What do you know about British mountaineers??!". Raju replied that he had read a newspaper today and knew that W. Noys and R. Smith from the Anglo-Soviet expedition had died on the ascent (our expedition was about 50 miles from the British one lead by Sir John Hunt. They were climbing the Peak of Communism*). Our fellows were very disturbed, and the questions came fast: when, how, where? But Osh could say nothing; they had not heard anything about it! We all spent a few minutes of silence (which is our habit in such cases), but that helped nothing. Later we found out all about it. When the accident happened, Sir John Hunt flew to Dushambe by helicopter and sent a telegram to England. Poor fellows;

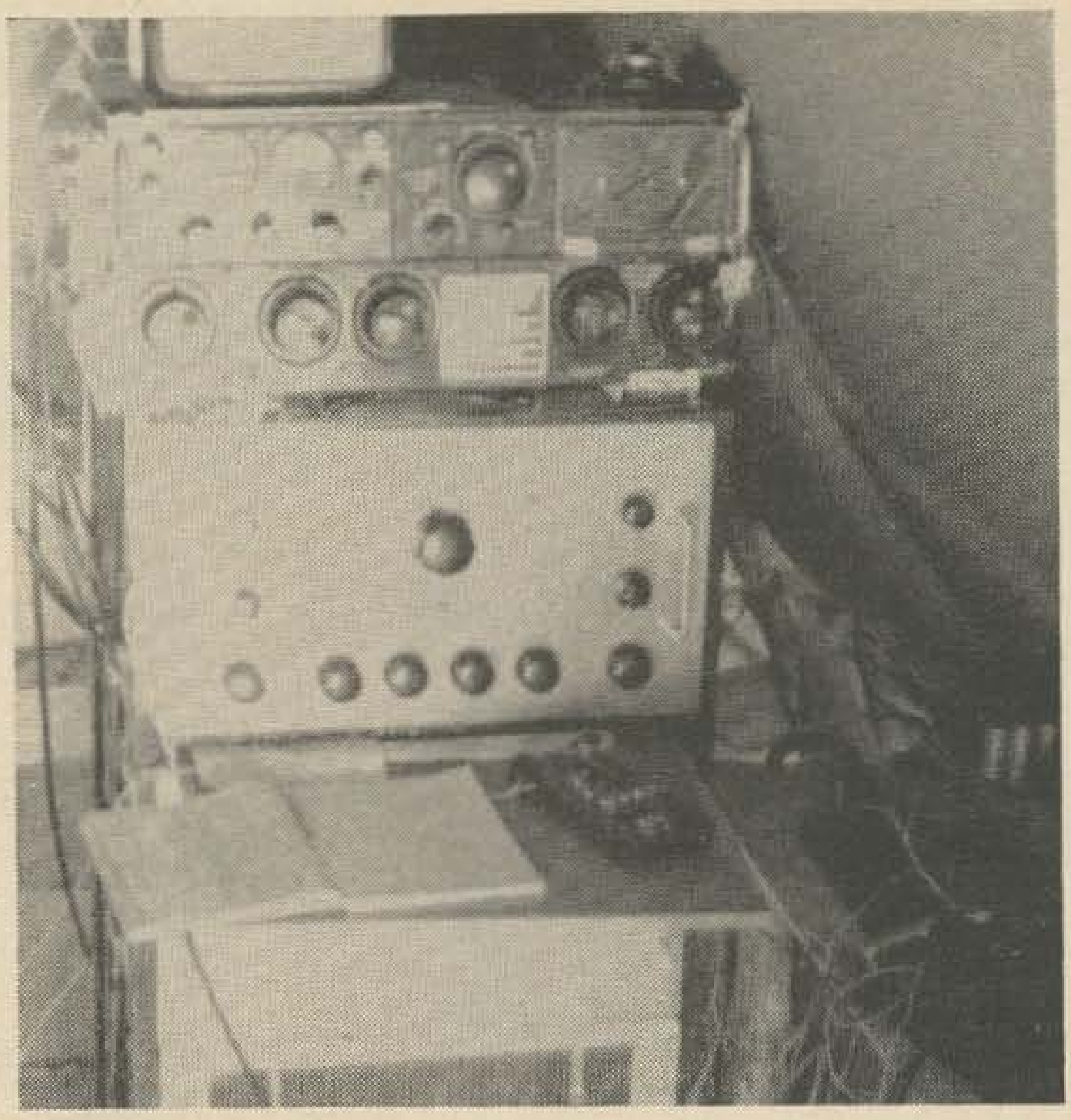
* Formerly Stalin Peak, hi.

they trusted the glacier too much and did not take sufficient precaution.

After a few days of building the camp we began to carry food and equipment along the glacier toward the Peak, about 15 miles from our place, over a pass. The hardest work was to set up the intermediate camps, but they were necessary for the climbing. I carried a 50 pound load without too much difficulty.

My other mountaineering work consisted of setting parasitic reflectors on the main or "ruling" summits to supply an UHF contact with the peak (Fig. 3). The reflectors were half-wave bars or ground planes mounted on wooden poles. The experiment was successful from the point of view of radio, but negative from the mountaineering one: the distance to the Peak was too far for our small walkie-talkies, but the QSO was FB over the mountains for less distance.

As we approached the border region I had a most unpleasant experience. One of our men had accidentally taken with him the papers necessary for our people to come through the border region from Osh. It was necessary for us to get the papers to a certain point by ANY means. This point was 35 miles away, without *any* road or automobile track. What means did we have? Of course, only our feet. I was in better condition than the other fellows at the time, so on an early morning I took these papers and set out through a real grey desert. I went that way for 7 hours without rest. On my way, a small river rushing into the valley (12,000 feet above sea level!) soon disappeared. There remained only stones, stones, and the horns of dead wild sheep. No grass. A few poor flowers (Edelweiss, the flowers of love. Ha!), which I put into my hat. Because of wild animals there (snow tigers, bears, and wolves) I took an ice-axe with me; a rifle would have been too heavy. Through the whole miserable journey I thought about the International Ham-Hop Club, and about our being able to meet your hams. And this pleasure brought a great calm to me and the time passed quickly. Eventually I came upon a road, and stopped a big automobile driven by a Kirghiz. Because of my odd red beard, burned nose, a strange hat with flowers, an ice-axe, and watch showing the wrong (viz. Moscow) time—and my sudden appearance near the State Border, he was very impressed. Undoubtedly I was a spy . . . I begged him to stop when we came to a river, because I had not had any water for 7 hours in the desert, but when I even



The rig I used

moved my leg slightly, he stood on the accelerator; it was important for him to prevent this spy from jumping out on the way. We slid from the mountain pass with the velocity of a falling body. Finally he stopped before a barricade in the road, and a soldier with a gun came out. My driver started to dash from the car, but I jumped out first, shook the hand of the soldier, showed my documents to him, and told my story in a few words. The soldier was very glad to see a mountaineer and he smiled widely. The driver was flabbergasted, and took off as though a demon were on his tail. I gave the papers to the proper authorities, and managed to grab a few hours of sleep . . . My walk back through the long desert is entirely another story again.

I stayed in the base camp while the team climbed the Peak. Though I felt strong enough to climb with them I had to be on the radio every minute; I was the radioman. My correspondent in Osh was a Uzbek YL, Dina with a nice voice. When the team returned I transmitted a pile of telegrams to all the loving girls, wives, and relatives. The usual text was "all our love and kisses, please send 100 rubles to Adler, yours . . . " (Adler is a resort on the Black Sea). Dina worked without dinner. At last, all was finished OK. At the foot of the mountain we loaded 4 automobiles and left for Osh.

We came to Osh dusty and tired. We dove into showers the first thing. You can imagine our pleasure to wash with hot water after two months of washing in ice (and I do mean ice!) cold water. Our faces were burned, and

The start to the peak. YL Alla

because of this we had worn beards. When the gang appeared in a restaurant in the evening, the waiters did not come by for a long time, and the other clients pulled their women close to them. That was a very pleasant party. We invited Dina and her girl friend to take part in it with us.

Aeroplanes took us to hot Tashkent again. We liked Osh very much. Osh has a new good center, broad clean green boulevards, parks, lake, and good public transport. We were impressed by the old town too, though it is small, because none of us had seen it before. I saw that the life of the Asians had been greatly changed for the better since the Revolution. The only question is: has it been done by Communism or by civilization generally? I think the former. To solve it for myself I would have to travel through Iran, India, Afghanistan, and compare.

We left Tashkent the same day. I visited the club and gave QSL cards. On the TU-104 to Moscow I heard English speech and met some Americans from the state of Wisconsin. They were 14-16 years old and very charming. They seriously declared that they would call me from their school ham station; but I did not have the heart to disenchant them with explanations about propagation. Our own fellows asked me to translate "is there black bread in America?", and the American girl asked whether or not any of us had ever been in Michigan or California. My friends and I laughed very much, because it was like asking "have you ever been on the moon?"

So . . . the expedition was over, and we returned safe with a score of about 400 contacts, of all modes, with approximately 50 countries. But the main thing was that we all had a tremendous time.

. . . UB5UG

Many thanks to W6THN/1 for helping to whip this story into shape.

Joe Sport K4QYC
Route 1
Patsburg, Alabama

A Junk Box Power-SWR Meter

As every Ham knows, the antenna is the making of your rig. No matter how much input power you are running to the final, unless you can transfer most of the energy in the output to the antenna, a mediocre signal will be put on the air. Some means is needed to determine whether or not the antenna is doing its job. Many commercially built power and standing wave ratio meters are on the market today, but why buy one of these when you probably have all the parts you need to build one in the old junkbox?

All power/SWR meters are basically the same in that they sample a portion of the forward voltage on the transmission line which can be used to give an indication of power, and also sample a portion of the reflected voltage which is compared to the forward voltage to obtain a standing wave ratio. This author built his own power/SWR meter using parts from the junkbox, and bought only a minibox to build it in (even this would not have been necessary if I had not wanted to dress it up a little). The meter has three positions for reading power—a 10 watt position, a 100 watt position, and a 1000 watt position—and one position for reading the SWR.

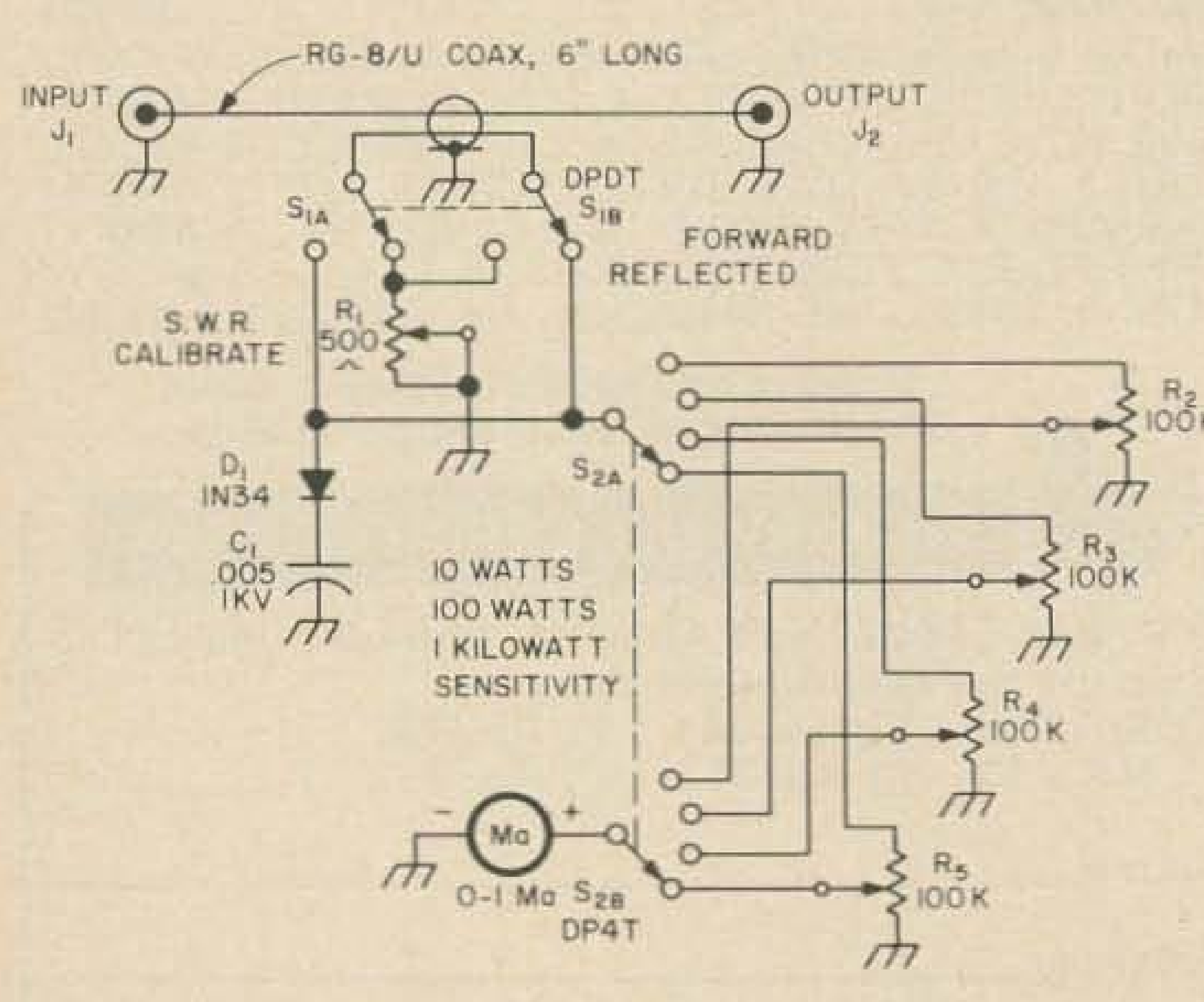
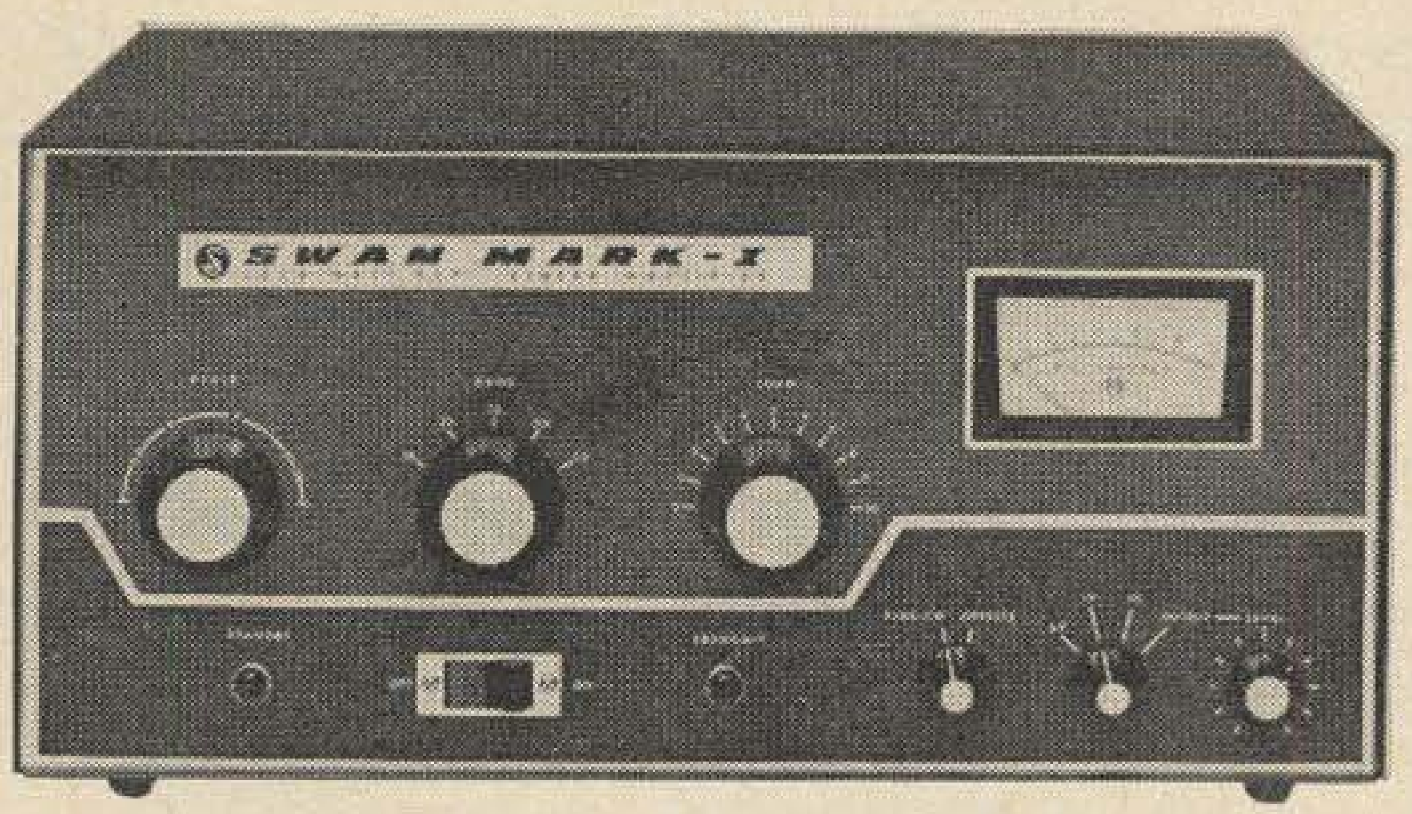


Fig. 1. Schematic of the Junk-Box SWR-Power Meter.

To sample the rf the coupling is made by inserting an insulated piece of hookup wire about 12 inches long between the braided shield and the inner conductor of the coax cable, and bringing it out the opposite end. Each end of the hookup wire is then connected to the proper terminals on switch S-1. To insert the hookup wire in the coax cable, remove the outer cover from the coax cable and push the braid together from the two ends. This will cause it to puff out and loosen. After the wire has been inserted it can be pulled tight again and smoothed out. All other components are connected as shown on the diagram, with the layout depending upon what it is to be assembled on.

As can be seen from the diagram, with switch S2 in the number one position, the upper side of R2 is connected to the rectified rf voltage through S2A1, and the center tap of R2 is connected to the high side (plus side) of the meter through S2B1. Likewise, R3 is connected when S2 is in the number two position, R4 is connected in the same manner when the switch is in its third position, and R5 when it is in the number four position. Switch S1 has only two positions, one to switch in the forward (fwd) voltage for a reading, and the other to switch in the reflected (ref) voltage. Only the forward position is used when reading power, while both positions are used in determining the SWR, as will be explained later.

A WINNING PAIR . . .



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The parts listed on the schematic diagram are the ones I used because they happened to be available in the junkbox. However, the value of the components used are not too critical, and can easily be substituted if not available. For example, potentiometer R1 may be of any value from about 250 ohms to about 2500 ohms. I just happened to have a 500 ohm pot, so that's what I used. R2, R3, R4, and R5 may be of values from 100k ohms up to 500k ohms, and too, each one can be of a different value within this range as they are all used individually and have no interaction in the circuit. However, I would not use a pot lower than 100k ohms because of possible damage to the meter, and I would not use one higher than 500k ohms because the higher value makes the tuning too critical. The capacitor C1 need not necessarily be a .005 but should be something close to this value at 1000 wvdc or higher. The diode D1 could be a 1N48, 1N60, 1N64, 1N66, or some other type and work equally well. Since I had a 1N34 on hand that is what I used. The meter M1 too, might be substituted with a microammeter of some value (although a shunt might be needed) or with another milliammeter of a different range such as an 0-3 ma or an 0-10 ma (however, it might not be possible to get a full scale deflection on a larger meter). As for the switches, it makes no difference what type is used so long as they serve the purpose. S1 is a double pole two position switch which could be a rotary switch or possibly two spdt ganged. S2 is a double pole four position switch which could also be a single rotary switch or two sp4t ganged switches, or another combination that would do the job. The Amphenol 83IR connectors are needed, but not absolutely necessary if you have some other means of connecting the input and output that will suffice. The six inch length of RG 8/U coaxial cable could be as long as twelve inches more or less if desired, but a six inch length should do fine. Also, the coax cable could be RG 11/U if a 72 ohm impedance is preferred.

Now, I believe most anybody who has been a Ham for only a short time will have accumulated enough in the junkbox to find most of the parts they will need, especially since the values are no more critical, and allow for a lot of deviation from the author's own construction.

It might be a good idea now to explain how to set the meter up for use. To calibrate for SWR readings, set the fwd-ref switch to the fwd position and the power/SWR switch to the power position. Next, connect the transmitter to the input jack and connect the output to a suitable dummy load if available; if not, you may use your antenna, although its impedance might not be an exact known value which means your reading would probably be a little less accurate than if a dummy load were used (however, it would still be accurate enough for a reference). Next, load the transmitter into the dummy load and adjust the SWR sensitivity control R5 for full deflection on the meter. Then switch the fwd-ref switch to the ref position. If the input and output connections have not been connected in reverse you should now get a lower reading on the meter. R1 should now be adjusted to give a minimum reading on the meter (the meter will probably dip, and this is where you want to leave it). When this has been done the meter is calibrated for reading SWR, and R1 should not be adjusted again.

To use the meter for reading SWR, switch the fwd-ref switch to the fwd position and the power/SWR switch to SWR. With the meter connected in the line between the transmitter and the antenna, turn the transmitter on and adjust the SWR sensitivity control R5 for full scale deflection, then switch the fwd-ref switch to the ref position and take a reading. The SWR can then be calculated from the formula $SWR = \frac{I_{Fwd} + ref}{I_{fwd} - I_{ref}}$. Assuming that the meter used is an 0-1 ma meter, then a full scale deflection would be 1 ma or 1000 microamps, and further assuming that in the ref position you read 200 microamps on the meter, then the SWR would be calculated as follows:

$$SWR = \frac{I_{fwd} + I_{ref}}{I_{fwd} - I_{ref}}$$

$$SWR = \frac{1000 + 200}{1000 - 200}$$

$$SWR = \frac{1200}{800} = 1.5{:}1$$

It might be pointed out here that if a full scale reading cannot be obtained after adjusting R5, then adjust for a half scale or three-quarter scale reading and still use the same formula which will give a relative indication of the SWR which will be fairly close.

To calibrate for power, still using the dummy load, set the fwd-ref switch to fwd and the power/SWR switch to the 10 watt position. Using a voltmeter with an rf probe, load the transmitter until you read 22 or 23 volts, then adjust R2 for a full scale deflection on the power meter. Using the E^2/R formula you will find that with a full scale reading you are very close to 10 watts. If other than a 50 ohm dummy load is used then the amount of voltage needed for a 10 watt load can be determined depending on the impedance of the load being used by referring to Ohm's law.

The 100 watt position is calibrated by switching the power/SWR switch to that position and the fwd-ref switch to fwd, and loading the transmitter until 70 or 71 volts can be read on the voltmeter. Then adjust R3 for a full scale reading. In the 100 watt position an rf ammeter can be used instead of a voltmeter, in which case a reading of about 1.35 amps would be needed, calculated from the I^2R formula. Again, these readings are based on a 50 ohm load, and if a load of some other impedance is used, readings may easily be calculated by using either the E^2/R or the I^2R formula. I might add that the rf ammeter could hardly be used in calibrating the 10 watt position as the current would be too low for any sort of an accurate reading.

To calibrate the 1000 watt position the same procedure is used as for the 10 and 100 watt positions. Switch to the 1000 watt position on the power/SWR switch, and to the fwd position on the fwd-ref switch. Load the transmitter until you read between 220 and 225 volts on the voltmeter or about 4.5 amps on the rf ammeter if it is being used. Next adjust R4 for a full scale reading. Once this has been done, all the power reading positions are calibrated and need not be bothered again. To read power all you have to do is switch to the desired position and with the fwd-ref switch in the fwd position, read directly from the meter which can be laid out in divisions to suit yourself.

The question might arise as to how you can calibrate the 100 watt position when your output is only 50 watts, 75 watts, etc., or, how can you calibrate the 1000 watt position when your output is only 150 watts, 300 watts, 500 watts, and etc.? Here you have two alternatives.

First, since this meter is to be used with your own rig, you can calibrate it to match your transmitter. If your output is 50 watts, then instead of calibrating the meter for 100 watts, simply calibrate it for 50 watts at full scale deflection, or if your transmitter output is 300 watts, then calibrate for 300 watts full scale instead of 1000 watts. The voltage and current values for any given power can be calculated from Ohm's law and the power meter calibrated in any position to read a desired power at full scale.

The second alternative would be to mark the meter off in equal divisions of 10, 5, or whatever you choose. If you have a transmitter capable of delivering 75 watts, figure the voltage or current necessary in order to have a 75 watt output and load your transmitter until you have reached this amount. Next adjust the pot R3 for three-quarter scale reading on the power meter in the 100 watt position and you now have this position calibrated for reading 100 watts full scale or 75 watts at three-quarter full scale, or 50 watts at one-half full scale, and etc. The 10 watt and 1000 watt positions can be calibrated in the same manner if the need arises.

As you might have already seen, in building the meter you could eliminate any of the power reading positions you do not need. If you wanted only one position for reading power, then the other two could be left out of the meter completely, and the one position calibrated to meet your needs.

Once all calibrations have been made, the only control that should ever be adjusted is the SWR sensitivity control R5. With a little practice you will soon be able to get a relative indication of the SWR simply by switching the meter instead of using the formula. The more it is used with different antennas, you can begin to mark off indications on the meter for permanent readings. If calibrated and used correctly, you can get fairly accurate readings of power and SWR with this inexpensive little instrument.

. . . K4QYC

Wayne Green W2NSD

The Design Industries Diplomat

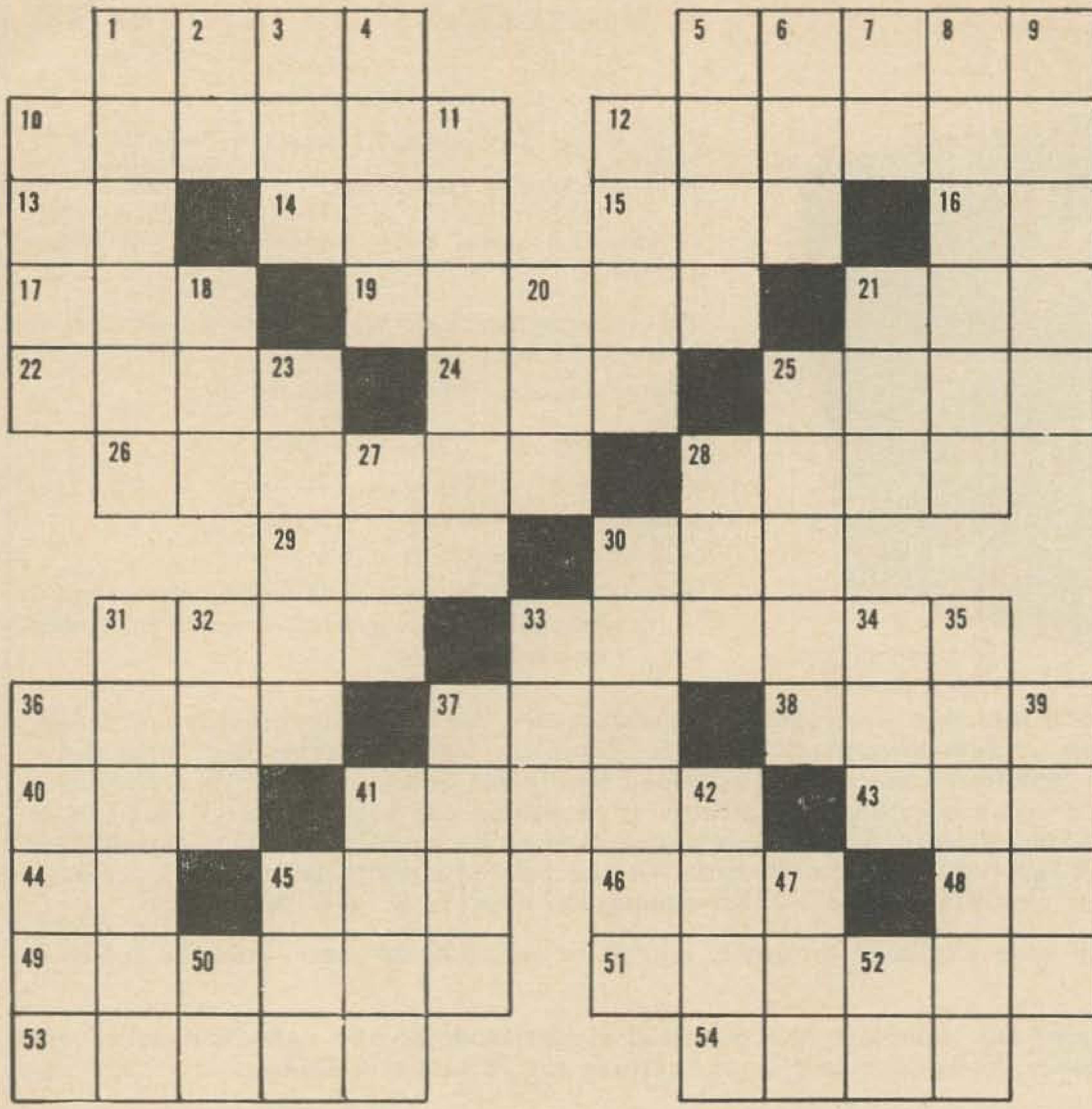
For a long time I have been making do with an ordinary office desk for my operating position. This is OK, I suppose, but now that I've invested in one of the Design Industries Diplomat operating desks I sure do appreciate the improvement.

The Design Industries desk is slanted at the rear so your equipment is directly facing you when you operate, thusly making all dials and knobs easily readable. When I had the rig on the flat desk I had to lean over and squint to see what frequency I was tuning, now it's right there at me.

I've been looking for some time for an operating desk that was well enough made so it would fit in my library and not look like a work bench. This unit serves as both an operating desk and a working desk, plus being a well made piece of furniture which has greatly improved the looks of the whole room. It has two good sized drawers which run smoothly on nylon wheels plus a small middle pencil drawer. The overall length of the desk is 60", the width of the slanted part is 13" and the flat part is 15". There is a cable trough along the back edge for interconnecting wires to keep things neat.

All in all it is a nice piece of workmanship and Design Industries is to be congratulated for making something beautiful and useful available to us for such a reasonable price ($139.95). I suspect that a good many hams who are proud of their stations will be getting these desks.

. . . W2NSD



Joseph Gaudet K1CLM
61 Adele Avenue
Haverhill, Massachusetts

Ham Cross Word

Across

1. Versatile ham meter
5. Measuring instruments
10. Relation between numbers
12. To suit
13. Tibet land
14. Variable resistor
15. Self
16. Power
17. Used with a bolt
19. Points of minimum voltage
21. Wooden pin
22. Day of the week
24. Pronoun
25. What an overheated xfmr can do
26. Control
28. Head coverings
29. Malt beer
30. The OM's XYL
31. Printing measure
33. Not winners
36. LC circuit
37. Sack
38. Eats
40. State in W5
41. Obscure
43. Switch handle
44. 150
45. Animal park
46. Ham record
48. Concerning
49. Type of poetic foot
51. Senior operator
53. Region in OE
54. Receiver control

Down

1. What's in a tube
2. Teletype
3. Wheel

4. Half way from KP4 to WI
5. Measure of resistance
6. Oscillator
7. Preposition
8. Officials in TA
9. Rule
10. Rave
11. Follower
12. Fermented drink
18. G lands coffee break
20. Owed
21. Place
23. Handy during a contest
25. Transistor electrodes
27. W4 state
28. Division of time
30. Self-contained replacement unit
31. Race track vernacular
32. Writing fluid
33. Well known ham distributor
34. Polish
35. Thin
36. Silent
37. Members of IoAR
39. Leave alone
41. Inductor
42. Dullard
45. I have traffic (Z sigs.)
47. Harmonic chaser
50. Title for OM
52. Half an em

Answer hidden on page 120.

Roy Pafenberg W4WKM
316 Stratford Avenue
Fairfax, Virginia

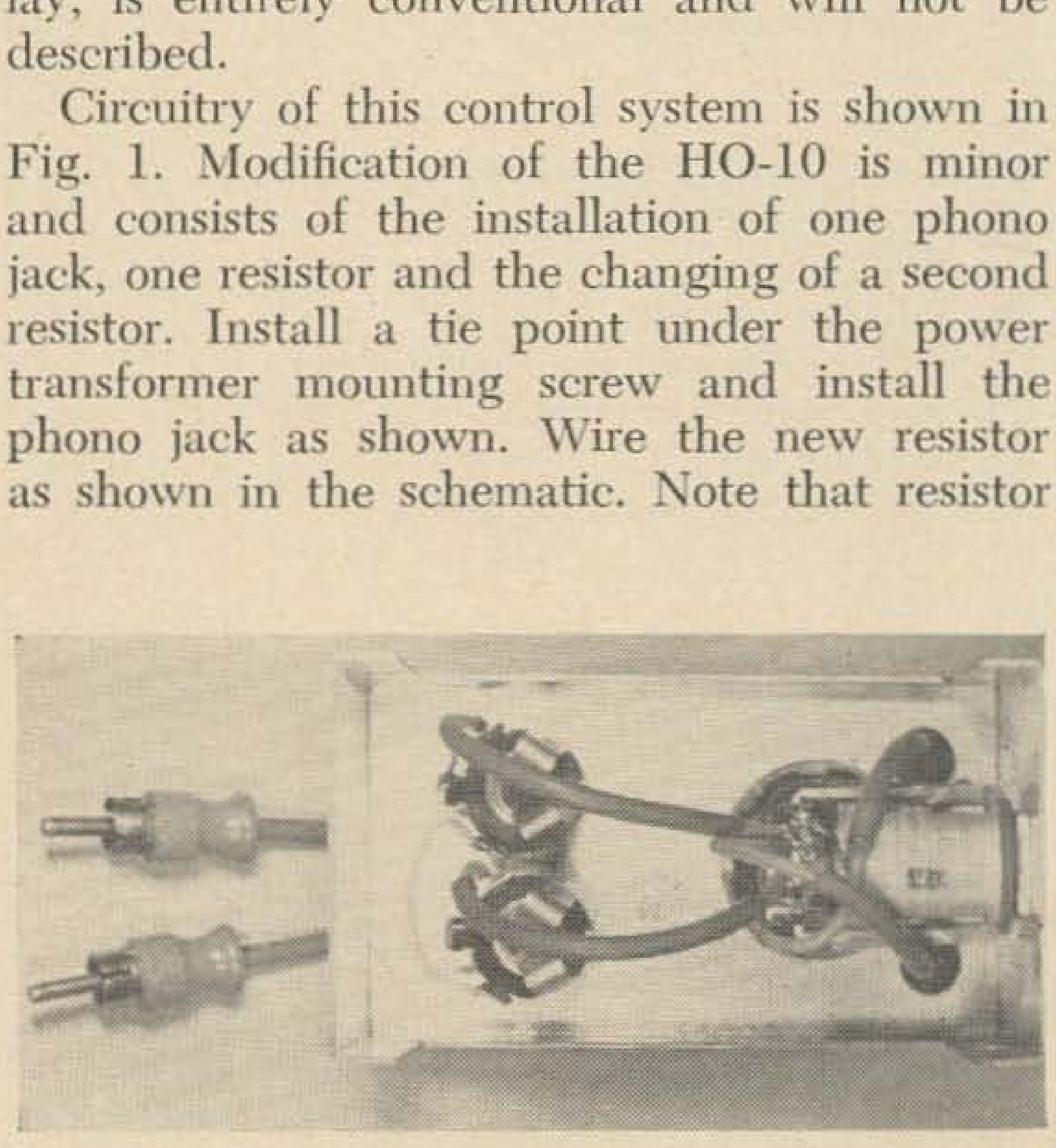
Automating The Two-Tone Test

The quality of your sideband signal is very much dependent on the proper adjustment and operation of your transmitter. Even the best equipment is capable of generating spurious output frequencies and interference if improperly adjusted. By far the best way of insuring the quality of your radiated signal is the use of a monitor oscilloscope. Preferred practice is to use the scope in conjuction with an audio oscillator and injected carrier (or two audio oscillators) for initial adjustments and for routine maintenance checks. Following these tests, the scope should be used to continuously monitor the transmitter output, using either bow-tie or envelope displays. The economical availability of specialized oscilloscopes, such as the Heath HO-10 Monitor Scope, makes it a simple matter to meet these requirements. To further simplify the procedure, the Heath HO-10 contains two audio oscillators for making two-tone tests.

However, even those amateurs who own the requisite equipment conduct the two-tone tests all too seldom. Why? First, you must unplug the mike and patch in the audio tone or tones. Then you must disconnect the antenna from the transmitter and connect the dummy load. Now you are ready for the tests and, after adjustments are completed, you must perform the steps in reverse. Then, if things look different into the antenna, perhaps it would be best to go back and refine the adjustments. At this stage, you say the heck with it, it's close anyway, and you go on the air. Future tests are postponed simply because of the inconvenience of making the two-tone test set-up.

The problem has been stated; now for the answer. This article describes a method of automating the two-tone test. While specifically applicable to the Heath HO-10 Monitor Scope, it may be revised to suit other equipments, including home-brew. In this control system, a control voltage jack is installed on the back of the HO-10. When the TONE GEN switch on the HO-10 Monitor Scope is switched to either the 1 kc or 2 TONE position, an external relay switches out the microphone and connects the tone output from the HO-10 to the input of the transmitter. In addition, another set of relay contacts may be used to switch the output of the transmitter from the antenna to the dummy load. This antenna switching circuit, using a coaxial relay, is entirely conventional and will not be described.

Circuitry of this control system is shown in Fig. 1. Modification of the HO-10 is minor and consists of the installation of one phono jack, one resistor and the changing of a second resistor. Install a tie point under the power transformer mounting screw and install the phono jack as shown. Wire the new resistor as shown in the schematic. Note that resistor



R41 must be changed to a 15,000 ohm, 2 watt unit.

The control relay and the required connectors are mounted in a Bud CU-2103-A Minibox which measures 4" x 2¼" x 2¼". The audio connectors may be of any type you desire although the types specified are compact and allow push-to-talk circuitry to be carried through the control unit. The relay shown in the photograph is a surplus unit. Those without well stocked junk boxes may use a Potter and Brumfield type LM11. Use shielded leads for the wiring. A hi-fi phono type patch cord was cut up and used to wire the unit shown in the photograph.

The control box cover is secured to the back of the HO-10 with the self-tapping screws used to secure the scope in the case. The patch leads from the control box are then connected to the appropriate jacks on the back of the HO-10. Plug your mike into the microphone input jack on the control box and install a shielded cable between the control box output jack and your transmitter mike jack. Now wire a coaxial relay so that when the control box relay closes, the transmitter output is switched from the antenna to a dummy load.

The operating convenience of the control system is out of this world. On the air testing

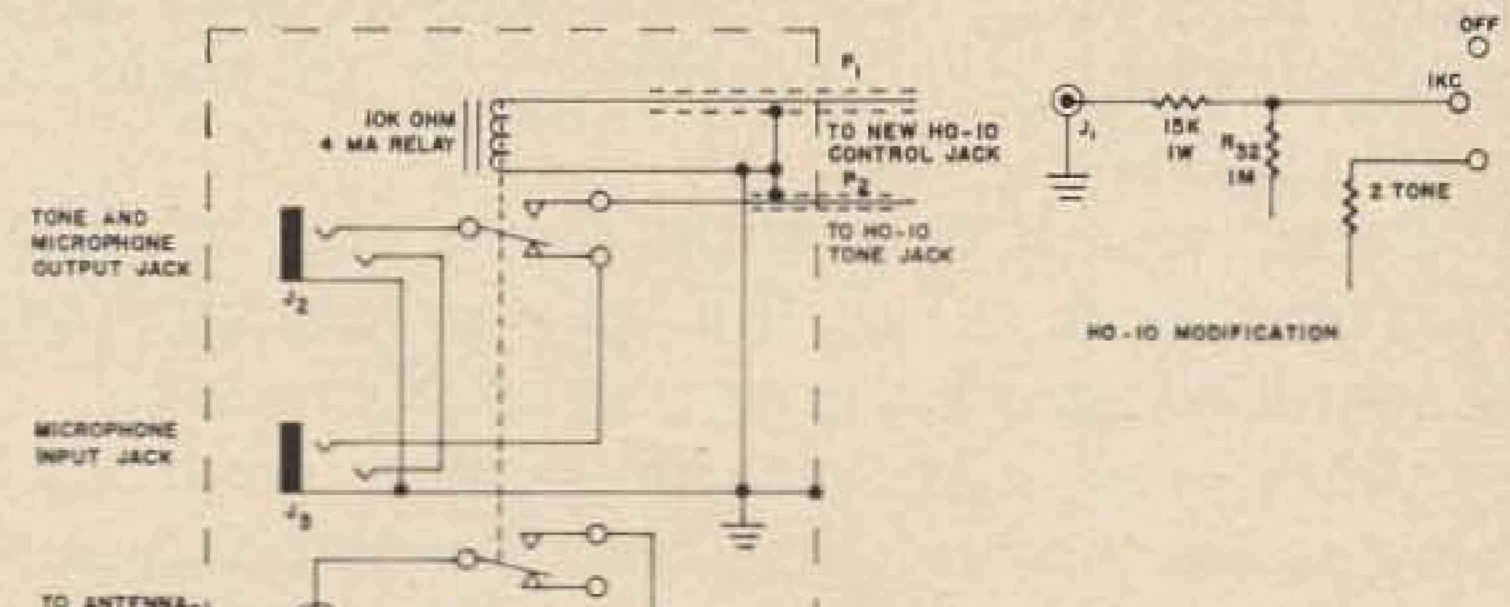


FIG. 1

Parts List

J1—Single hole mount phono jack.
J2, J3—3-conductor microphone jack, Switchcraft C-12B or equal
J4—AC receptacle
P1, P2—Phono plug

is minimized and the dummy load gets the use that it should. While the circuit change in the HO-10 raises the voltage applied to V3 and V4 in the normal operating condition, no adverse results were noted. Also, in the test condition, the voltage on these stages is lowered somewhat with no ill effects.

Relays, particularly surplus units, are cheap. Why throw a multiplicity of switches and make like a one arm paper-hanger when you can automate your station?

. . . W4WKM

Bill Hoisington K1CLL

Two-Meter Solid State Walkie-Talkie Transmitter

Transistors have come a long way since 1950 when I first started to work with them on 75 meter fone. They still burn out at the drop of a pin though. Usually your collector current meter pin! I cured that for the moment by wiring a no. 49 bulb, 2 volts-60 ma, in series with the battery lead. They do work but you've just got to pay more attention to safety. The transistor's that is, not yours. I wound up on this rig with a box of dead soldiers, as usual! Only six this time though. I'll say one thing for them, when you do you get them working right, they do seem likely to work for a long time.

I can see them cutting down size, weight, cost and heat in all TV sets eventually, but that will require loads of very careful work.

When you hike or camp away from that plug or car battery then they become interesting. Even mandatory one might say. Because you are then carrying the power supply, and every dc watt counts. Ever struggle up Slide Mountain (Catskills, 4,000 ft. elevation) toting a car storage battery? I did. Once!

What a deal! Some ambitious soul has edited a book listing "over 3,000 transistors." Let's pick out just one good one and put it on the air. The spec sheet on the one involved, an SYL4221, says "gain-bandwidth product is 850 mc minimum, 1000 typical". Note carefully this is megacycles, not kilocycles.

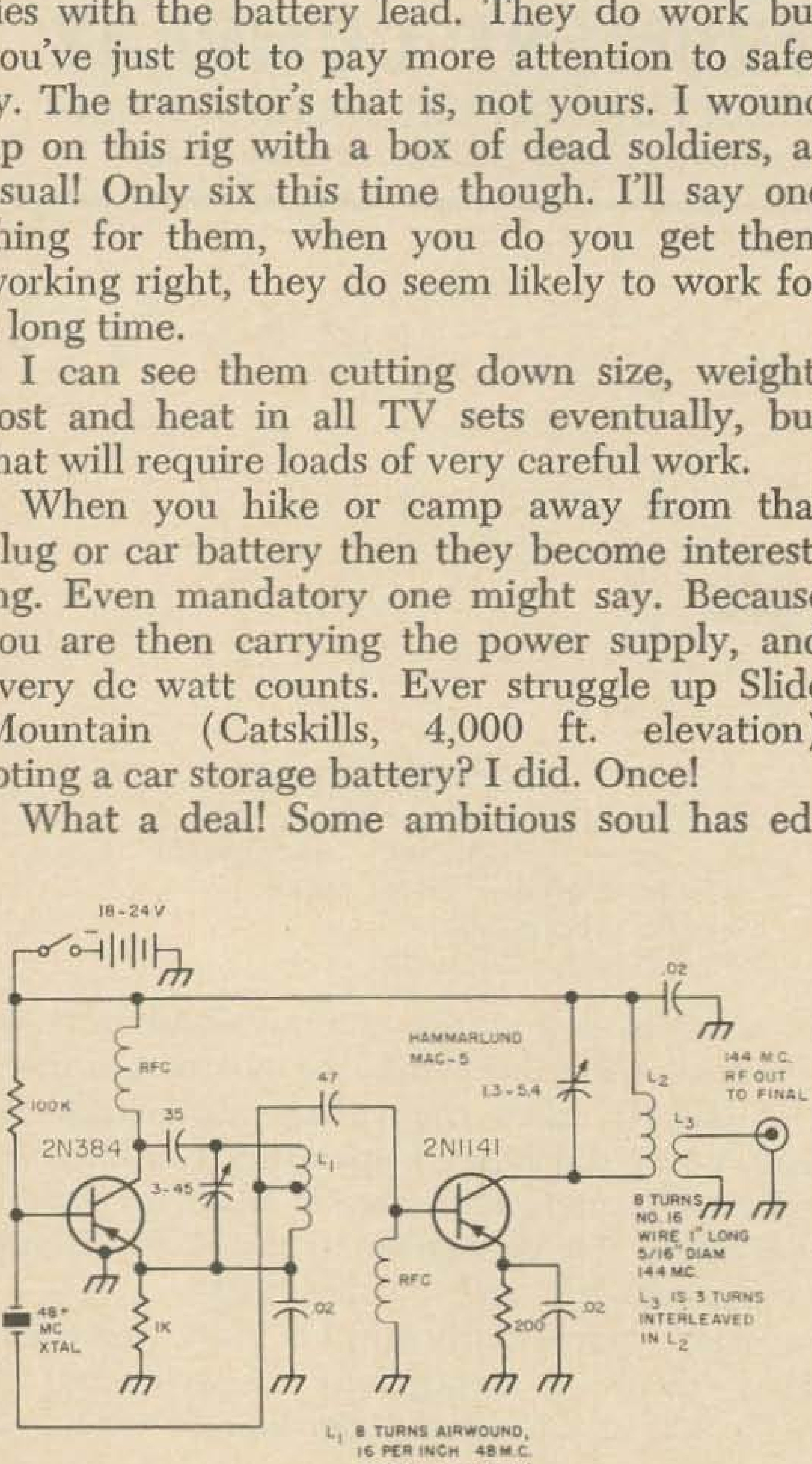


Fig. 1. Two meter driver.

What does this mean? Well, as a comparison, the gain-bandwidth product of the 6AK5, a real red hot WW2 tube, is around 400 mc. This gain-bandwidth business incidentally tells you something about the device. A 6AK5 tube is thus about all through at 400 mc. How then can a transistor beat it? A story of the rf advance of these little solid state miracles since they were invented some 16 years ago will be undertaken later, but only if the facts can be dug out. Around 1953 I lit a bulb on 75 meters with one of them as an rf amplifier. Since then I have watched with great interest their march up towards microwaves.

Several years ago some very large ads came out, like "750 milliwatts 250 mc", and so on. If you read all the fine print in the ad, you found that you could have *either* the 750 mw or the 250 mc. But not both at once! You were "supposed to know" the little dot between those two nice big figures was meant to read "or".

CB has given a boost to 10 meter transmitter type transistors. UHF TV apparently has given the greatest push towards economical UHF types, at least in the low power region.

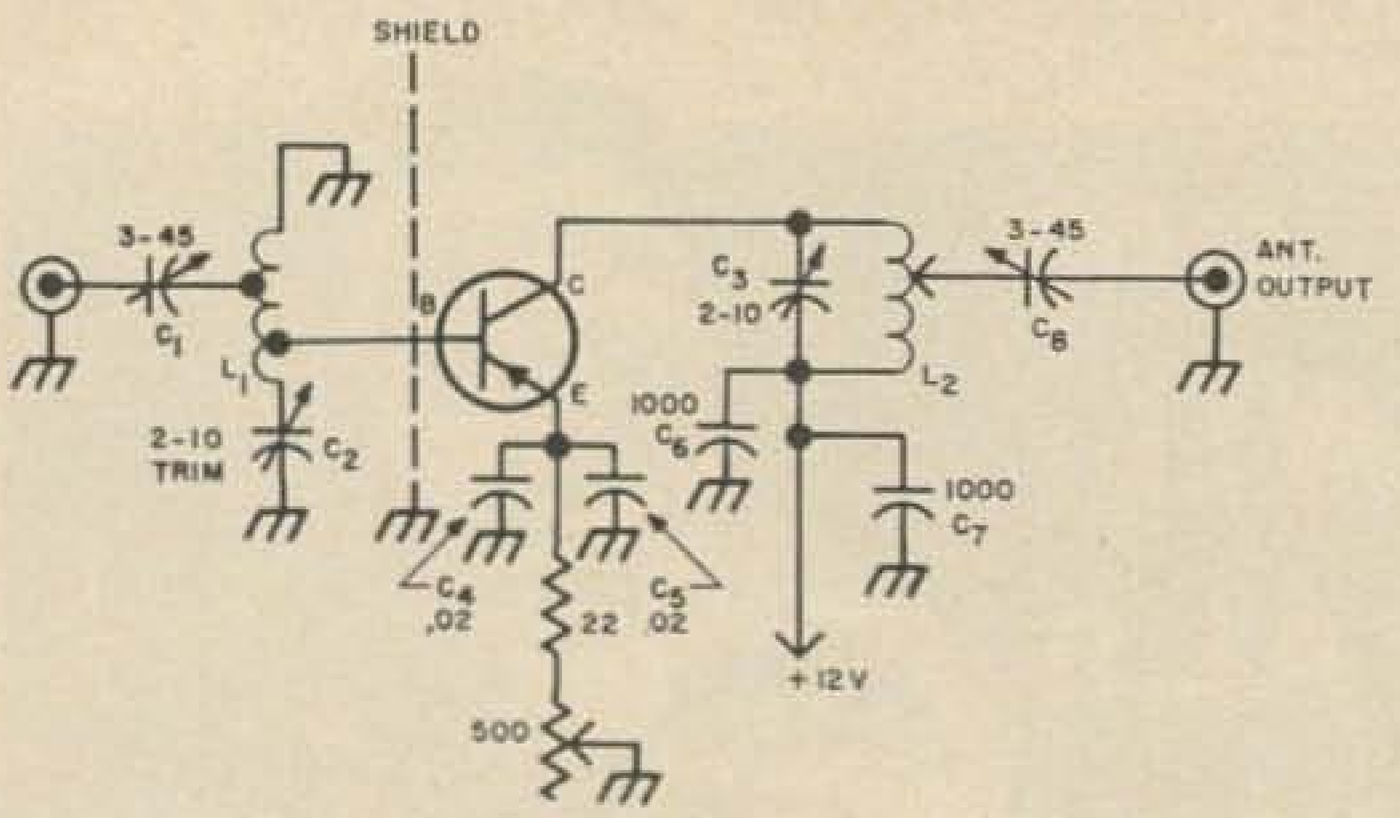
Other things to remember are prices and db gain. Manufacturers getting 4 db gain with 10 watts out on VHF would crow about it. And charge $80 for one! In fact, in a recent article on rf amplifiers at 144 mc the author (again the honest type) says "The price of the transistors used are out of the reach of the average amateur, $100 to $200 range." And still with only a few db gain! Watch out for that last one. This is why some circuits show "four 2N— in parallel!" Some of the little ones can be quite good as far as db gain at UHF is concerned. Maybe Uncle Sam (that's you and me) could buy the $200 ones and sometimes he did. If you were in orbit and had to talk back home that's ok. I certainly am willing to help pay my mite to get our brave space cadets down again. But, for the amateur use, too high. The dollars, that is.

Fortunately, as time goes by prices do seem to always drop. That is, for semi-conductor devices. Which is more than you can say for groceries.

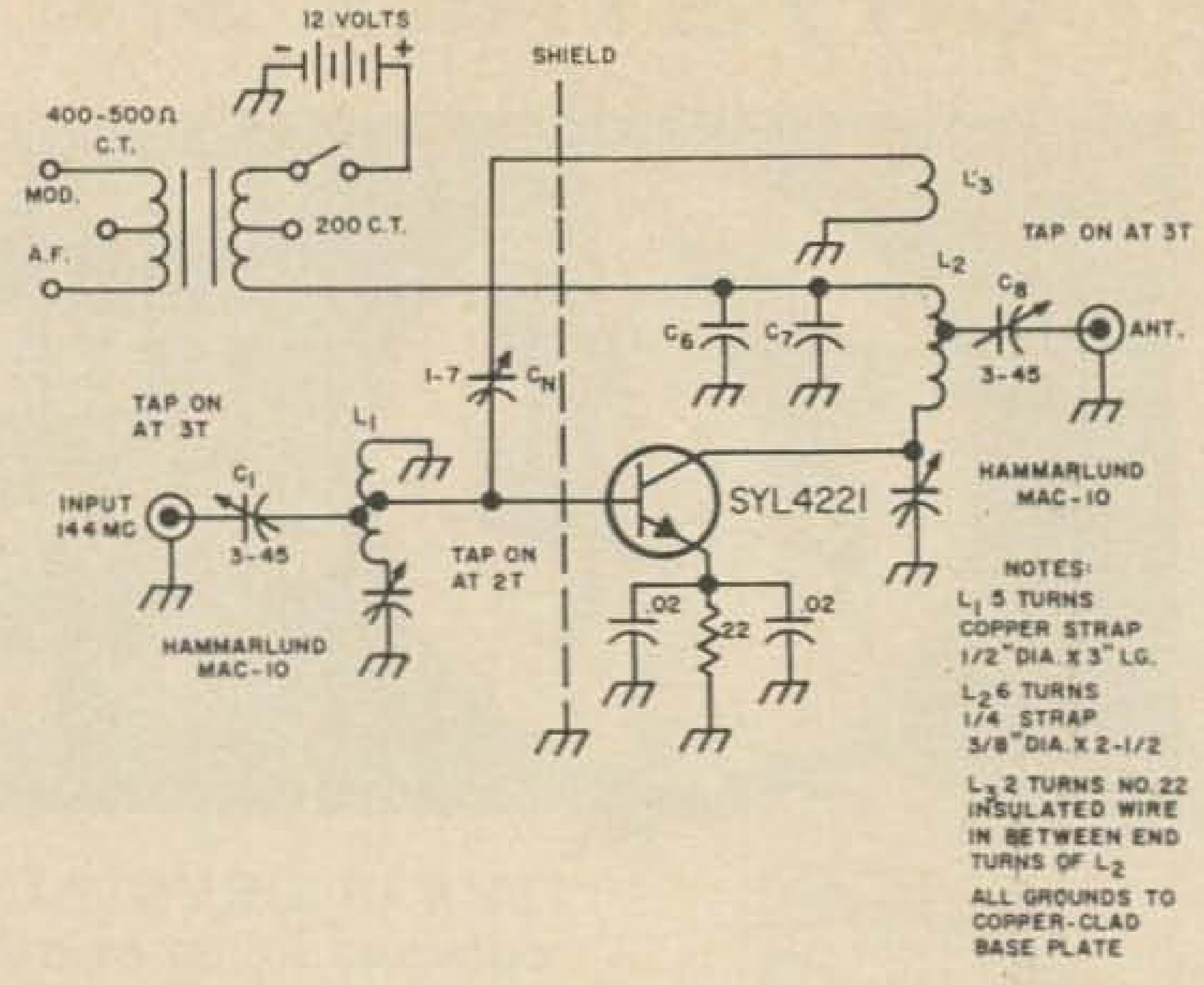
The transmitter to be described below makes use of relatively low-cost transistors now available.

VHF Amplifier Design and Neutralization

You can get a real boot out of this. Practically as many schools of thought as there are writers. Some make no mention whatever of neutralization. Some do. Some speak of unilateralization. Don't let that 17 letter word bother you. It just means that transistors have resistive nuisance feedback as well as capacitive nuisance feedback and you have to "neutralize" both. That's "unilateralization." For



Above. Fig. 2. Trial circuit. Transistor should be shown as NPN. Fight. Fig. 3. Final circuit.



the time being for amateur rigs forget about the resistive part. Be happy if you can neutralize the capacity component.

Now to get to the point. Setting up our good transistor, it's got to be good for two meters because it is listed as a 1000 megacycle amplifier, oscillator to 2000 mc." I started in.

Fig. 1 shows the crystal oscillator and tripler. (Yes, I know I've always advised *doublers,* but you see, this rig is supposed to be low cost, high efficiency, low drain, highly portable, etc.) This is essentially the same circuit as described in a previous article, "A Two Meter Signal Source," but is optimised for maximum output on 144 as an exciter-driver. Until further notice the little transistor with its milliwatt power and low voltage can be considered as not pushing the 48 megacycle rock around. This does not mean you can put in a VHF power job as the oscillator unit with maybe 100 volts and 3 watts. The 48 megacycle crystal might just not like that.

Fig. 2 shows the rf final test set. Note the bare simplicity of it. My first thought was to use an untuned input as shown in most diagrams. Started off OK, base excitation loads up the collector mils, but when I tuned the collector circuit through 2 meters, Zilch! Excitation drops to almost zero and only by a severe amount of fiddling around does the rf output bulb show even the tiniest glow. What about neutralization? So, more study, through a baker's dozen reference books, 73's, CQ's, QST's, Electronic World's and Radio Electronics back to 1958 and the handbooks. Nothing much there on the subject. I did dig up however an actutely interesting piece of information. It seems that present day VHF power transistors aren't good enough to require neutralization! The statement is made that "As high frequency transistor power gains improve it is expected that high gain high frequency power amplifiers will require neutralization". This of course ties in with the above mentioned 4 db gain and the leaving out in some published circuits not only of neutralizing but even any mention of it. Or why it's left out. It also explains why neutralization is required with the transistor shown here. Simply because they are too good not to require it on 2 meters. Live and learn!

That solves for the time being the question of neutralization for this transmitter.

So, for neutralizing first I tried a 2 meter tuned circuit capacity coupled, loosely, between the collector and the base, also trying it between the collector and the hot end of the base circuit. This gave the first real sign of life to the rf output as the 180 degree out of phase energy attempted to cancel out the internal feedback capacity of the transistor. It did work fair, but was touchy, and of course would be strictly a single frequency affair.

After due deliberation I came up with the neutralizing circuit of Fig. 3. At least it works. You can of course see the resemblance to a more or less standard neutralizing circuit. The inductive coupling is low impedance and readily adjustable as to amount, by varying the number of turns, or their placement, or both. It also leaves the rest of the collector circuit as is. It's hard enough to get a decent handling collector circuit on 2 meters without having to put in neutralizing taps, ungrounded tuning capacitors, etc.

So now we have variable inductive coupling for low-impedance neutralizing. The reverse phase is easily obtained by turning this coil over, in case you had it wrong at first. Just remember the old "blooper" rule, with a plate coil and a grid coil wound the same way near each other on the same coil form, put the plate on one end, and the grid on the other. That's for an oscillator with 180 degrees

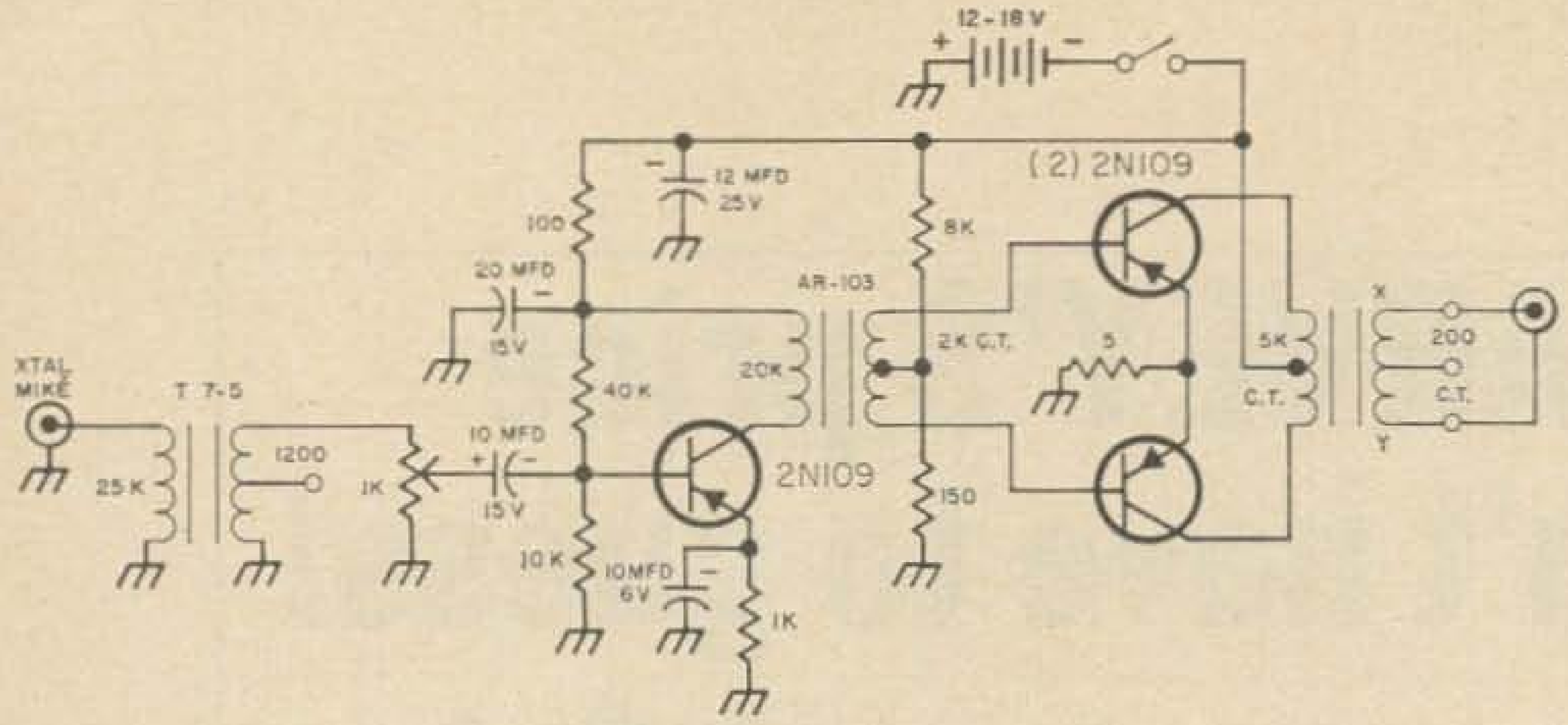


Fig. 4. Modulator.

out of phase grid-plate operation. It is also the way to neutralize if you use just the right amount, in an rf amplifier!

Also remember that more plus voltage on an npn base makes the collector go more negative, like a grid and plate, so the same rules hold for a grounded (or common) emitter stage.

Adjustable low-impedance (simply because it is large) capacity coupling is used over to the base, Cn in Fig. 3. And I think it can be arranged to be quite suitable for 432 megacycles.

With this neutralization the amplifier stage works fine on 2 meters. Lights a no. 49 bulb brightly. Looks almost like quarter watt out. But don't modulte it that way. Tried it out on a little 2 over 2 beam hung on my rotator mast below the 432 14 element Yagi. Carrier went 25 miles or so. QTH here only 100 ft. above sea level. See later tests also.

Note the assorted bypasses on the emitter and collector returns. The 500 ohm variable in the emitter lead can be left out as it stays mostly at zero. The collector mils run between 10 for a 12 volt battery, to 20 miles for a 24 volt battery supply. But, to repeat, do not modulate it that way! Read below what happened when I did.

Note also the copper strap inductance with six turns parallel tuning on 2 meters!

Modulation

This seems to be the same story all over again. RCA handbook has nothing. QST Handbook either. Very few construction articles have much to say about it. I understand that when Raytheon was working on their new all-transistor marine radiotelephone that came out this year they found it very difficult to modulate 100% and had to develop new and patentable modulation circuits for it. Proof enough?

There is one article by a lad who appears to know a lot about it and has done a lot of work on the subject. He first goes in for base modulation, which seems to me like the old grid modulation at first glance, and then he really gets into the business with what he calls "series collector" modulation. This turns out to be a circuit for using the modulator as a variable collector resistor. It requires twice the battery voltage, which he honestly admits, and then he also modultes the driver, which has been required in grounded-grid tube circuits. And the result is "more than 100% modulation!" A form of controlled carrier modulation.

Then what happens? He goes on to say that receivers may not be able to handle this type of modulation. This is where we get off. Mobile and point-to-point services can use special receivers. I've often thought of certain types of special jobs for tests between two amateurs, but this walkie-talkie transmitter is for general use. So, I just hooked up the most economical af design I had using small transformers, with good old collector modulation. (Not that I won't play around with that 150% idea myself later.)

The modulator itself is just straight af work, on which plenty of real good dope is available and published. The problem is just what to do with that audio when you get it. Here, as mentioned, I simply modulated the collector voltage by inserting a modulation transformer in series, like with tubes. And promptly burned out a whole mess of good UHF 2,000 mc transistors. Just so it doesn't happen to you, this is what took place. In trying out various modulation transformers (and transformers, period) some of which had nice labels like "16 ohms", "48 ohms", etc., I assumed that there wouldn't be too much af voltage on such low ohmage secondaries. Was I ever wrong! Incidentally I was using a single large audio transistor and a carbon mic. in this first modulator. (Not shown). The first time I laid the mike down on the bench, Ping!, out went the transistor, shorted out from collector to emitter. Before

I got wise and put my VTVM on the modulation transformer secondary and found as much as 50 volts of af, several more went out! Add that 50 volts to the 24 collector volts dc that I was using, and no wonder. So, too late wise, but still better than never at all, I dropped the collector voltage back down to 12 volts, dc, and kept my eye on the ac modulator voltage before switching on the collector. And while talking also! Since then ok. Just another item about transistor work. Hope it doesn't happen to you. We'll investigate later some 100 volt transistors, with an eye on the price and the gain figure. The little ones described here are only rated at 20 volts, but they work also on 432!

On the Air Tests

As I "tune up" a modulator I listen in on a tuned crystal detector, transistor af amplifier, and earphones, the kind with the big ear pads on them. This is pretty good for a start. You can compare modulation nicely with your regular rig if you have one. Of course, this doesn't tell the whole story. Like FM, overmodulation, etc. It does check reasonable fidelity of speech though, and distortion is heard right away. I have heard plenty of lads with rf-af feedback who should have been listening to their carriers!

The vital check of course, is to go over to a friend's house and "hear yourself as others hear you." The first time I did that I changed modulators in a hurry. The final one shown in Fig. 4 works OK. It also uses quite standard parts and will get you on the air walkie-talkie. On your beam at home it will also surprise the heck out of you and your buddies on the band nearby! It is kind of an eerie effect, going on the air with such a rig for the first time. Someone calls you and you look over your shoulder to see who it might be that he's calling. Soon your confidence grows though, and you're talking like you had 100 watts instead of 100 milliwatts.

I've always maintained that if you can light a bulb you can be he herd. Even though it's only a no. 49, 2 volts at 60 mils.

Reports on modulation run from 75% to "nearly 100%", "clean carrier, no splatter", "modulation excellent", (took that one with a grain of salt). Worked four stations in the first hour, including Weymouth, 21 miles airline, and Billerica, about the same using a small 2 over 2 beam about 35 ft. off the ground. Ground is only 100 ft. elevation above sea-level as mentioned. Receiver (super-het) to match is working; more later on that.

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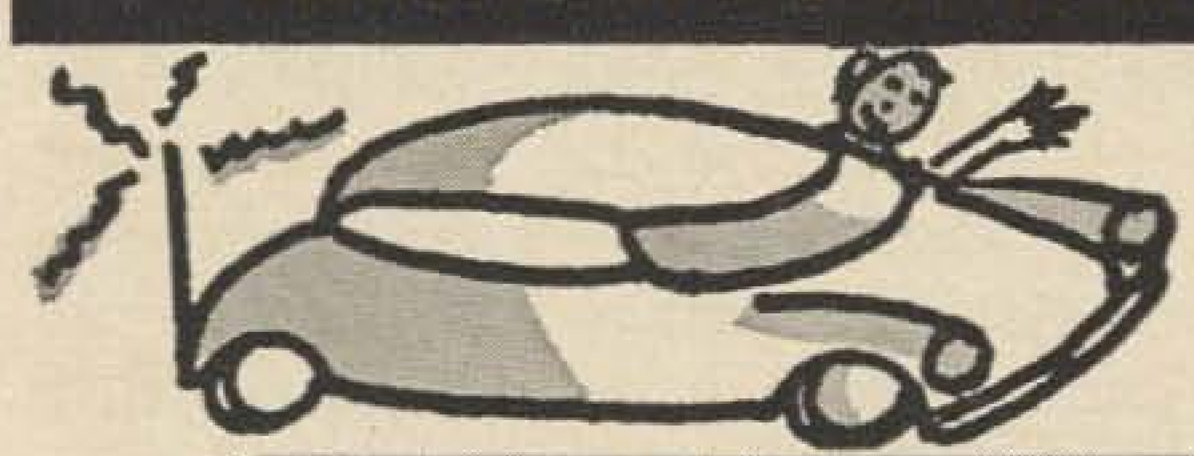

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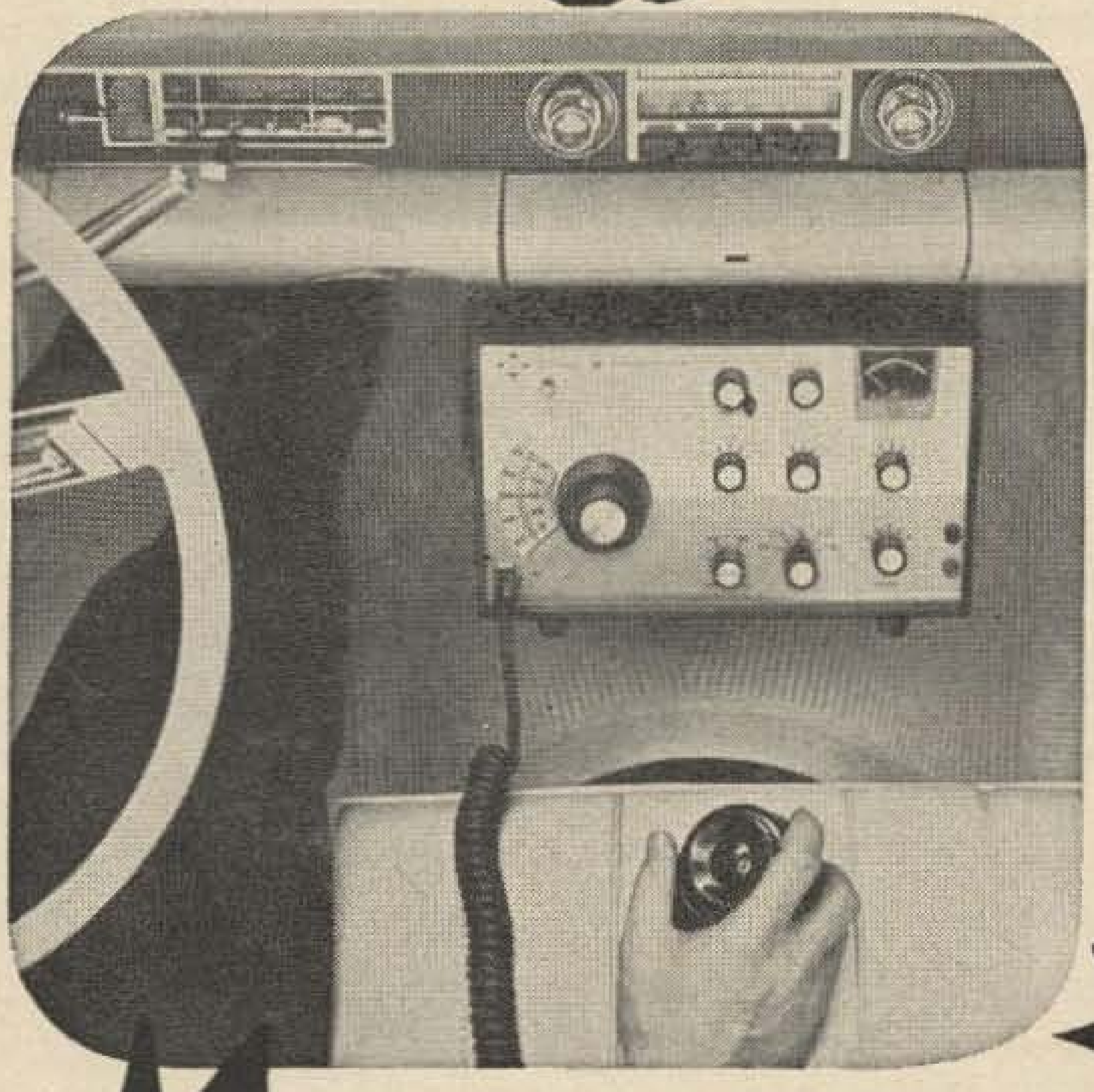

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Ronald Ives
2075 Harvard St.
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A Reliable Audio Source

No matter how much equipment there is around the ham shack and the experimental laboratory, there always seems to be a need for another audio oscillator for amplifier testing, bridge driving, and filter checking.

"Classical" audio source for these purposes is the General Radio Microphone Hummer, which, within its stated limitations, is a most consistent and satisfactory performer. The writer's instrument, purchased in 1928, finally "went to God" in 1960, necessitating a replacement of some sort.

To make unnecessary the purchase of large high Q inductances, or large variable air capacitors, an RC circuit was decided upon. This family of circuits holds promise of giving satisfactory operation at low cost, low bulk, and low weight. With careful parts arrangement, the probable stability seemed great.

Circuit finally chosen, including power supply, is shown in Fig. 1. Note that this is entirely conventional except for the frequency adjustment, and that all components are "over the counter" items at any distributor's. Although the parts specified are the parts which were used, electrically equivalent parts of other manufacture and the same quality will give substantially identical performance.

Preliminary experimentation with the circuit, which may be described as a cathode-coupled Wein Bridge oscillator, showed that it contained no hidden gremlins. Amplitude stabilization was attained by use of a nonlinear feedback resistor (here a 3 watt, 115 volt lamp) and by regulating the plate supply voltage. This combination makes the circuit insensitive to both slow drifts of line voltage and to switching transients.

For convenience in the laboratory and in the field, the oscillator was constructed with an integral power supply. All components were easily fitted into a standard 5″ by 6″ by 9″ steel utility case, and no "packing factor" difficulties were encountered.

To minimize thermal drift, all major heat-producing components (tubes, lamp, and VR dropping resistor) were mounted above the chassis, which is a 5″ by 8″ by 2″ SeeZak.

Frequency control and other "cold-running" components are mounted under the chassis. The fixed resistors and capacitors in the frequency-determining circuits are kept free of the chassis to insure good air circulation and to minimize heating by conduction. Tie points were used where necessary to support the heavier resistors and capacitors. As no high frequencies are involved, wiring presents no serious problems.

As a precaution against hum injection, filament wires are run as twisted pair, and are dressed around the edges of the chassis.

Ohmite type AB pots are used in this oscilla-

Front view of the 1000 cycle oscillator.

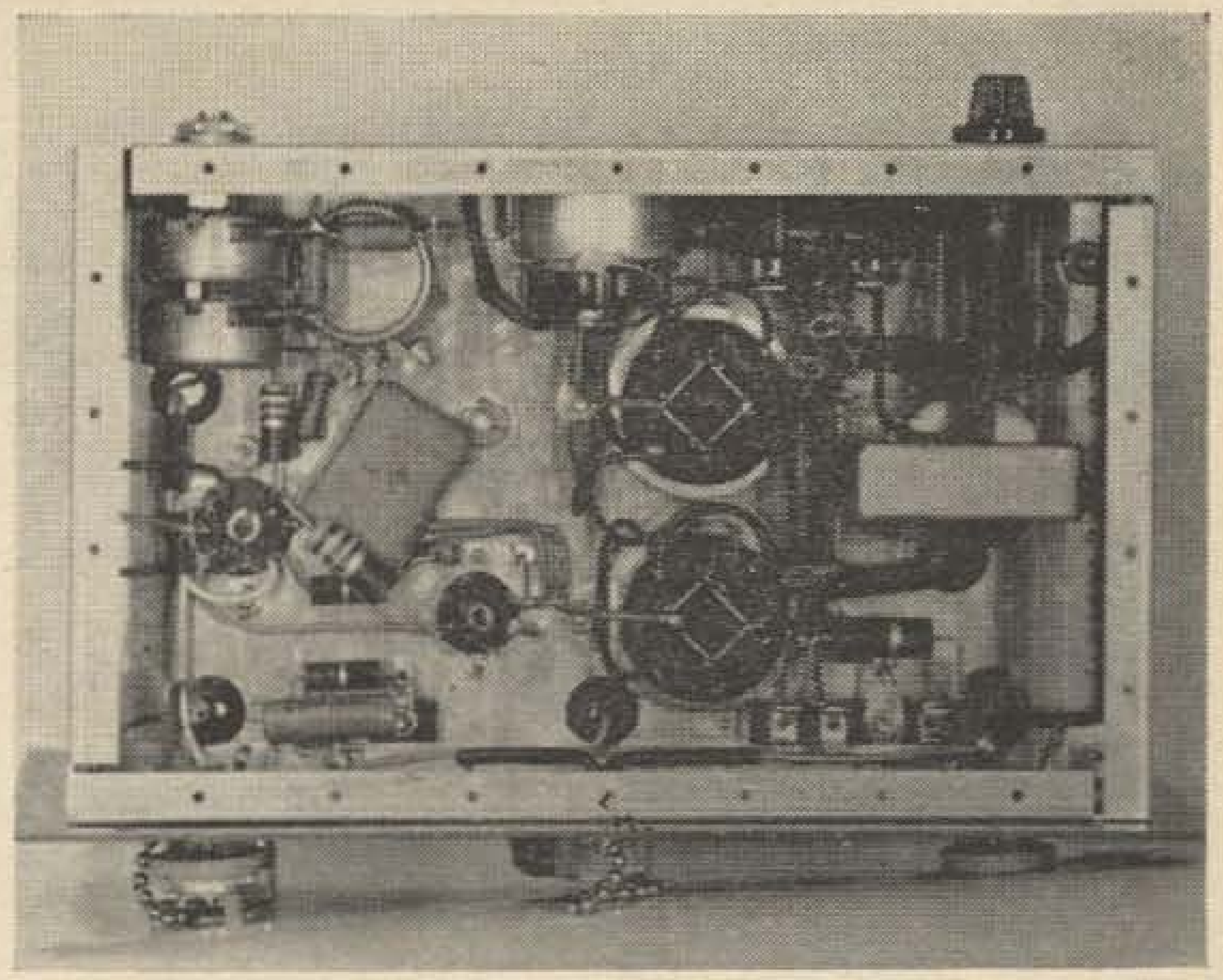
tor wherever a variable resistor is called for. Despite their higher first cost, these pots (or others of equal quality) are strongly recommended, as they will hold their settings indefinitely, and will not break down in this service. Use of the very inexpensive variable resistors designed for ac-dc "kitchen" radios is false economy here.

Power supply is the conventional full-wave center tap circuit, but it is arrived at by use of two small half-wave transformers (Merit P-3046) with primaries parallelled and secondaries connected in series, with the interconnection and furnishing the center tap. To suppress small transients introduced by the "toe" of the silicon rectifier characteristic, a small paper capacitor (0.01 mfd, 600 volt) is shunted across the outside ends of the secondary circuit.

Output circuit appears somewhat unconventional, in that there is a multiplicity of terminals of various sorts. This arrangement is intentional, and is designed to eliminate the need for carrying around a pocketful of adapters. A separate jack is provided for the scope connection.

Adjustment of this oscillator is done in two steps. First, with the chassis out of the cabinet, the oscillator is run for a time to permit rough stabilization, the scope is plugged into the SCOPE jack, and the waveform is brought into sinusoidal form by adjustment of the WAVEFORM control. When the waveform is satisfactory, this control is locked, and the oscillator installed in the cabinet.

After a further period of stabilization, the output is compared with a 1000-cycle standard, and adjusted "right on" by the FRE-



Bottom of the audio oscillator.

QUENCY control on the rear. By use of a conventional Lissajou comparison, the test oscillator can be set to the same frequency as the standard with an error of less than 1/10 cycle per second. It is also possible to obtain a good frequency setting by means of a linear audio frequency meter, which has recently been aligned with one of the tones from WWV. When the frequency adjustment is satisfactory, the FREQUENCY control is locked in position.

If a frequency other than 1000 cycles is desired, this may be obtained by changing the 300 mmfd capacitors (C in Fig. 1) to some other value. The frequency being an *approximate* function of 1/C. Voltage output (rms) is approximately 1.5 into a high impedance load, and can be attenuated to any value down to zero by means of the volume control on the panel.

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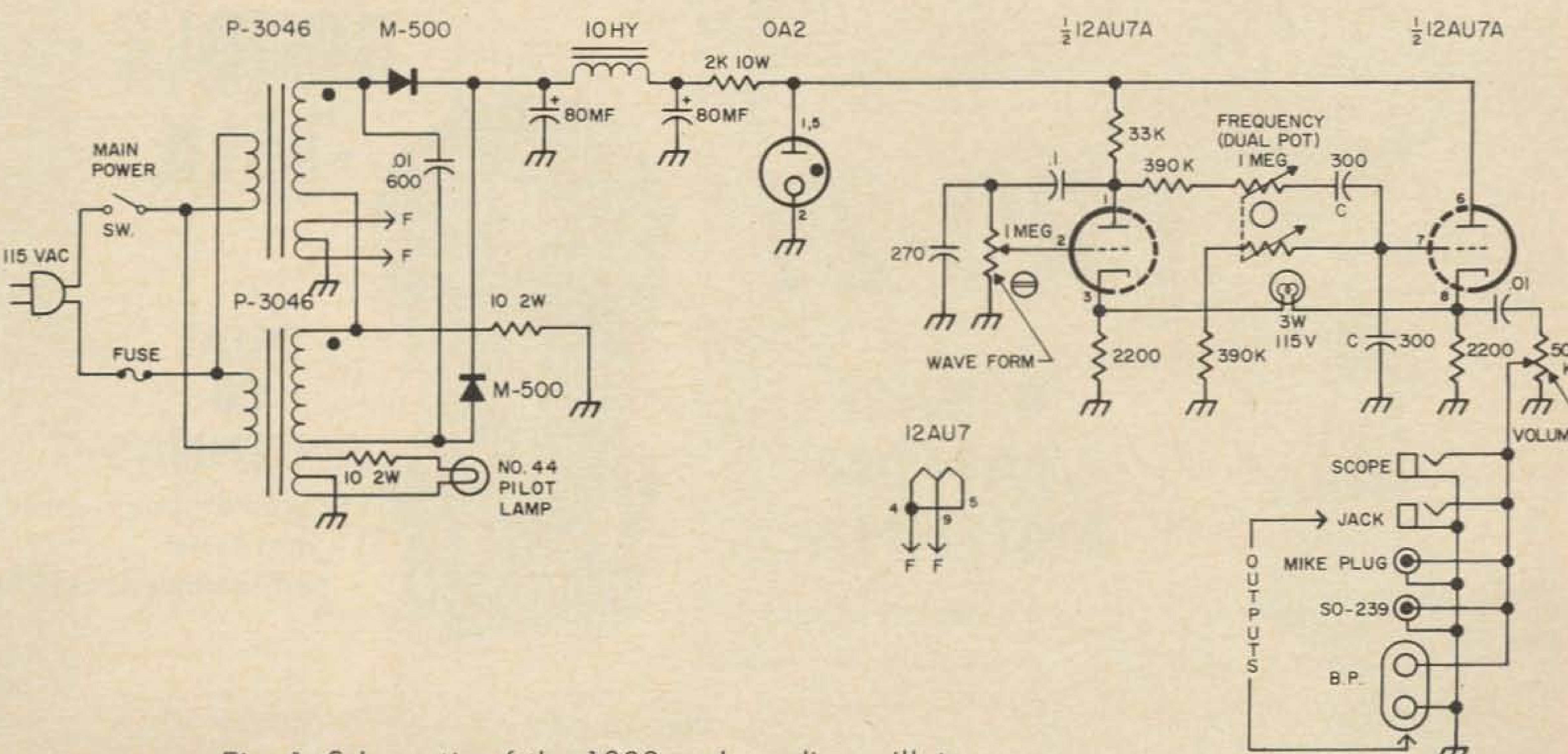
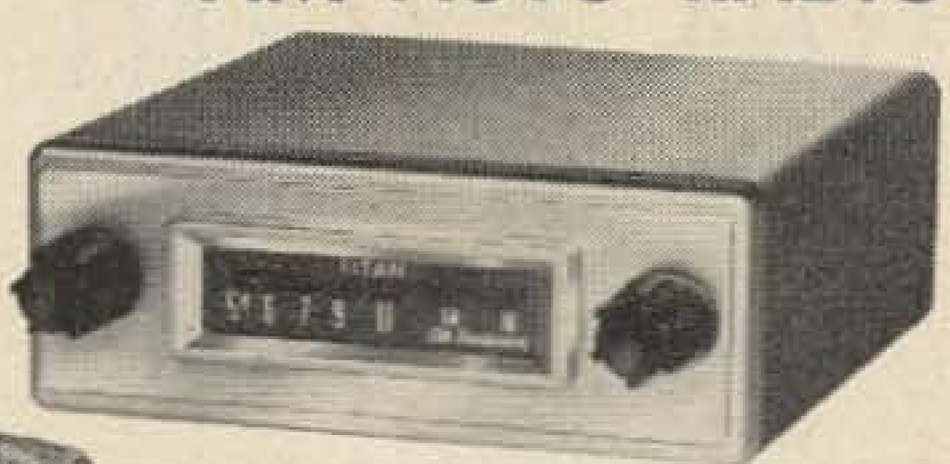
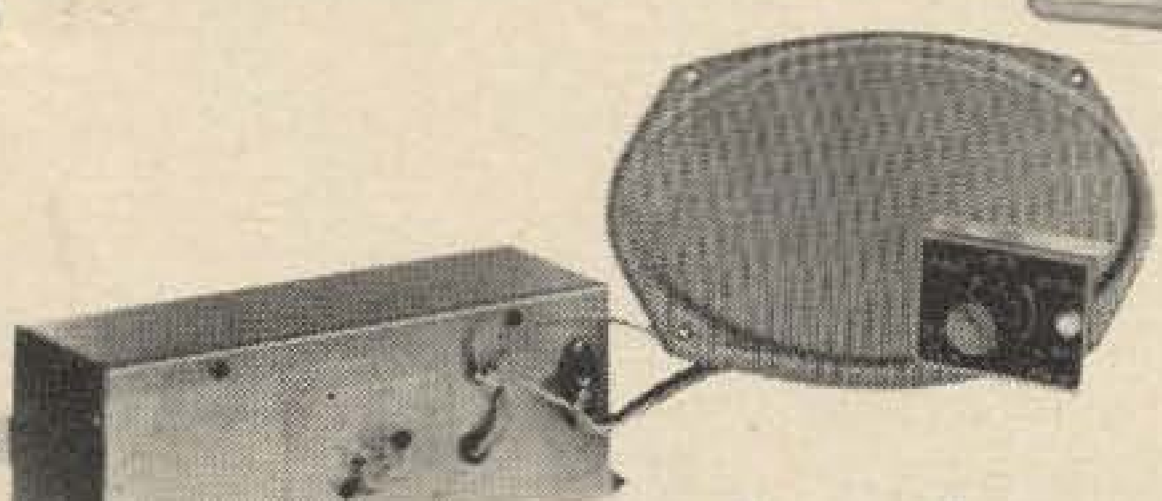
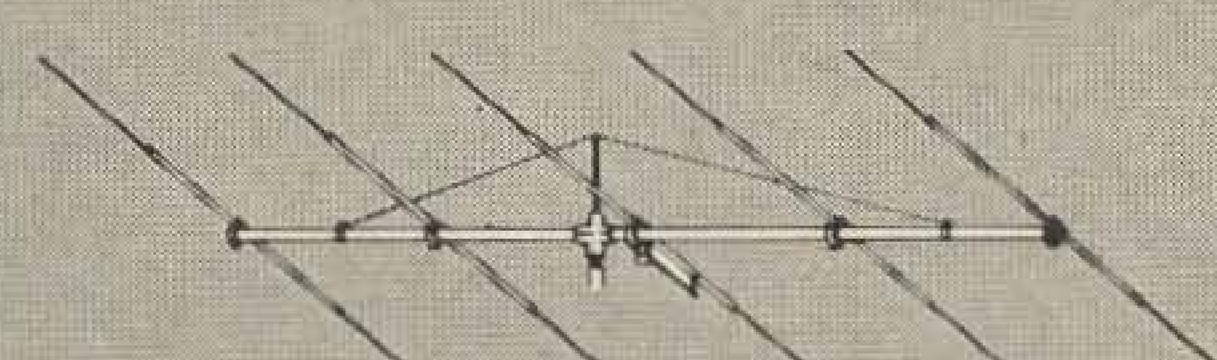
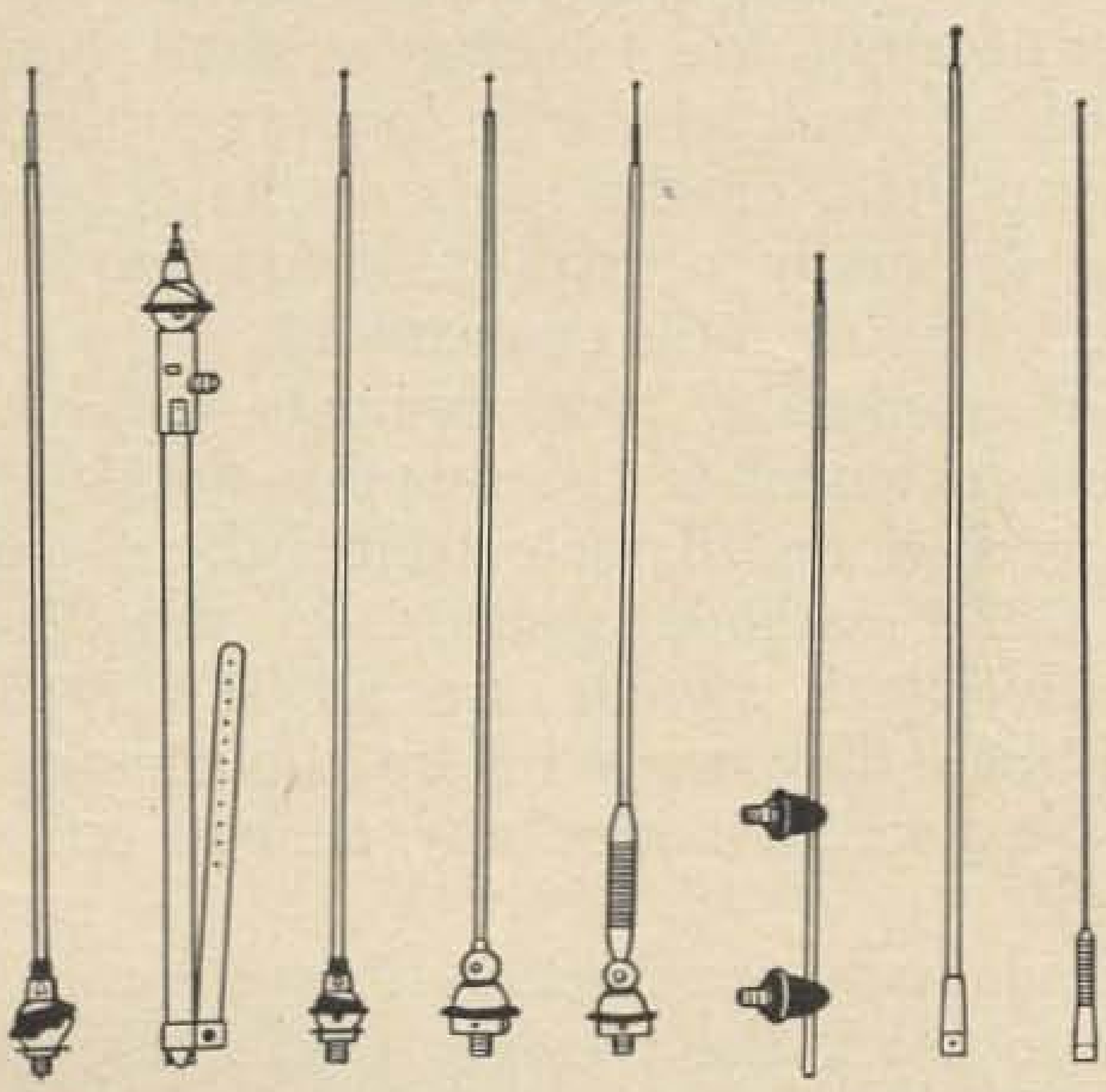


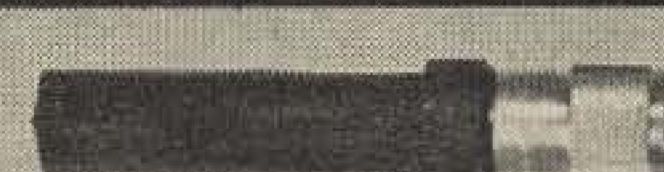
Fig. 1. Schematic of the 1000 cycle audio oscillator.

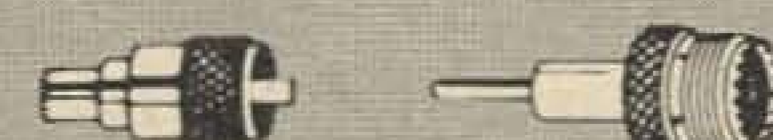


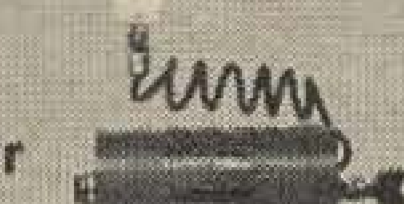












Herbert S. Brier, W9EGQ
385 Johnson Street
Gary, Indiana 46402

Improving the Heath Mohawk

Although it has recently been superceded in the Heath line, there are still many Heathkit model RX-1, "Mohawk" receivers in various ham shacks. It is still an excellent ham receiver, but a few simple modifications will increase its sensitivity and improve its audio quality on SSB.

Pepping up the Front End

The Mohawk uses a 6B6 tube in its rf amplifier stage. However, the tube is prevented from doing the full job it is capable of by the use of a 220 ohm cathode bias resistor instead of the 56 ohm resistor recommended by the tube designers for maximum gain. Reducing the value of the cathode resistor to 56 ohms improves the signal-to-noise ratio a couple of db on 10 and 15 meters. It also increases the receiver gain a trifle, although this is of minor importance.

As the 6BZ6, rf amplifier, 6CS6, mixer, and 12AT7, oscillator tubes are mounted on a preassembled subchassis in the front-end section of the receiver, it looks like a major task to change the 6BZ6 cathode resistance. Actually the job is not difficult. The left side of the chassis on which these tubes are mounted is removable to expose the components connected to the three tube sockets.

To remove the side plate, unscrew the hexhead screws at the front and back of the subchassis. After removing the plate, locate the 220 ohm (red-red-brown), ½ watt resistor connected between pin 2 of the 6BZ6 tube socket and the nearby, insulated terminal strip. Do not attempt to remove the resistor; instead, connect an 82 ohm, ½ watt resistor in parallel with it. This may be done by cutting the leads of the new resistor to a length of approximately ¾", forming a small hook on the end of each wire with long-nose pliers and hooking them on the leads of the original resistor. Naturally, a small soldering iron is helpful in soldering these connections.

Noise-generator measurements indicate a 2 db improvement in the signal-to-noise ratio of the receiver on 10 meters after the change in the 6BZ6 cathode resistor. In practice, extremely weak signals are slightly easier to read than they were before the change. But don't expect to notice any change on strong signals.

Incidentally, if extremely-strong, local signals tend to block the receiver (especially on the lower-frequency amateur bands) after the resistance change, retard the 6BZ6, rf gain control sufficiently to eliminate the blocking while the locals are on the air.

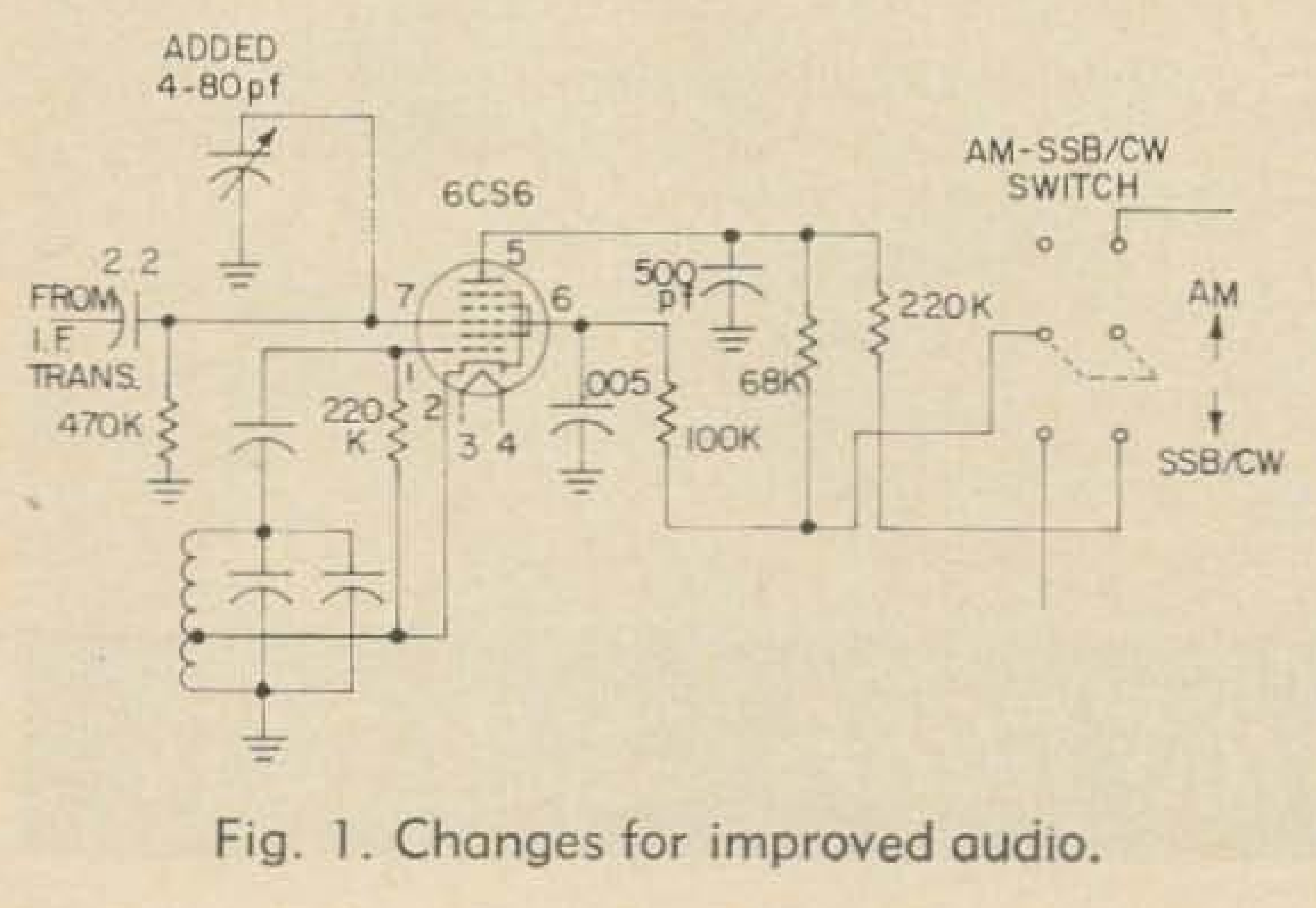


Fig. 1. Changes for improved audio.

Better SSB Quality

The audio quality of the Mohawk receiver leaves something to be desired when receiving SSB signals. The principle cause of this seems to be that, in order to hold down the audio output of the 6CS6 product detector to the same level as from the diode (AM) detector, the 6CS6 is operated with considerably less voltage on its plate than on its screen. Much better audio quality is obtained on SSB if the screen voltage of the 6CS6 product detector is reduced and its plate voltage is increased.

To modify these voltages, disconnect the 68,000 ohm resistor from the screen terminal (pin 6) of the product detector socket. Then, reconnect the resistor to the insulated tie point where the 10,000 ohm resistor (which also goes to the screen terminal) is terminated. Next, replace the 10,000 ohm resistor with a 100,000 ohm, ½ watt resistor.

After these changes are made, the audio output of the product detector will be far too high, until a small capacitor is connected from pin 7 of the product-detector socket to ground to decrease the *if* signal fed into the detector. A 4 to 80 mmfd mica trimmer capacitor, such as the Lafayette C-732 trimmer capacitor, is ideal for the purpose. Adjust it so that there is no change in the volume level from the loudspeaker when the receiver is switched from AM to SSB/CW reception. A 47-50 mmfd fixed capacitor may also be used, if you don't mind touching up the volume control setting a bit when switching modes.

Slowing down the avc action on SSB also improves the receiver's audio quality a bit. This change is simple: connect an additional 0.1 mfd. paper or mylar bypass capacitor in parallel with the original 0.01 mfd capacitor across the avc line. The additional capacitance does not impair avc action for AM.

Taming the Mohawk S Meter

As you Mohawk receiver owners know, the Mohawk S-meter has a tendency to be a mite generous—indicating 40 db over 9 on the lower frequency bands with no signal tuned in, unless the *if* or rf gain control is turned away back. If this generosity bothers you, try substituting a 12AU7 for the 12AT7 in the S-meter/1st audio tube socket. It will have to few db off of the readings. You will have to re-zero the meter with the meter-adjust control, but this takes only a few seconds. Also, with the 12AU7 in the socket, you'll have to advance the audio gain control about five per cent to compensate for the lower gain of the 12AU7 compared to the 12AT7.

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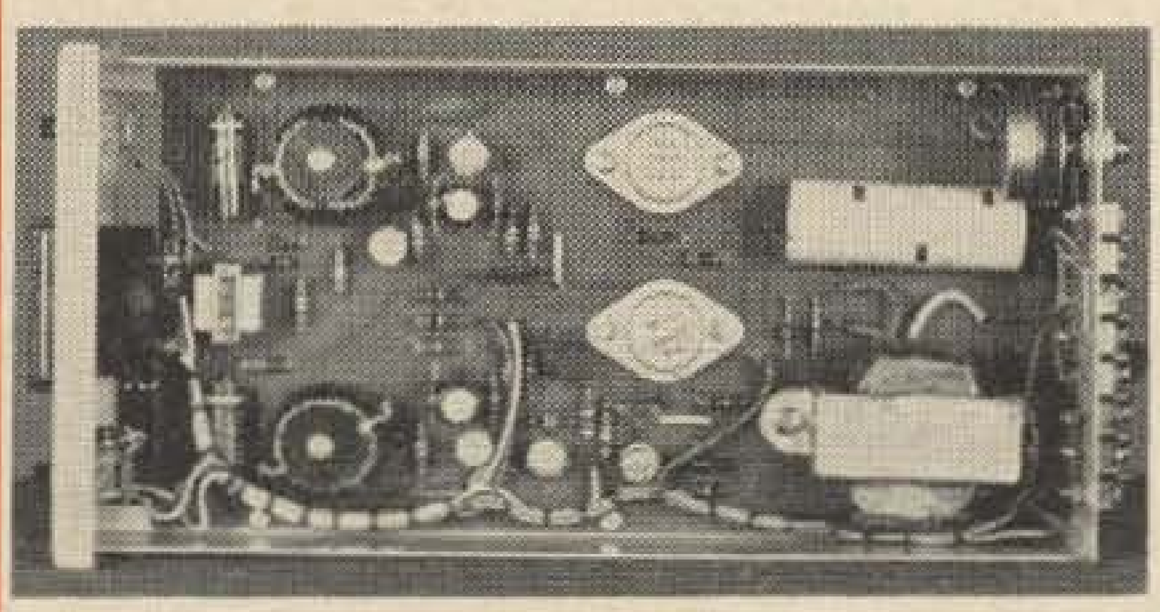

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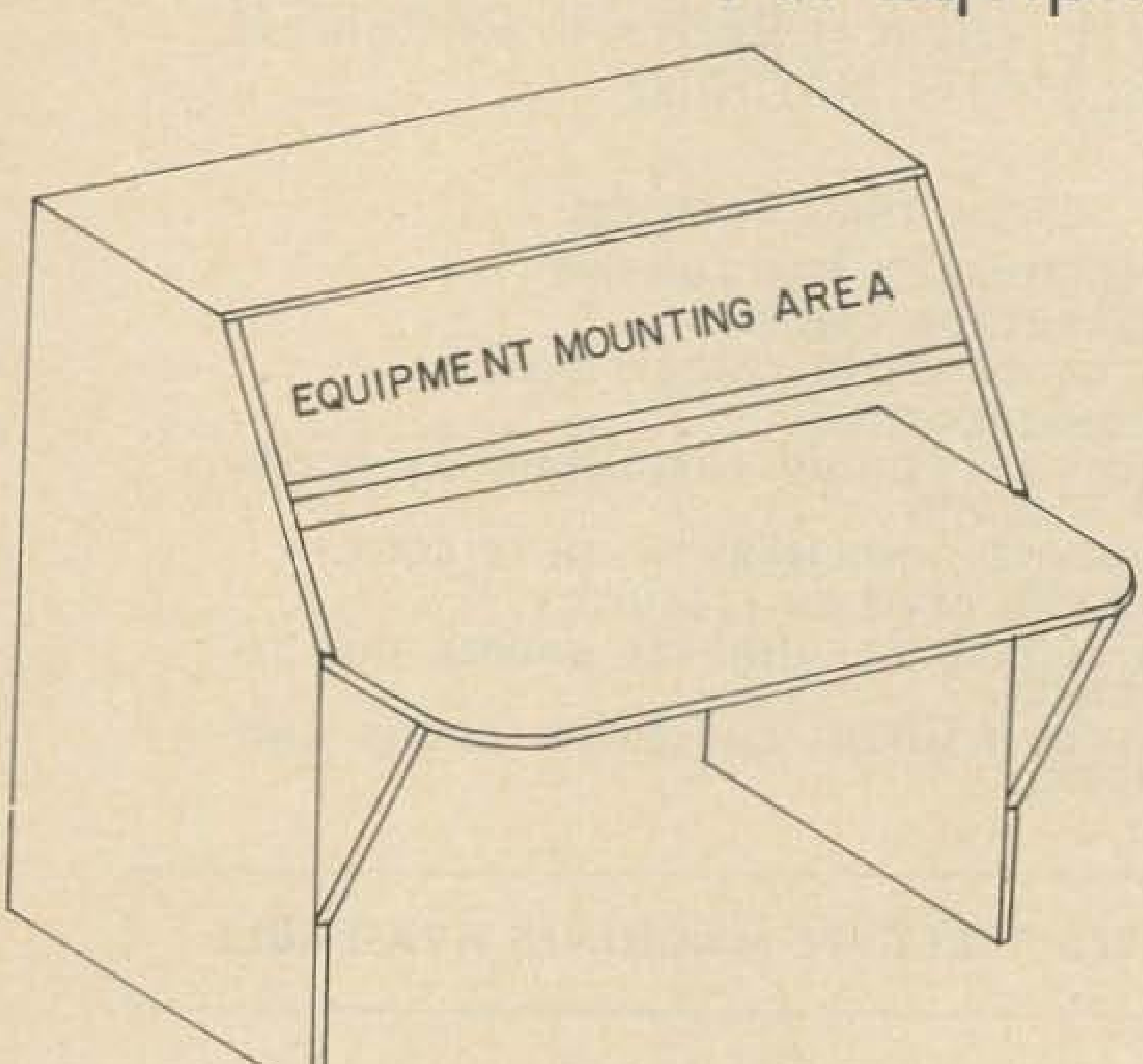
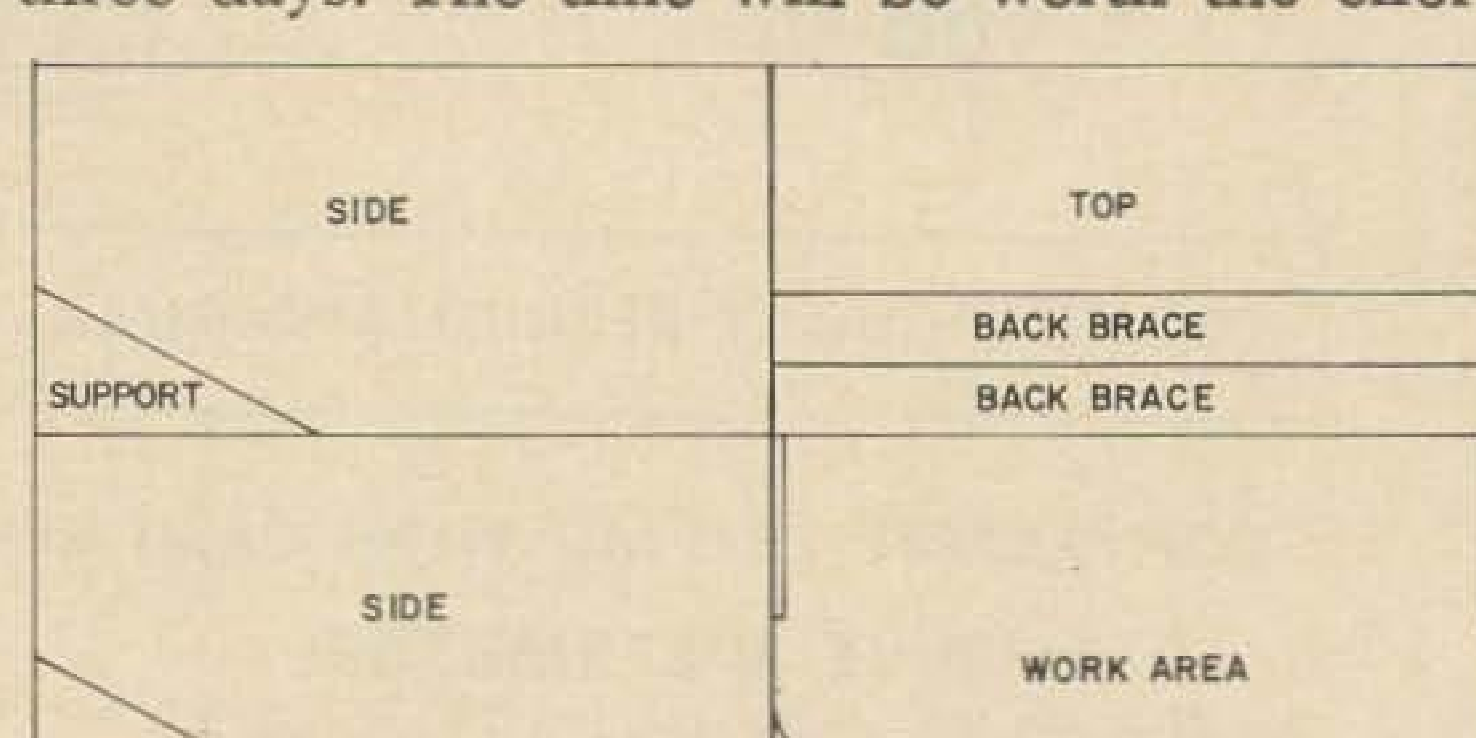
An Equipment Console



The XYL will be very glad to have the stuff all in one area without wires all over the place. The equipment is mounted on a slope to suit the operator. The shelf over your equipment is a fine place for reference books and files. A light under the equipment shelf keeps the log and notepad in an easy to read status without the overhead glare of normal room lights. A drawer can be added to store Crystals, QSL cards, etc. This is just the basic idea; the individual can adjust to suit his own equipment. My DX has been much better since the unit gives more freedom and ease of operation.

I used a 4′ × 8′ sheet of ¾″ plyboard and other scraps of lumber. If you have to buy every piece of material, I feel sure that you can build this station for less than $20.00. You should be able to put the unit together in one evening and then with a good paint job you should be ready to install the station in three days. The time will be worth the effort.



Material Required
1—4′ x 8′ sheet ¾″ plyboard
10′—2″ x 2″ for shelf & work area support
1—4′ x 18″ sheet ½″ plywood (equip. shelf)

Other Suggestions
Screen molding along edges of plyboard
Formica on work area
Metal edge on work area

. . . K7YU(

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75S-3	499	449
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Superceiver	35	15
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SX-99	89	59
SX-100	139	99
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SR-160	269	189
SR-160 (new demo)	369	229
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PS-150 DC	119	79
S-76	69	49
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SW-140	149	119
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Gus: Part VI

Well, boys, I was at the Radio Prague studio a few minutes before 9 am and was taken in the big fancy studio and seated in front of the mike and told that when the green light came on, I had one minute to get ready to go on the air; that when the red light came on, I was "on the air", to start talking. I am one of those crazy fellows who just don't plan what I am going to say before I start saying it. Here I was and as usual had made no plans at all on what I was going to talk about. But I did make up my mind that if there were any propaganda said into that mike . . . I would be the one to say it . . . and it would be propaganda for me, and not them.

So on came the red light . . . I was on the air. I started something like this, "My name is Gus Browning, and I am from one of the poorest but nicest places in the US, the little state of South Carolina. If you look at a map, you will see that it is one of the smallest states in the US. I am not one of these rich Americans you hear about, I am only just an average American, with 4 children and a nice wife. I have my own business, which is radio sales and service, just a small business which I run myself. As far as the US is concerned, I am sure that they have no idea where I am; in fact, they don't even care where I am. I suppose they feel it's none of their business where I want to go. I decided two years ago I would like to make a trip around the world, so I saved my money and am now on that trip. The radio amateurs here in Prague are treating me very nicely. I think radio amateurs the world over always treat people nice because I think radio amateurs are the finest people in the world." Then I rambled on till my 15 minutes were over. I felt that in my little way I had done a little propaganda for the US, and right over Prague radio. Such remarks as saving enough money to make a trip around the world in 2 years and that I am only an average American and that what I do is my own business were read-between-the-lines propaganda. I figured that listeners would be able to see from that how things were in the US.

One day I was walking down the streets of Prague and out of a clear sky a big Rolls Royce (it looked like one to me) pulled up to the curb and blew its horn. I nearly jumped out of my skin, because I thought maybe he was trying to run me down. A big tall chap stuck his head out the window and said, "Is that Gus Browning, from Orangeburg, South Carolina?" I looked closer at this fellow and said, "Hello, John!" Then I asked him what in the world he was doing here, and his remark was, "The same as you; I wanted to see what's behind the curtain." I hopped into his big fancy car and we got to see lots of Prague together the next couple of days. John had shipped his car to Munich and had driven it to Prague along with his wife and son. John (GW3ZV) had visited me in my home a few years previously, that's why I knew him when he poked his head out of the car. Boy, it's a small world when you meet someone from South Wales in the middle of Prague.

One night I had a telephone call from Harry, over in Bratislava, in the east part of Czech land. He asked me to come over and visit him. I kind of beat around the bush (my money was not too plentiful). He said, "Gus, I will fly over and pick you up and we'll both fly back here together." The next day Harry arrived, bought me an airline ticket and we flew back to Bratislava together. Harry is a doctor and he was a very fine host to me, taking me all around that area, and we met many of the OK3 boys. Harry's call sign is OK3EA, and there is no finer and more friendly fellow in all of Czechoslovakia. Harry bought me my return ticket to Prague. I spent a few days again with Mirek OK1FF and with a very kind feeling towards the Czech boys, I departed from Prague for Munich by train.

The trip was as usual: very crowded train, people standing all over the aisles, good many police here and there . . . then we arrived at the West German border . . . and customs again. These boys meant business; they were making everyone dump their clothes out of the suitcases and they were searching every pocket in every garment. Then I remembered a badge with a red star on it one of the OK fellows had given me, and had suggested that I wear when leaving the country. I immediately put it on the lapel of my coat. When the customs man got to me, I reached into my inside coat pocket and noticed the customs man glancing at the red star badge on my lapel. I handed him my passport, and pointed to my luggage overhead. He said, "Oh, that's all OK," and without any further remarks to me, proceeded to the next seat, still making everyone dump their suitcases like before. You know, I am still wondering if the red star badge I had on my lapel had anything to do with my suitcase not being dumped and searched. Maybe it was a coincidence he did not give me the big search like everyone else received. Or maybe I had an innocent look on my face, or it may have been my "Auspice Day".

Now, that "Auspice Day" stuff reminds me that in this area of the world (I'm in AC5 land right now) nothing of real importance will be done unless it's your "Auspice Day". One of the Temple (Dzong) priests who understands about the stars, planets, moon, sun, etc. tells them if the day is "auspice" or not . . . don't fool yourself, these people believe him, too, all the way from the lower caste to the very top. Then it seems that they have another sort of "Un-auspice Day" . . . or something like that, which causes them lots of trouble. We've all heard people say, "This is one of my bad days," or maybe, "This is my day to shine." Well, there you go . . . "auspice or un-auspice."

Life here in Bhutan is very interesting. Occasionally I see a Bhutanese or group of Tibetans driving a herd of yaks up one of the mountain passes. Then I see quite a number of Lamas coming or going from the nearest Dzong. At night, I hear those big long Tibetan horns blowing, and some of those horns are about twelve feet long and it takes three or four men to hold it up when it's being blown. These are the most peaceful people I have ever seen.

I had just found out about Bhutan's biggest religious celebration that's held each year over in Paro at the Paro Dzong. I was asked if I would like to go over there and witness this big celebration. I, of course, said yes. (I was thinking about that being the AC6 portion of the country too!) So on Monday we packed up the Jeep. Now, over here when you go from one place to another, you just don't hop

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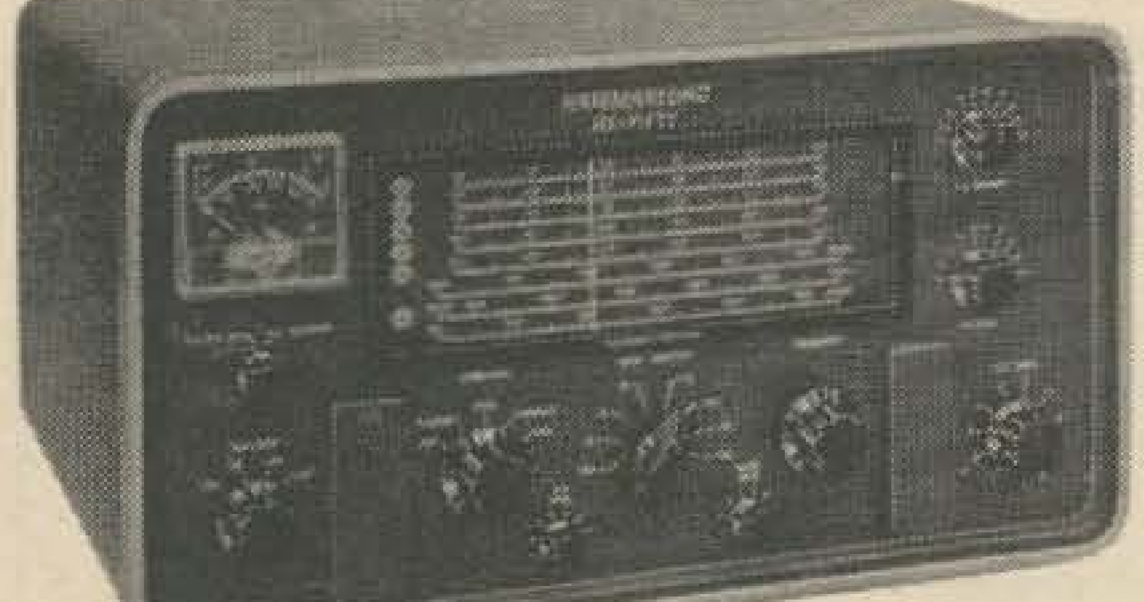

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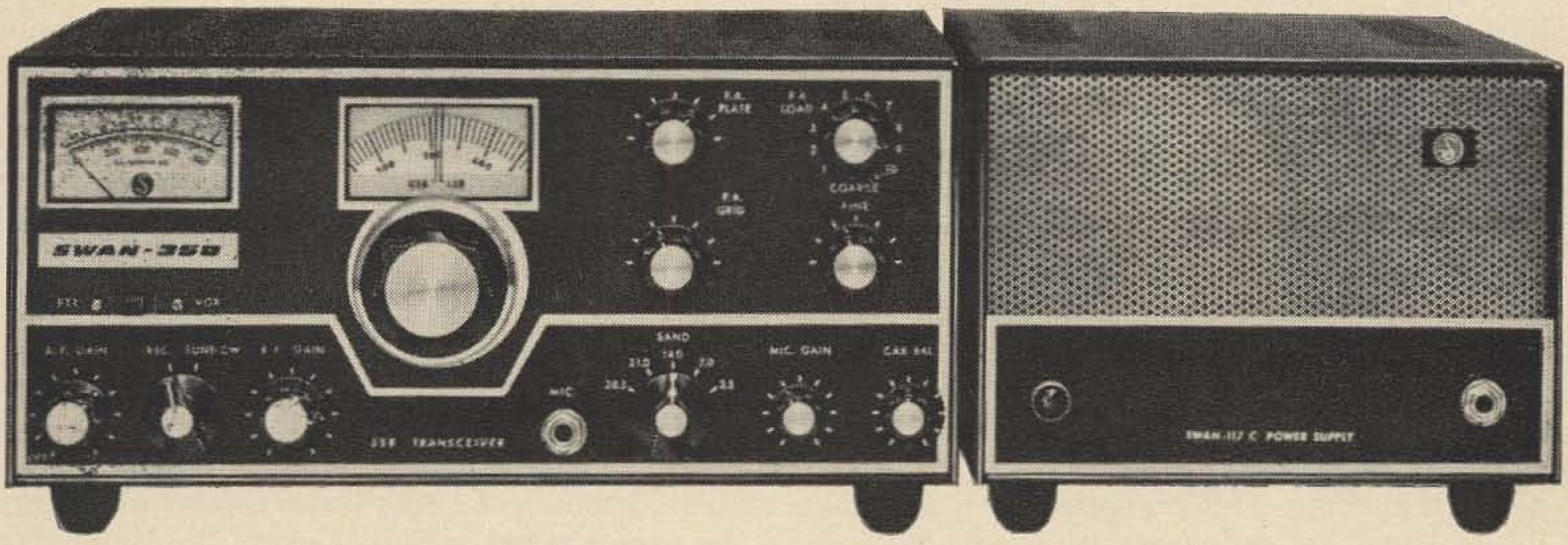

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you have to take under consideration. You take ALL your food, your bedding (mattresses and all), you take your own cook and bearer (this bearer is a sort of all-round servant), and of course you take your radio gear, power plant, antenna. I also invited my good friend Mani Kumar (the radio technician at Dechen-Cholling) who is my constant companion and a real nice fellow. You try to picture us, four people and all their bedding, food, and radio junk all to be carried in one small Jeep. When all that stuff was out on the ground, it was a very big stack and to me looked absolutely impossible that all of this, plus four people, could go on a Jeep. Well, after a lot of juggling, repacking, and cramming, we got it all inside the Jeep and away we went.

The acting Signal Officer at Dechen-Cholling had sent a radiogram to the Signal Officer at Paro to take care of us, and let me tell you, we really were taken care of in the very best of style. When we arrived that afternoon I saw three brand new nice antenna poles all cut and trimmed, laying outside especially for my use. They were cut a number of miles from Paro and carried by bearers to the station. I found out that a room in the radio station had been completely rebuilt especially for me; even a bed was made for me (they don't use beds here since over 99% of the people sleep on the floor). A new kitchen was built for my cook to use, and even some special food was on hand for my use.

Everyone pitched in and helped me erect my Hy-Gain 14 AVQ vertical, which was installed on the very top of a good straight sixty foot pole. Even digging a hole here in Bhutan is a very tough job; rocks are everywhere. After two trial holes, we were successful in getting a hole three feet deep where the largest rock was no larger than my head. Remember that these fellows were digging only with their large knives and their hands to remove the dirt and rocks. Finally the antenna was up, and I took out my compass to see what was between me and the US. I saw that due north, about three miles away, there was a big mountain, covered with snow, about 6,000 feet above our altitude (we were about 8,000 feet). To the south there was the Paro valley with the Paro river in its middle and rice paddies on each side. To the west was a mountain, and to the east was a mountain . . . it's mountains all around you, regardless of where you are in Bhutan, and they are always higher than you are!

I operated during the night, the band folded up about 0300, I ate breakfast, and into the Jeep and go. There are many things away to the Dzong I went to see the celebration, which lasted five days.

Inside the walls of the Dzong, people were sitting all around an open spot. There was not one other Westerner there but me. I had secured permission from the Head Lama that I could take all the pictures I wanted to. They had me a chair on hand to use, situated right in the middle of the crowd, at a nice spot to see all the events as they took place. There were about 10,000 people in the crowd the first day.

All of a sudden, I heard the most unusual horn blowing, and up on the roof were two Lamas blowing two big long Tibetan horns . . . about fifteen feet long. These fellows all during the events acted as "introducers" to each event as it started.

There were lots of dogs present, and to control them and also people who got too close, there were a few . . . let's call them "crowd controllers" . . . who were really on the job all during the five days. These fellows were really free with their whips, regardless of whether it was a dog or a person. Their whips would strike out and whoever was in its path knew to move back. I must say these fellows kept everything under control too! I was glad I was not on the front row!

All during the events, there were about four red-masked clowns on hand to liven up things, and I would like to tell you *everything* they did, but if I were really to describe *everything*, Wayne Green would be arrested and sued for publishing such things. At times one or two of these clowns dressed like women . . . and such carrying on you have never seen . . . at least not in a mixed crowd!

First there was the procession of the Lamas in all their red garments, the High Lamas in their gold garments, and all the high ranking civilians in their very fanciest dress. This marching around lasted about thirty minutes. Then those loooong Tibetan horns blew, they all marched back inside a side room, and then one by one out came the Lamas dressed like animals, with masks on, in vari-colored garments. These were very colorful, and the masks had a sort of terrifying effect on me. The crowd controllers were very busy with those mean looking whips, whacking dogs and people. During the week those masks got more frightening looking all the time and the tempo of things gradually picked up all the time. To me, it was very hard to believe that what I was witnessing was taking place in the twentieth century.

On the first day, I was invited by the Head Lama . . . a very fine old man . . . to come up on the third floor or the Dzong and have tea with him and a few other of the very highest Dzong officials. At about 11 am the first day I went up there and was served that good old (and I mean *old*) yak butter tea! Now, if you want something to stick with you, it's yak butter tea. The flavor has a lingering stay with you for a *long* time after it's all gone. They insisted I stay up there with them every day, which, incidentally, is considered a Great Honor. I ended up having every one of my lunches up there and tea at both the morning and afternoon tea sessions too . . . and I finally got where I could handle yak butter tea. Luckily for me I am from South Carolina, one of the rice eating sections of the US, because rice is their basic food here. But, oh brother, how they like to cook everything loaded with red hot peppers, just about ten times as hot as I am used to. I could handle yak butter tea ok, but I never did get to the point where I could really eat those red hot dishes loaded with pepper. I would nibble on a little of this and a little of that, but I was careful not to ever get a real mouthful of anything.

The next to the last day, they brought out the big Buddha . . . it took about twenty Lamas to carry it. This was carried all around the arena, turned round and round for all to see, and again all the Head Lamas and head civilians were in the procession. After the big Buddha was placed under its awning, all the Lamas and important civilians prostrated themselves in front of it three or four times. I only wish I understood Buddhism, because all this has lots of meaning; each event has an explanation as to what it's supposed to be representing.

The last day was the most exciting; things were at a high tempo near the end of the day. All of a sudden, everyone started whistling and sort of shouting and out from the Dzong ran about ten of the most frightening "demons" you have ever seen. These fellows had a half moon shaped instrument in their hands, made of iron about half an inch thick, with a very small rubber tip on its end. They beat the drums with this . . . I mean, they usually beat the drums with this, but not this time. These demons ran all through the crowd, jumping over people's heads. Everyone was shouting and whistling, and so were these demons. In one hand, they carried one of those very odd looking painted drums. They would hit the drum a few times and then they would hit the people on their heads with this instrument, and I don't mean "love taps" either. For a while they did not bother me, until one of the clowns pointed me out and then I got those taps on my bald head. A few of those taps caused me to rub my head. This kept up for about fifteen minutes. The natives who had babies with them held the little fellow's heads up high so that they would be tapped also; of course, these were gentle taps. I am sure everyone got at least ten whacks, then all the demons gathered out in the middle of the arena again and danced around for a while. Then the crowd started whistling and carrying on and . . . back to the crowd they all ran, all heads were whacked again any number of times, things died down, and back to the arena the demons went again. More dancing, the crowd started that whistling and yelling again, and back to the crowd the demons came and more head tapping took place. They did this three different times. I saw quite a number of people rubbing their heads but they must have loved those whacks because they kept asking for more and more. I got my share too! I asked one of the Dzong Lamas who could speak a little English just what this meant. He explained to me that the head tapping was supposed to run all the demons out of your system. There must have been lots of demons in the people, because it took about an hour of head beating to get rid of the demons in everyone!

There were all those dogs running around and very often there was a big dog fight. All the people bring their food with them, and since there is never any sort of an intermission during the entire day, they just eat when they want to. Now, when there are lots of people eating right on the ground and there are lots of loose dogs running around, some funny things happen. A dog will run up to someone's dinner and grab a mouthful of food and away the dog scrams with rocks being thrown at him and a lot of yelling. This was certainly some get-together. Just think, for five solid days from 8 am until 5 pm, one thing following another, no intermission at all, not one moment lost and never any repeats. Everything was taken in sort of a holiday mood and no one ever got mad! All considered, this was one of the most enjoyable weeks I have ever spent in any country . . . the nice part of it all, was none of this in any way QRMed my ham activity, since it started at 0230 GMT and ended at 1130 GMT.

You know, I gotta stop getting away from my story, but I think all these side lights are interesting, so I guess it's no harm to wander from the main theme once in a while.

That's it, fellows . . . I will get back on the ball in the next issue of 73 . . . this I promise you! . . . Gus

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The National NCX-5

Bob Mitchell W5DWT
6403 Stonewall
Greenville, Texas

The NCX-5 and I became involved when a friend, W3BTQ/5, bought one for use on an extended field trip. Len lives in a no-antenna apartment and asked me to give the rig a thorough shakedown on my good antenna. So I brought the Five home. I was prepared to be prejudiced against the NCX-5 even though I've been a National fan since that day thirty years ago when I first turned the dial on the venerable—then new—HRO. Nevertheless, it seemed improbable that gentlemen from Massachusetts could put all they claimed in a little $685 box.

I decided first to check the stability and dial accuracy of the rig. On all bands but 15 meters, the calibration ran within a kilocycle. So I followed the vfo linearity adjustments described in the excellent instruction manual. To my amazement, the dial was then within 200 cycles from 3.5 to 4.0 mc. An adjustment of the heterodyne oscillator crystals put all bands on the same standard of accuracy.

Next I adjusted the vfo sideband switching as described in the manual. The Five gave zero beat on either side at 3.8 and was off only a couple of hundred cycles at the band edges. This is unavoidable with this type of sideband selection unless the designer further complicates the circuit.

Drift measurement was next. Initially the rig drifted about 600 cycles within 15 minutes after a cold start. then stabilized to less than 100 cycles drift. Three adjustments brought the total drift under *100* cycles at 3.8 mc with a little more—up to 200 cycles—at band edges. I was getting tired of waiting for the rig to cool for measurements and the drift was so small that it was becoming annoying to measure it, so I stopped my adjustments.

So I put the Five on the air barefoot. In one 34 minute period at nine on a poor night, I worked a KM6 on 15, a KH6, a W7 and a KA9 on 20, a WØ in North Dakota on 40, and a W5 in Houston on 80. All of the reports ran from S9 to 40-over. All commented on the excellent quality of the signal.

The NCX-5 also works on 10 and on cw. The keying is heavy and sounded very good. I was disappointed to find that I had to lif the lid for carrier balance to get a carrier fc cw, but the new NCX-5 Mark II has elim nated this problem with a front panel carri insertion control.

By this time, I decided to get scientific. First, I checked for output on all bands. It ran 110 watts or better. Interestingly, the little 6GJ5 output tubes (two in parallel) run very stably with over 200 watts input for five or ten minutes. Most rigs with 6146's in the output experience some drift in plate current under key-down conditions over similar periods. Output was unusually uniform from band-to-band. Incidentally, "side-band suppression" ran 35 db or more.

Next I checked the receiver selectivity. It ran just about as advertised: 2.8 kc at 6 db, with a shape factor of slightly under the advertised 1.7:1.

Sensitivity was excellent. On cw and ssb positions, a one-tenth microvolt signal was clearly audible on all bands. A one-half microvolt signal gave better than 10 db S + N/N ratio on all bands. The S-meter calibration was good, with less variation from and-to-band than most sets.

I had apprehensions about cross modulation and overload in view of the two rf stages in the Five's receiver section. The Five wasn't perfect on this score, but it was better than several medium-to-high priced receivers I had tested. I gave it extensive tests and found excellent front-end characteristics.

AGC on the Five is outstanding. I like it better than any other I have ever used on ssb or cw. For example, one morning I was working two mobiles on 3920. One was three miles away, and was pinning the meter. The other was over 50 miles away, and was running S-7 on peaks. The minimum difference in signal levels (by signal generator calibration) was 44 db. The rf gain was full on, and both signals were completely readable without resetting the rf gain control. What else can be said, other than that the AGC has no snap, crackle, pop, or thump?

The ALC also worked. It appeared to have the 10 db compression ratio claimed. I am not completely enamored of ALC, because too many operators use it as a substitute for brains. Once the ALC compression ratio is exceeded, all sorts of unfortunate things happen. The NCX-5 isn't any smarter here than any other transmitter. ALC can also be disadvantageous on cw and am. Fortunately, National cleverly disconnects the Five's ALC on cw.

As for the VOX—it worked, too. I prefer a foot or hand switch, but that applies to all rigs, and the NCX-5 has a very satisfactory VOX.

And the dial—it is superb. I was prepared to dislike it because it looked like a counter dial, and my experience has been that they bind, thump, jump, slip. (They have backlash, too.) This one was just a dial that could be tuned easily and read better than most dials. The dial felt as it should. Tuning rate makes stations easy to tune. I put my 200-cycle audio band-pass filter behind the Five, and could tune in cw stations easily. The 3.5 mc and 28 mc ranges tune backwards. The dial very cleverly shifts gears and disguises this, but the crank still turns backwards. National is not unique in using "backward tuning" on some bands, but they have done a fine job of concealing it with the dial. In fact, some users haven't even noticed this until it has been pointed out!

One thing seems to be missing—a noise limiter. The NCX-5 isn't unique here either. If the Five had belonged to me it would have had a Bishop ifnl system, which, while not perfect, is better than no limiter at all. The Five might be able to use an internal keying monitor, too, for us old fashioned types who still use some cw. I use an external, rf activated system, and didn't miss the internal monitor. However, each of these items would add to the price tag.

So, all-in-all, I like the Five. It has an excellent receiver and transmitter. It generates no TVI in this fringe area on Channels 4, 5, 8, or 11. It works. It does what the book says. That dial is a dandy. The vfo is almost unbelievably good. The gentlemen from Melrose have done a fine job on this little box. I still don't know how they did it for the money.

. . . W5DWT

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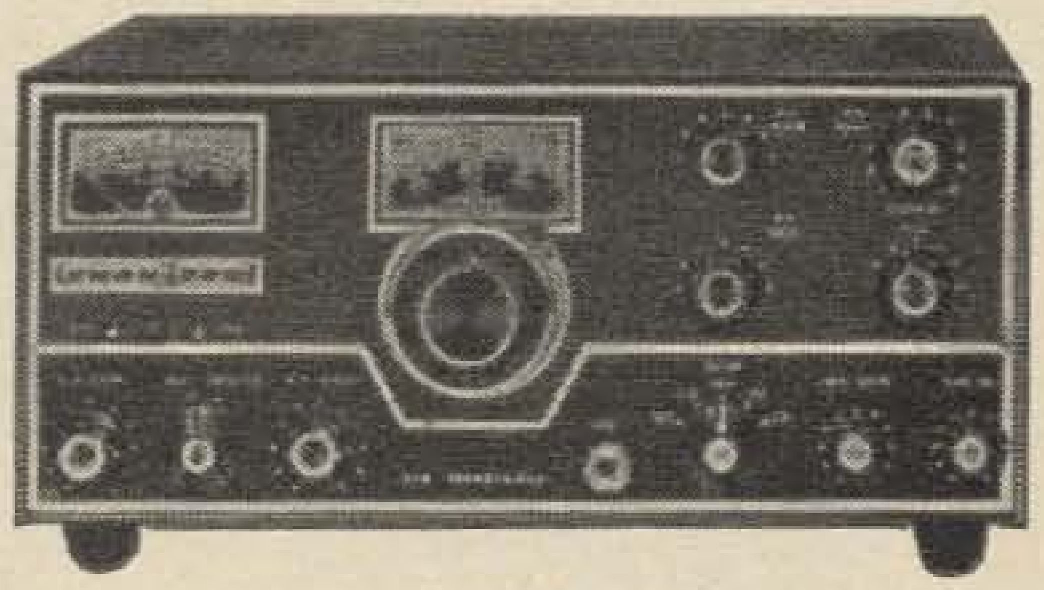

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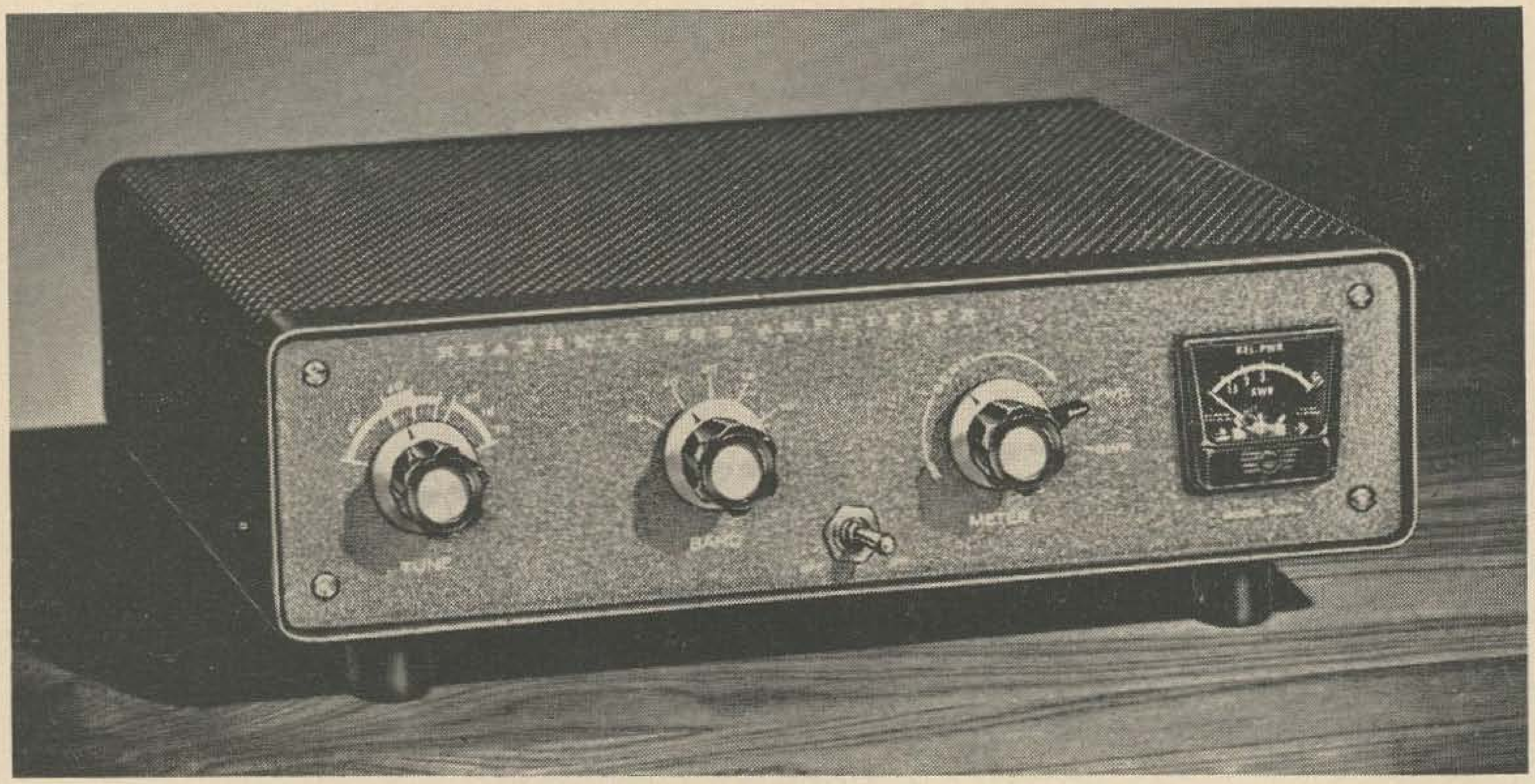

The Little Bomb

Bill Siefkin WB6KEH
410 Audrain Drive
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It's the new Heathkit HA-14 "KW Kompact" linear amplifier. And "kompact" it is—12 inches wide, 10 inches deep, 3 inches thick, and weighing only 7 pounds!

Basically, Heath took their SB-200 (champion of the low cost kilowatts), removed the power supply, reduced the metering functions to two, and then shrunk the whole thing into a tiny cabinet.

The power supply comes extra. You can get either the HP-24 for 120/240 volt ac operation at $49.95, or (here you go mobile fans) the HP-14 for 12 volt, negative ground d.c. operation at $89.95. Both supply all voltages for a full, rounded 1000 watts PEP on sideband, and, since they are separate, they can be conveniently located remotely.

The HA-14 uses either a pair of T160L's or 572-B's in a parallel, grounded grid, class B configuration. It makes no difference which tube number you get, because both will perform equally well. Driving power needed for full rated output is 100 watts.

There is no blower. Ventilation of the two graphite anode power tubes is accomplished by natural convection currents flowing through the completely perforated steel cabinet. My experience so far has indicated that a blower is not necessary.

The KW Kompact features a built-in relative power/SWR meter. It measures relative power and SWR of the exciter plus the linear, or simply the exciter alone. The meter aids greatly in adjusting those sometimes balky mobile antennas. The built-in antenna changeover relay is in a neat little exciter controlled circuit that makes it easy to switch from high

Continued on page 9

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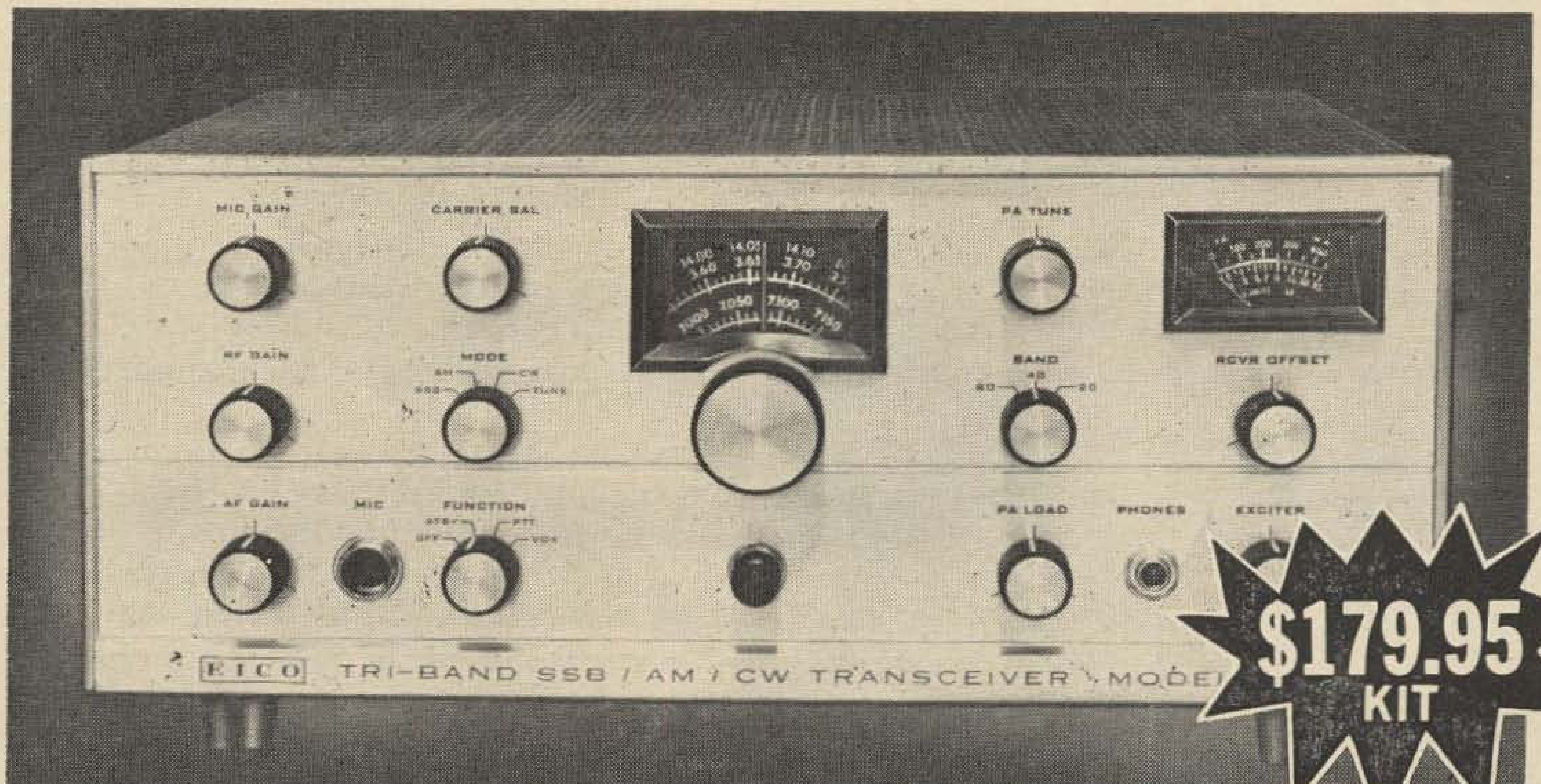

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73, *Eliot* WA2HDP

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Improve Your

Here are a couple of modifications that will make your single band Swan an even better rig than it is now.

One problem that almost every Swan owner has run into is frequency modulation of the vfo when the supply voltage is low or the final isn't loaded heavily enough. When going mobile this problem can become quite severe. Another associated problem is that in mobile operation changes in supply voltage are large enough to cause a two to one change in resting current. Both of these problems may be seen to come from the final amplifier screen circuit.

In the case of the vfo stability, large amounts of screen current passing through R12 cause the VR tube to go out. If the final is loaded very heavily this problem can be kept to a minimum. The resting current problem is just due to the fluxation in screen voltage.

The solution to both these problems is to regulate the screen voltage of the final and not draw the screen current through R12. Shown in Fig. 1 is a circuit that will maintain a constant 220 volts on the screen of the final for supply voltages down to 250 volts. It also regulates some elements of V5 and V6 on receive at no extra charge.

Only one wiring change is necessary in the original circuit of the Swan. The lead from the junction of R12 and R13 to the 220 volt contact of relay K1 must be disconnected at one end. The tubes can easily be mounted under the chassis using a small bracket. A 6AW8 triode pentode can be used in this cir-

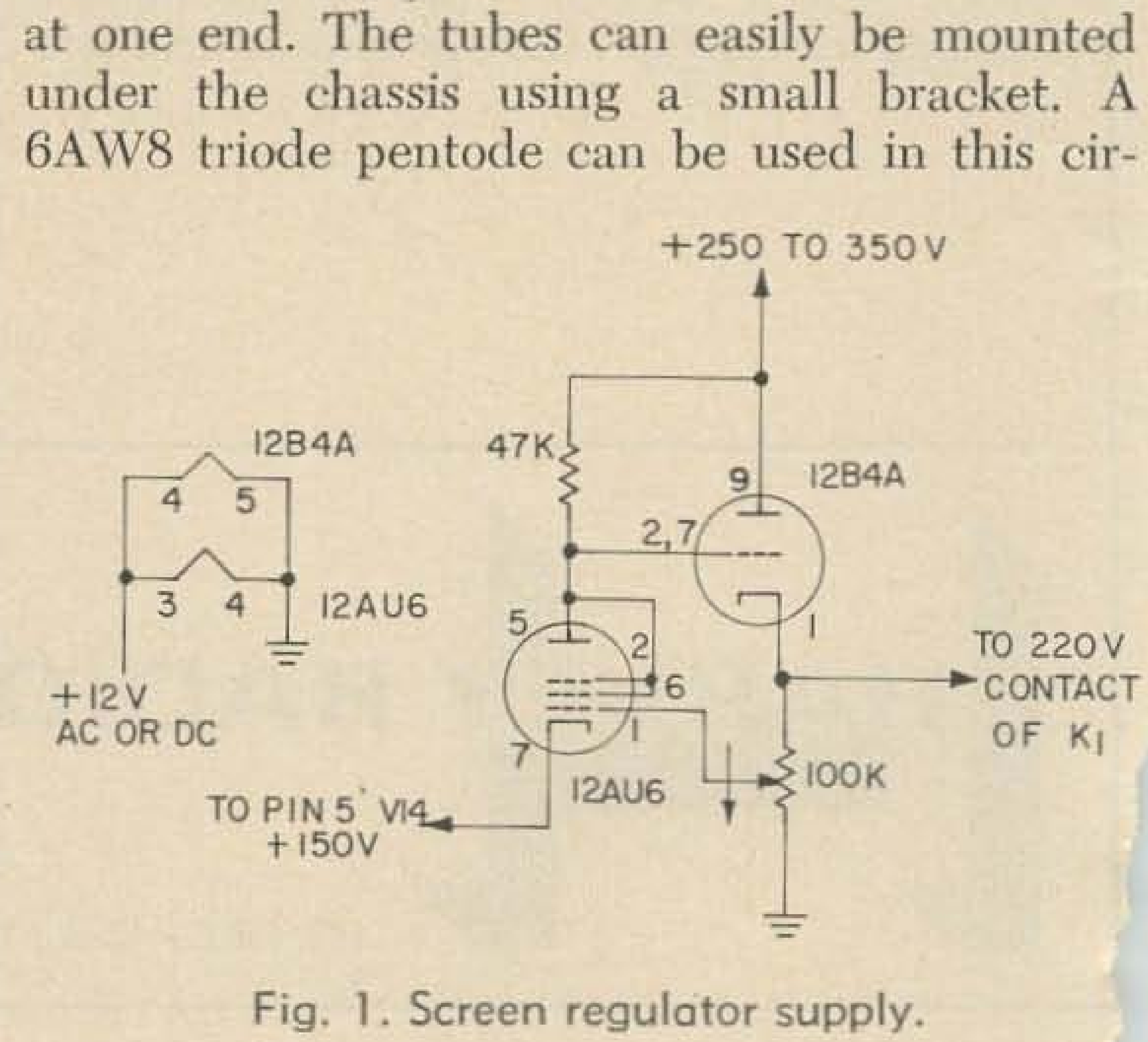


Fig. 1. Screen regulator supply.

Monoband Swan

cuit by connecting the pentode section as a triode and using it as the series regulator tube. The triode section will be the feedback amplifier. This change in tube will give good results except that the screen voltage will drop about 20 volts on voice peaks.

Another interesting modification that can be made is to arrange for class C operation. Some people are interested in mobile CW on their vacation and many people still have that plate modulator available for plate modulation of their mobile rig. The circuit for switchable changing to class C operation is shown in Fig. 2.

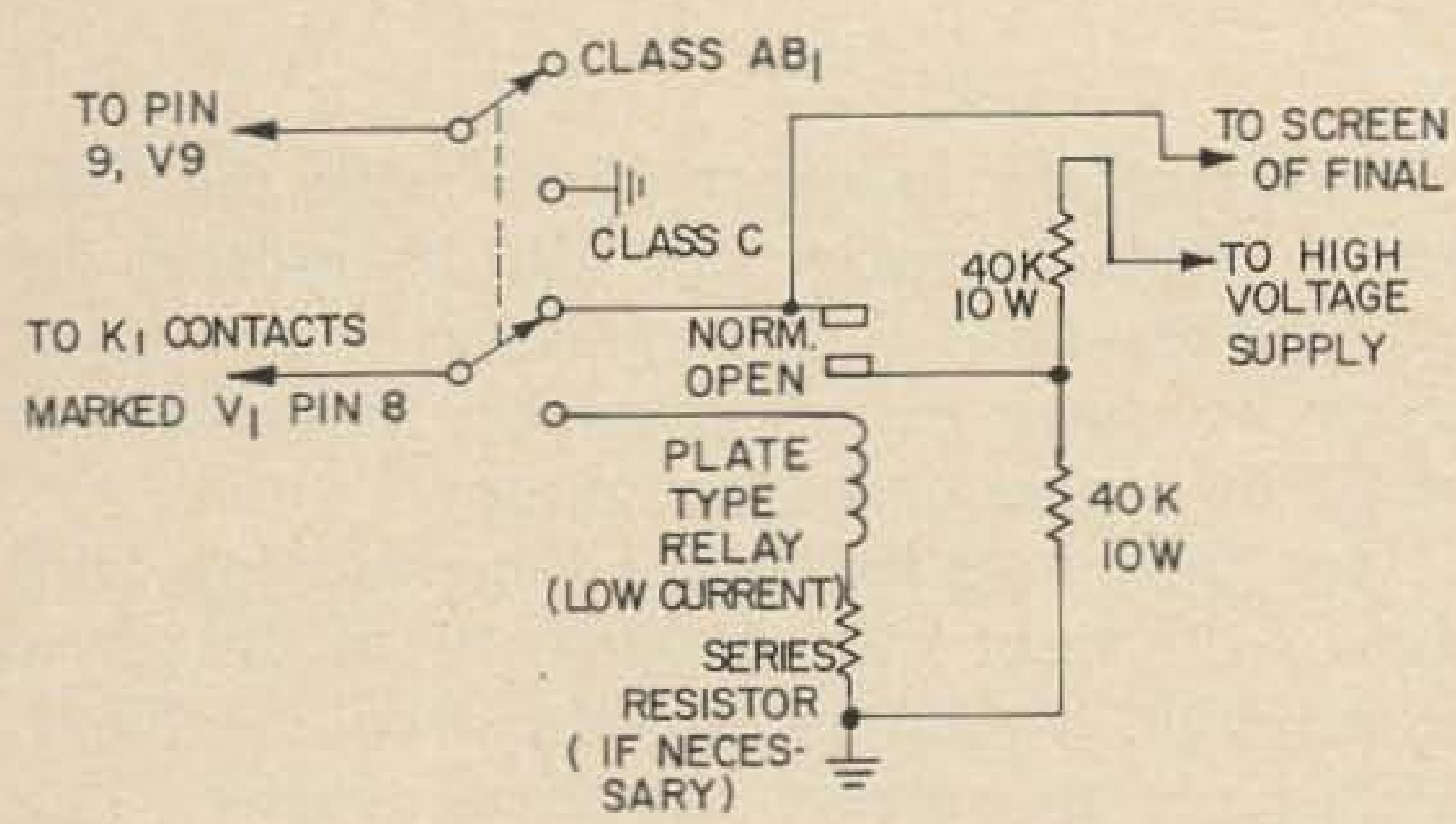


Fig. 2. Class C modification.

From Fig. 2 it can be seen that the lead from the screen of the final to the relay has been removed. It is also necessary to change the screen bypass capacitors from .01 to .001 for AM operation.

In the class C position the balanced modulator is unbalanced by the top half of the switch. The other half of the switch allows the relay to be energized during transmit time. The screen now gets its power through a 40K dropping resistor. This will cause the screen voltage to be about 130 volts. With this screen voltage and the same grid bias used in linear operation the 6DQ5 is being operated class C. There will be about 1 ma of grid current but little or no grid current is necessary to get good efficient class C operation with this tube. In class C operation the final may be loaded to 150 ma plate current which will give an output of at least three times that which may be obtained from inserting carrier in linear operation, staying within maximum dissipation ratings of the tube.

. . . K6LGW

Jim Kyle K5JKX
1236 N.E. 44th St.
Oklahoma City, Okla.

That Unwanted Sideband

If you've been following our sideband series this far, you may have noticed by now that (unlike most other references to the subject) we have *not* been specifying either single or double sideband!

And, like for most everything that happens in these pages, there's a reason—though it may seem a trifle strange.

The reason is this: so far as communication is concerned, it makes not the slightest bit of difference whether the signal sent through the ether has one or two sidebands. Since the normal two sidebands are mirror images of each other, only one is necessary. However, it's sometimes simpler at the transmitter end to send both of 'em along.

Unfortunately, present-day receiving techniques make it almost impossible to receive a double-sideband signal without extreme distortion. The reason is that the locally supplied carrier must be in exact phase with the (absent) original carrier for distortion-free demodulation—and this requirement for exact phase accuracy means precision impossible to attain by conventional techniques.

One technique exists for demodulating DSB signals the right way, making use of the phase information contained in the two sidebands themselves to correct the local carrier. This is the Webb synchronous-reception adapter, described originally in CQ some six years ago and in shorter form in Stoner's sideband handbook. However, since two audio phase-shift networks and something like eight tubes are required, the unit has never been very popular.

The more popular technique for receiving DSB signals is simply to get rid of one of the sidebands, thus making a SSB signal out of it—and these are relatively easy to demodulate.

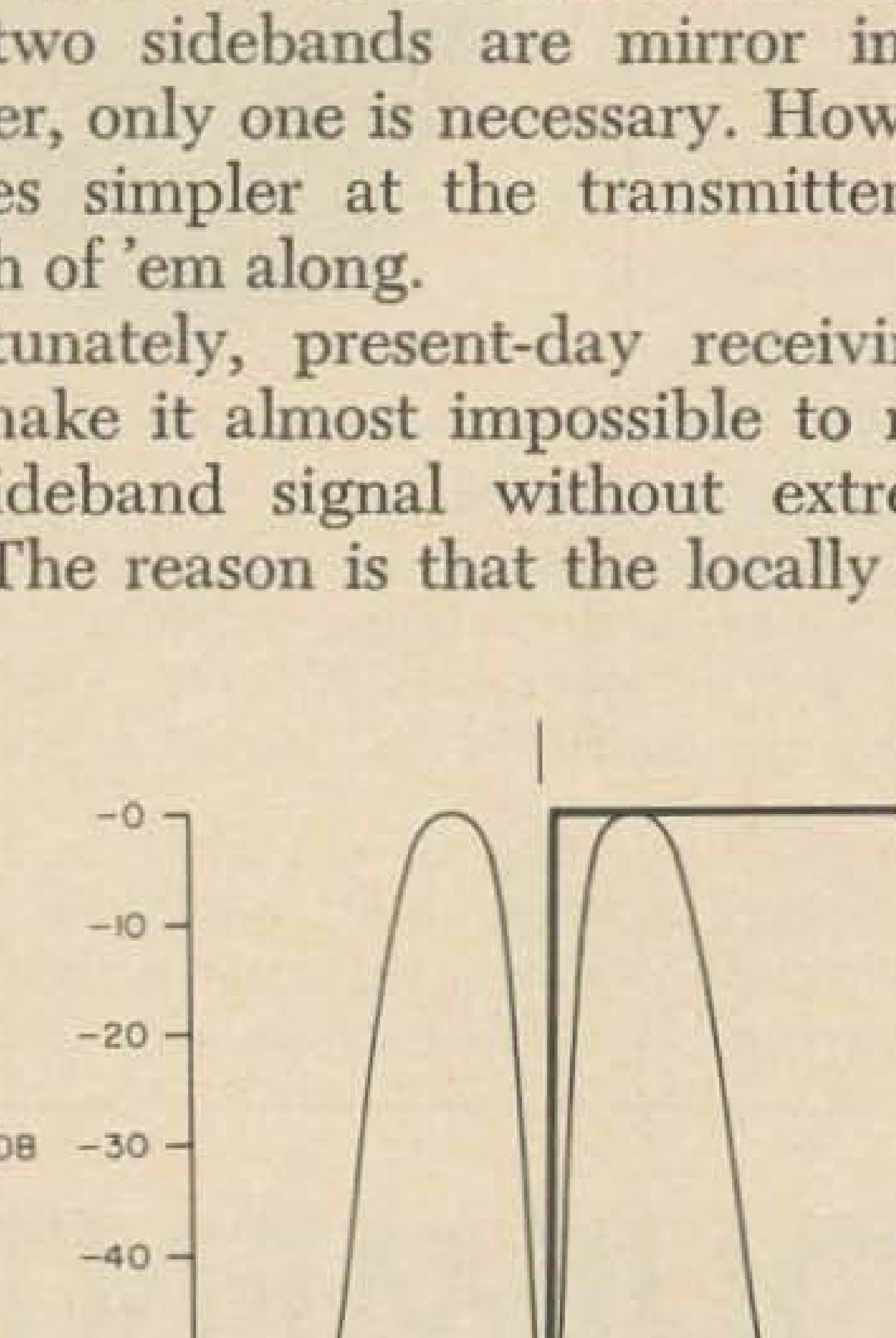


Fig. 1 Selectivity curve of ideal SSB filter

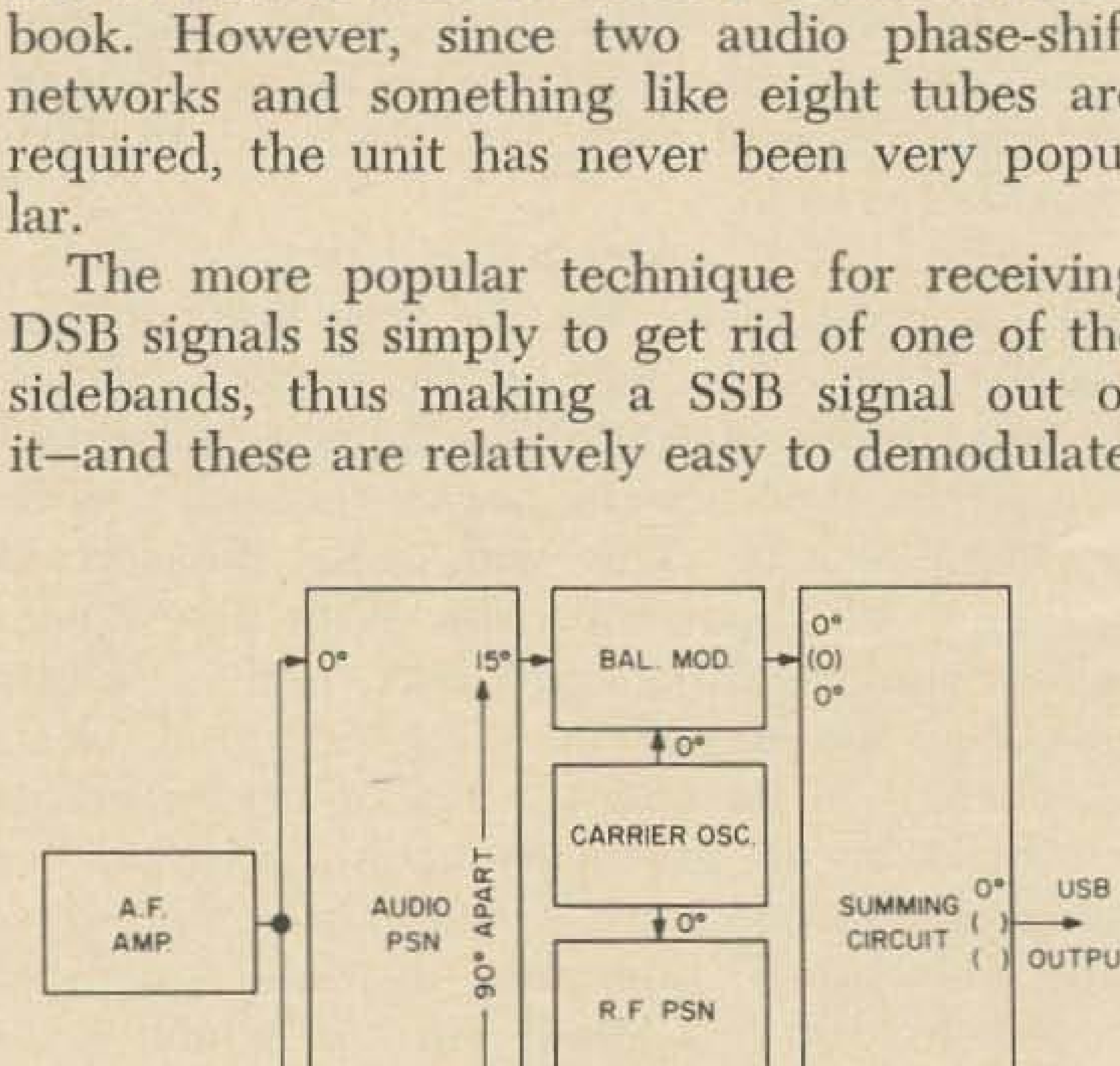


Fig. 2 Typical xmtr phasing unit

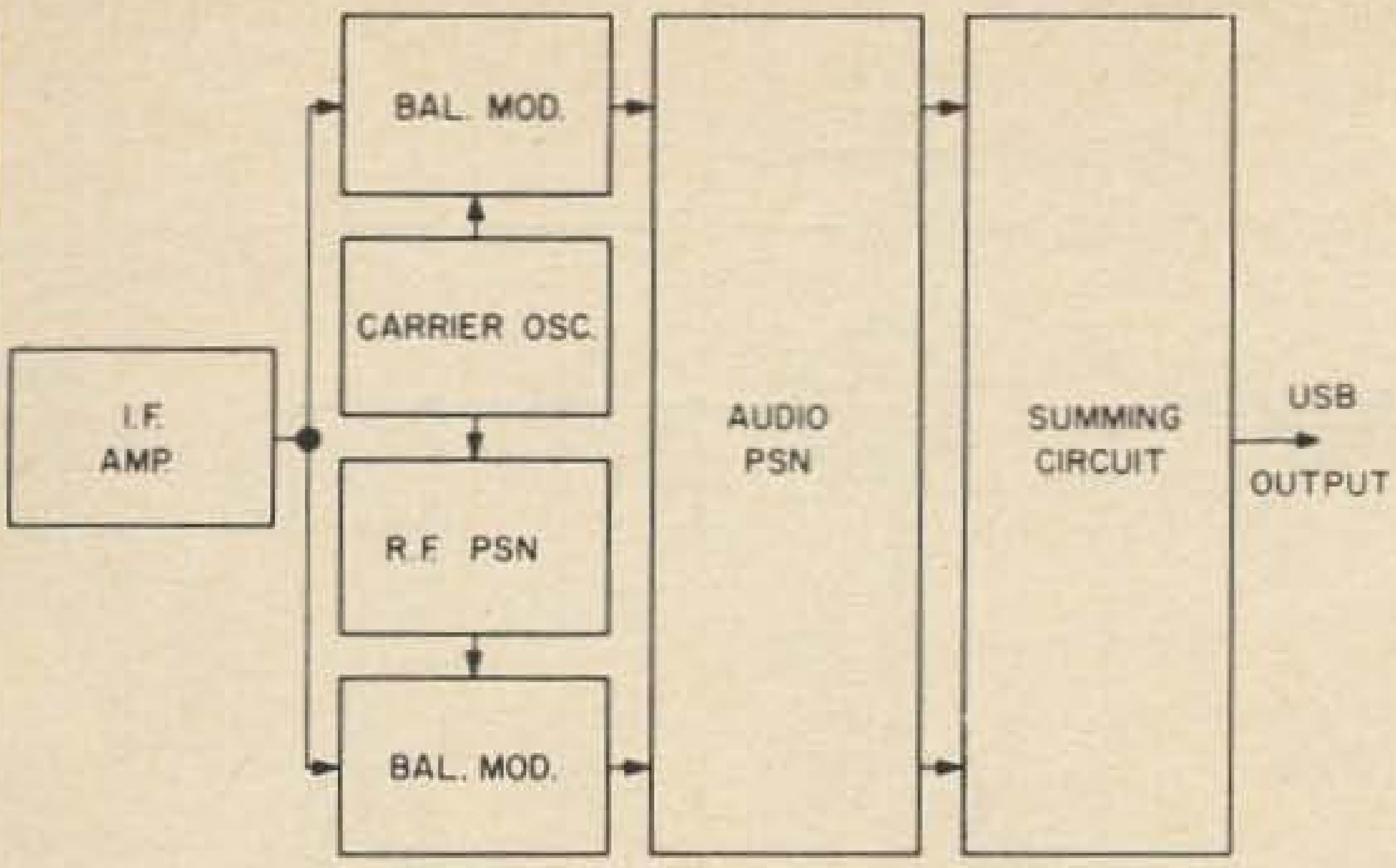


Fig. 3 Typical rcvr phasing unit

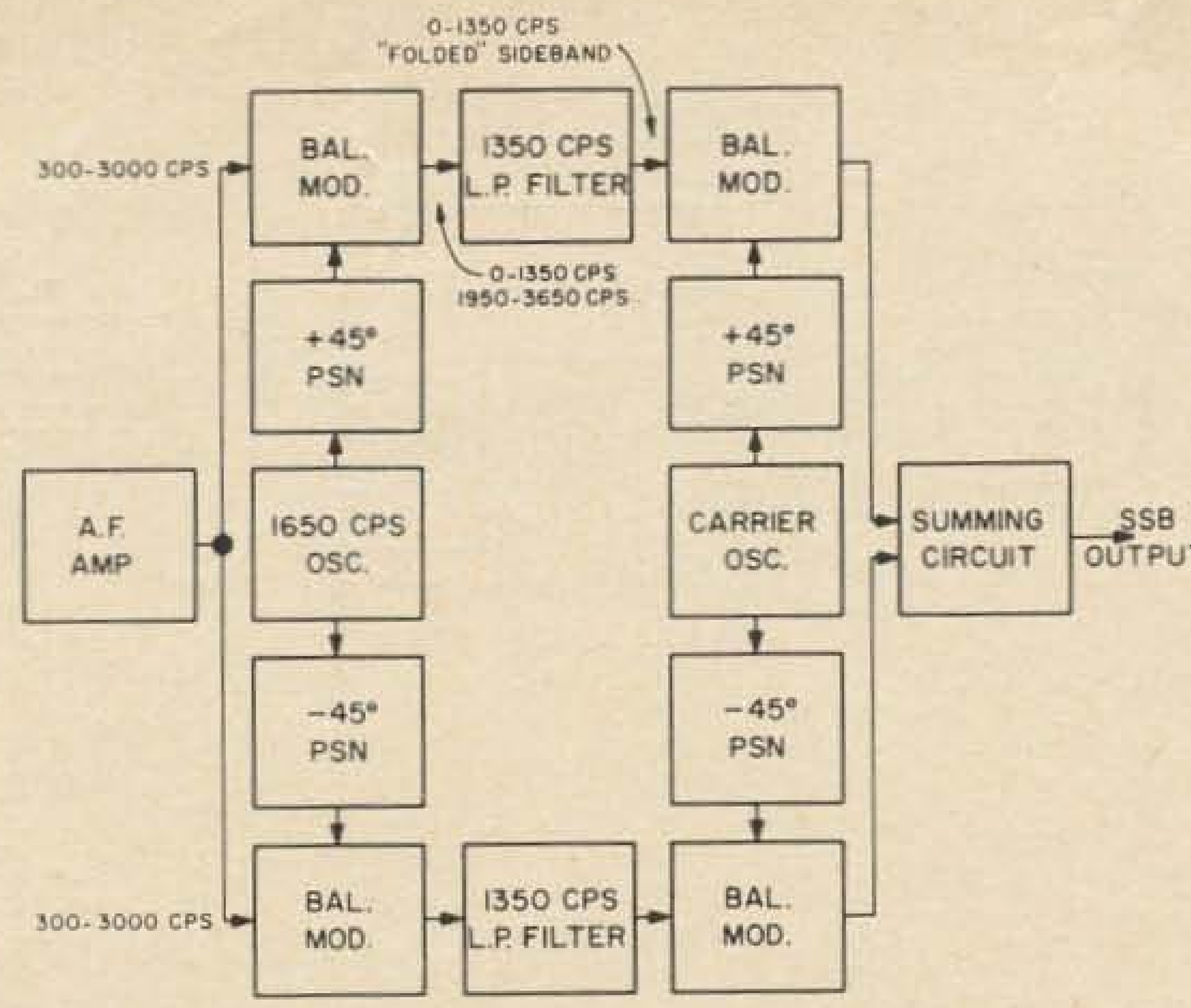


Fig. 4 Block diagram of third method

But—and this bears repeating—it makes no difference so far as communications are concerned whether this "unwanted" sideband is disposed of at the transmitter or at the receiver. If it is dumped out at the transmitter, twice as much talkpower may be transmitted for the same dc power input. On the other hand, if the orphan sideband is disposed of in the receiver, the receiving operator can take his choice as to which is the "orphan," which is sometimes a help in the case of QRM on just one of the sidebands.

The selectable-sideband feature, though, is more theoretical than practical, and will be so long as the present convention of using lower sideband on 75 and 40 and upper sideband on the higher bands is followed!

Anyhow, since the techniques for getting rid of the poor orphan little critter are the same whether employed in the transmitter or in the receiver, it only makes sense to examine them one time and one time only. Let's go:

Basically, we have our choice of three methods of getting rid of that unwanted sideband. These are the "filter" method, the "phasing" method, and (logically enough) the "third method." If we examine them in order, we'll find out just how logical that last name above really is!

The filter method is simplicity itself. We simply squeeze the DSB signal through a filter which is wide enough to let one sideband through but not wide enough for two. If the DSB signal is positioned properly in relation to the filter passband, one of the sidebands will be shaved off neatly while the other goes on through to be used.

But the simplicity of the filter method, in theory, is more than a bit deceiving when it comes to putting it in practice. The width of the DSB signal (assuming proper speech processing to limit audio bandwidth) will be in the neighborhood of 6 kc. The width of the

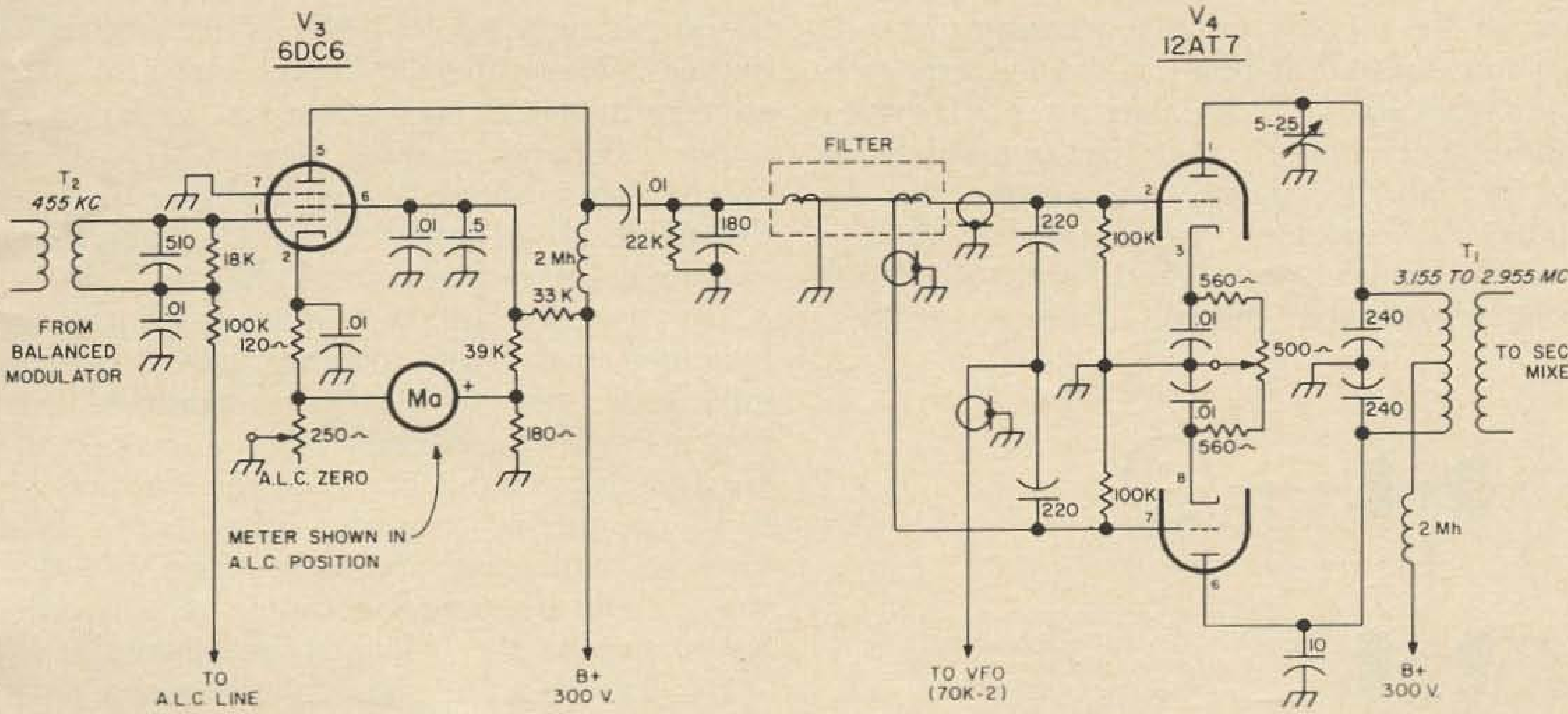


Fig. 5 Collins 32S1 filter circuit

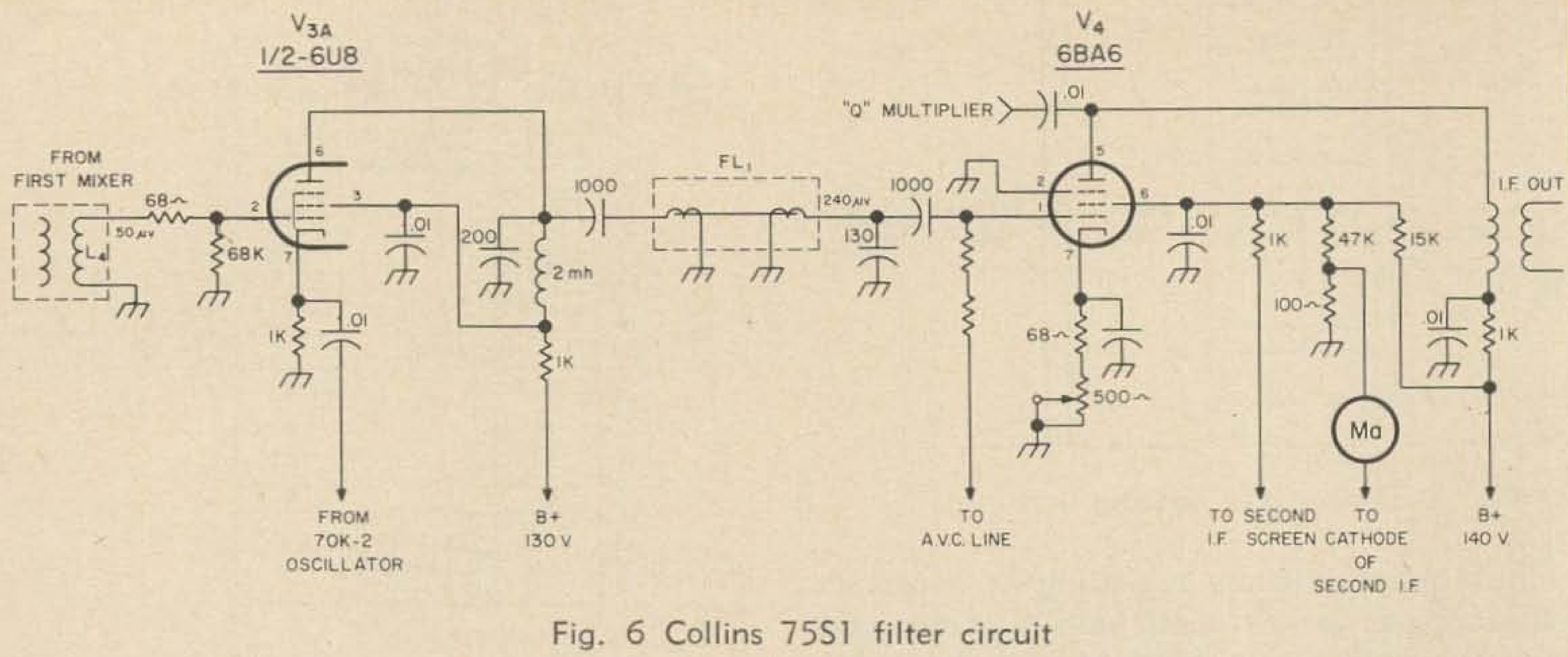


Fig. 6 Collins 75S1 filter circuit

filter passband, then, should not be over 3 kc. To get just-acceptable performance, the unwanted sideband should be attenuated at least 30 db—which means that we must have a filter which passes a 3-kc band with no attenuation, and at the same time rejects an immediately adjacent 3-kc band by 30 db!

The passband of such a filter would look something like Fig. 1—if we could get one. Unfortunately, we can't. We can get a reasonably (and usably) close approximation by using high-Q LC circuits at 17 to 20 kc, or by using crystal lattices at frequencies as high as 9 Mc. One of the more popular approaches to the filter situation is by use of a Collins mechanical filter at 455 kc. Obviously, the filter approach is going to require some frequency conversion to be useful, and so it appears to be a preferred approach for a receiver but not necessarily so good in a transmitter. However, other considerations enter into the picture and we find that many persons hold the belief that a filter approach outperforms the equally popular phasing method.

To sum up at this point, the filter approach is somewhat like a razor, shaving off the sides of the signal band so that just one sideband gets through. In theory it's simple, but in practice the extremely rapid rate of change required between passband and stopband makes the problem difficult. In spite of this, a number of highly successful filter designs are available.

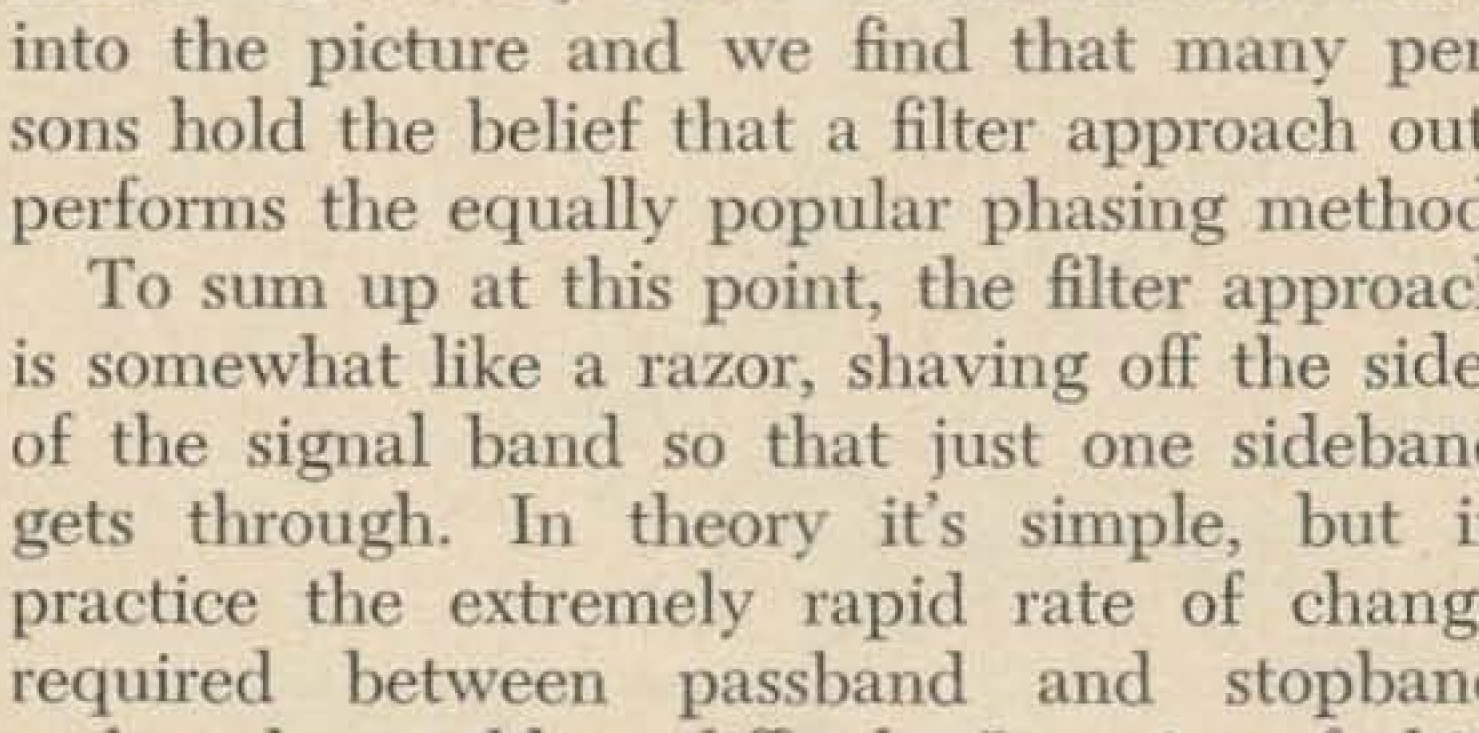


Fig. 7 Vester HF xtal filter

How about the phasing method?

This approach is considerably more sophisticated in its concept, in that we make the unwanted sideband simply cancel itself out! To see how this can happen, take a look at Fig. 2.

This illustration shows how phasing can be employed in a transmitter. All phases mentioned, incidentally, are with reference to the phase of the "carrier oscillator"—without such a reference, the explanation can get too confusing to ever be comprehensible! It's bad enough, even with a reference!

First let's look at audio coming through the upper channel. The sidebands will have phase determined primarily by that of the carrier oscillator, so we can say that the entire output of balanced modulator I is in "zero-phase," or *in* phase with the reference.

However, the carrier supplied to balanced modulator II is shifted 90 degrees. In addition, the audio supplied to BMII is also shifted 90 degrees. These two 90-degree shifts of phase effectively cancel each other out so far as the *upper* sideband coming from BMII is concerned, leaving it at 0-degree phase. However, the phase shifts *add* for the lower sideband, making it 180 degrees out of phase.

If, now, we add the outputs of the two balanced modulators together (say, in a common tank circuit) the lower-sideband components will cancel each other out since they are 180 degrees out of phase. The upper-sideband components, on the other hand, being in-phase will reinforce each other. We don't worry about the carrier components, since they fail to survive the balanced modulators!

By changing the phase of the audio fed to either (but not both!) of the balanced modulators by 180 degrees, we can switch the ac to low power in an instant. (and vice-versa)

Construction of the HA-14 couldn't have been simpler. All of the parts are top quality, made in U.S.A. types. Assembly time from parts to power was just 8 hours.

The instructions were great. Details are given on how to hook the linear up to nearly any exciter. The manual even gives modification procedures to provide an ALC input for the Heathkit Model HW-12, 22, and 32 single-banders.

After you have finished soldering, there is one resistance check to make on the filament line. Then you're ready for the preliminary smoke test. This consists of several bias and filament voltage measurements. The high voltage is left disconnected, and no measurements are made on it.

The KW Kompact is very easy to operate. There are 5 controls in addition to the meter on the front panel—tune, band select, meter sensitivity, meter function, and on-off. With the linear turned off and switched to the band being used, you tune your exciter for 100 watts output. Then switch the linear "on" and rotate the "tune" control for maximum output as shown on the meter. Heath recommends that you work into an SWR of 2:1 or less. I have found that you start having difficulty in loading if you try to use an antenna with an SWR of 2:1 or over.

The HA-14 needed little adjustment when moving from the high to the low portion of the band.

With my little HW-32 and the KW Kompact, I acquired new "prestige" on the airwaves. I can now talk to VK's and ZL's with 5-8 signals with just a trap vertical.

With only four connections to make, it is easy to transfer the HA-14 from the shack to the car. It's hard to explain the feeling you get when you have 1000 watts in your mobile. That extra power sure helps cut through the QRM. And does it ever surprise a lot of hams when they see their S-meter peaking a-way up there—from a mobile! !

I used the Webster Top Sider antenna and their gallon coils with very good results. It's a good idea to keep people away from your mobile antenna while transmitting with the HA-14. Someone could get quite a surprise if they get hooked up with it as you call CQ-DX.

I put a sign on the back bumper reading "CAUTION—1000 watts." You'd be surprised how it kept people from following me too closely on the freeway!!

Heathkit's HA-14 KW Kompact is a real jewel—and, strictly state of the art.

. . . WB6KEH

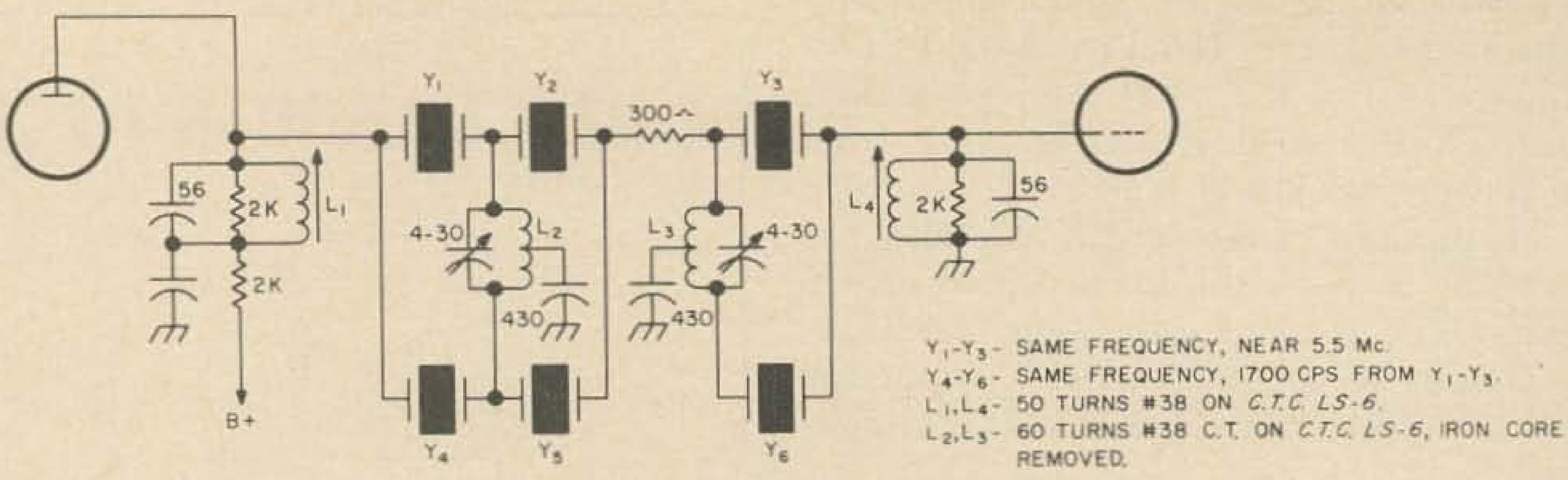


Fig. 8 Healey anti-spur HF xtal filter

tion so that the upper sideband cancels out and the lower gets through. This leads to a simple DPDT reversing switch, to select sideband!

How can this be applied to receivers? All we need do is to move things around a little as shown in Fig. 3. Now the phase-shift network for audio comes between the demodulators and the summing circuit, but that's the only major change. Operation is exactly the same; in effect, the signal is sliced in half precisely at the frequency of the carrier oscillator and everything on one side is rejected while everything on the other side passes through.

The major advantages of a phasing approach are the elimination of the requirement for rapid change of discrimination in a narrow frequency interval (which made filters so difficult in practice) and the ability to generate the SSB signal at any frequency desired rather than being limited by filter characteristics. Disadvantages are more critical adjustment requirements, and (in the past) expense of the audio phase-shift networks. However, present networks cost less than $5.

So what about the "third method"?

This is a technique which combines principles of both filters and phasing, but comes up with a result different from either. It was gone into in some detail in the September, 1957, issue of *QST*, but almost nothing has been mentioned about it since, although one commercial firm marketed a "third-method" unit for a time.

Basically, in this method, audio is limited to the 300-3000 cycle band and is applied to a pair of balanced modulators. (As shown in Fig. 4.) The first carrier is at 1650 cps, and is shifted +45 degrees for one bal-mod and −45 degrees for the other. Outputs of the two bal-mods go to sharp cutoff low-pass filters with 1350-cps cutoff frequencies. Thus the outputs of these filters consist of 0 to 1350 cps, DSB signals, in which corresponding sidebands are 90 degrees out of phase with each other.

Each of these signals is applied to another balanced modulator. Second carrier is at any convenient output frequency, and like the first carrier is shifted plus and minus 45 degrees.

The outputs of these bal-mods, then, consist of the sidebands of the second carrier, with phase relationships such that upper sidebands reinforce while lower sidebands cancel

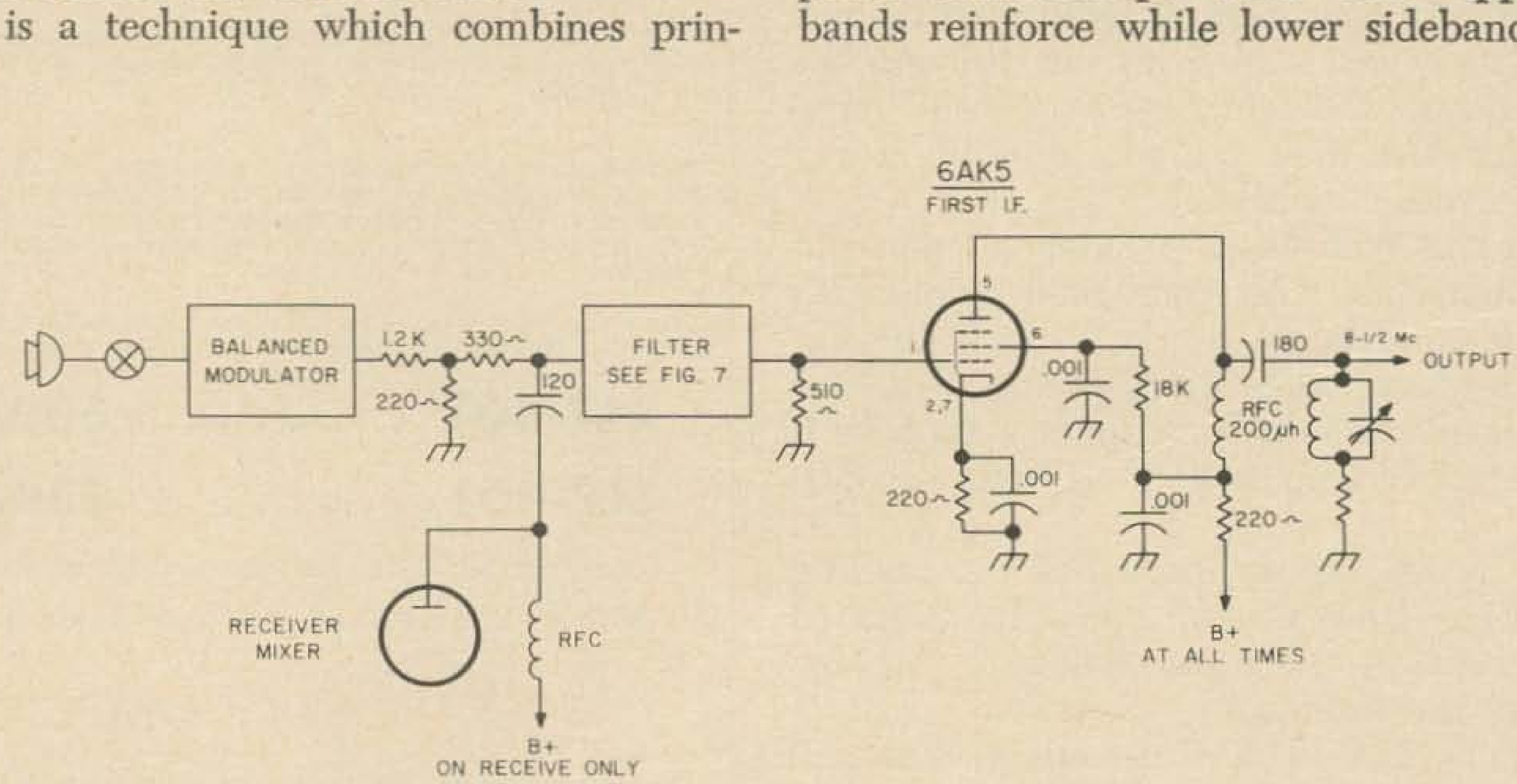


Fig. 9 Partial schematic of Vester transceiver

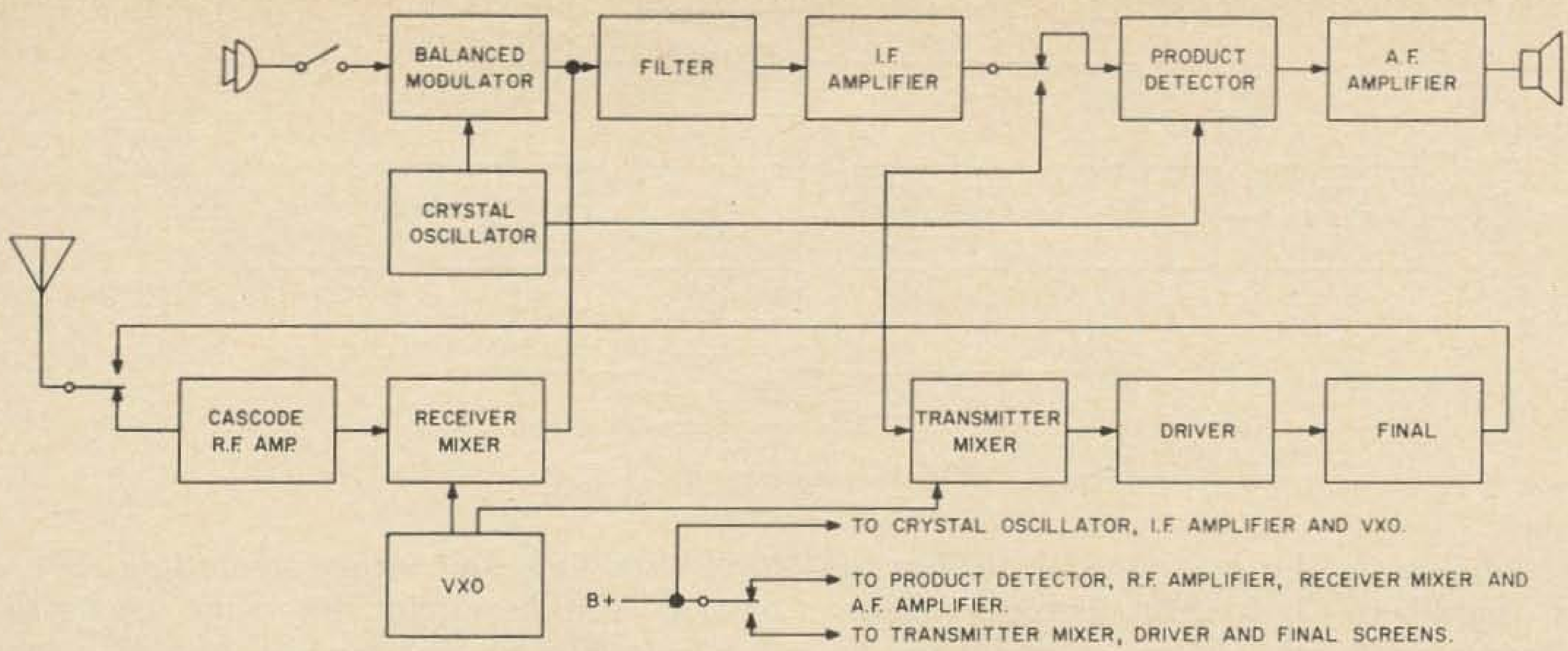


Fig. 10 Block diagram of Vester transceiver

out. In addition, half the spectrum is contributed by one channel while the other half comes from the other channel. And finally, any unwanted sideband appears inverted, right on top of the desired signal, instead of out to the side!

Let's take a closer look to add to the confusion—but if you really want to do anything with this system, go back to the original QST article by W1PNB!—and try to see how this inversion works.

The first carrier, being in the middle of the audio range, splits the signal rather rudely. It produces one "folded" sideband where you would expect a "lower" sideband, since the "difference" frequency between 3000 cps and 1650 cps is 1350 cps. The low-pass filters cutting off at 1350 cycles eliminate all the upper-sideband output of the first balanced modulators, leaving us with a pair of folded sidebands that reach from 1350 cps down to dc and back up to 1350. The "folding" around dc introduces a phase reversal of 180 degrees.

Now, when we modulate the second carrier with these folded sidebands, we find that we have in the output two perfectly good single-sideband signals *superimposed on each other*. The second carrier replaces the dc point as the

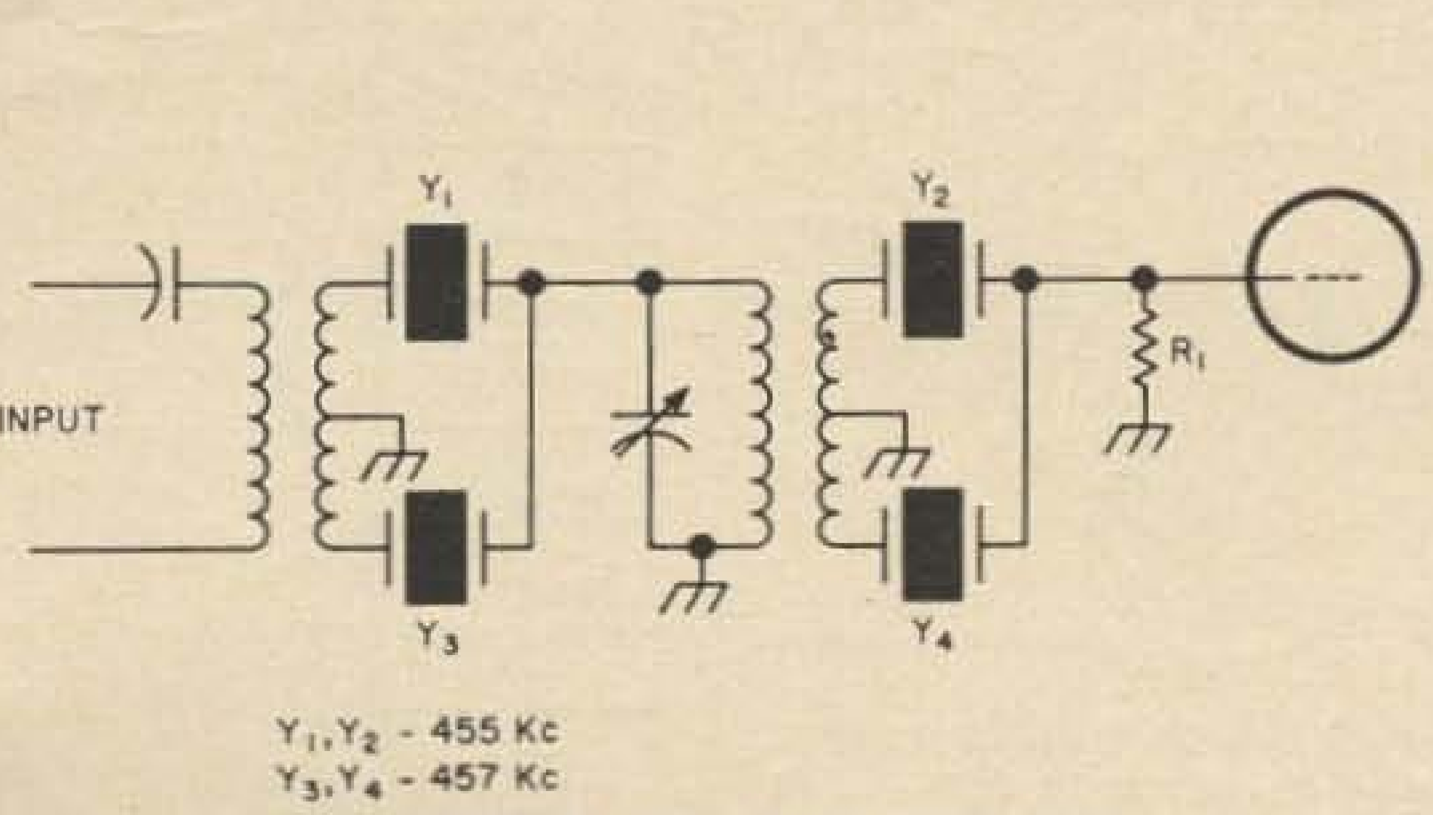


Fig. 11 455 kc xtal filter circuit

"folding point," and the upper-lower sideband phase relationship combines with the 180-degree reversal introduced by the folding. From this point on, it's just like a straight phasing unit.

Apparent advantages of the third method are the complete elimination of any requirement for audio phase shifting, together with elimination of bandpass filters. Two spot-frequency phase shift networks are required, but these pose no problems. One sharp cutoff filter is needed, but this is easy enough at the frequency involved.

In addition, any drift of circuit adjustments will result only in degradation of the signal channel; it will *not* put unwanted spurious signals on other (even adjacent) channels.

Disadvantages include possibility of disturbing whine from the first carrier if any drift at all occurs, and quite a few more adjustments than either of the other systems. It is not certain whether this approach can be applied to a receiver as well as to a transmitter, either.

Some Detailed Examinations

At this point, we've taken general looks at the three ways of disposing of that unwanted sideband. Let's take a little more detailed view of the *practical* applications of these methods, to see what they entail. We might as well start with the general class of filters, to keep the same order as in our preliminary looks.

Most popular filter arrangement these days, it seems, revolves around Collins' little gem, the mechanical filter. Or, to give it its proper name, the magnetostrictive mechanical-resonance filter.

This filter (actually, there are many different models, but those most popular for ham use have similar characteristics) requires low-impedance feed, and has between 2 and 16 db

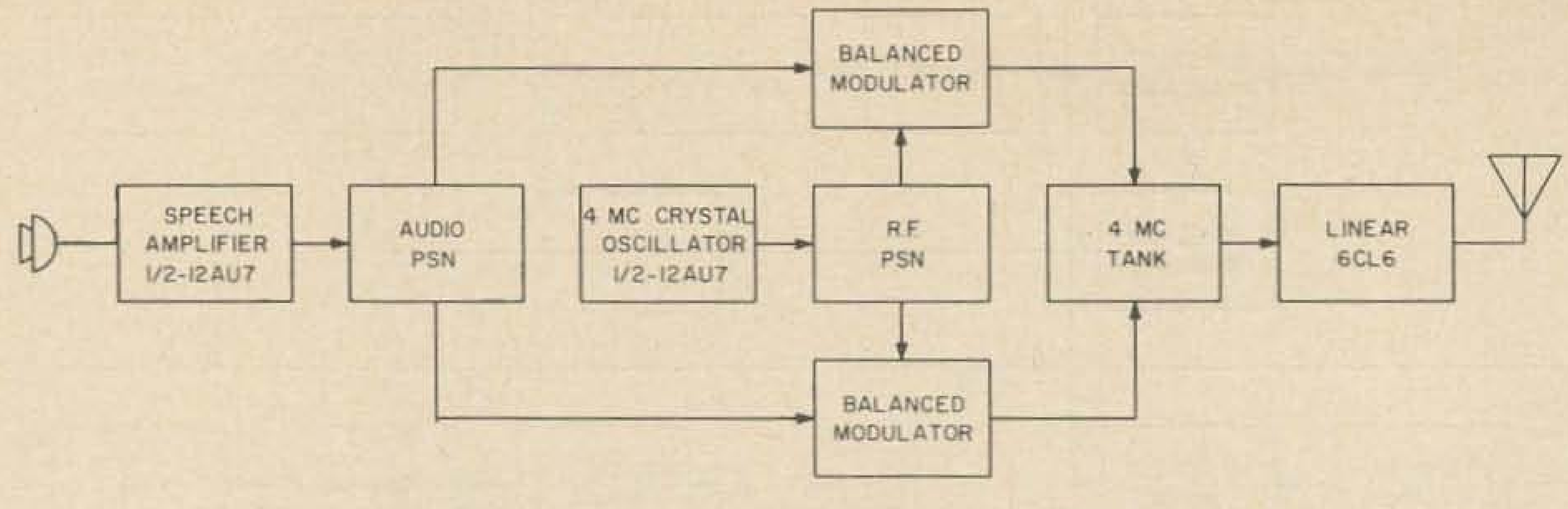


Fig. 12 Block diagram of GE SSB Jr.

of insertion loss in the passband according to Collins' handbook on SSB. Typical shape factor (ratio of bandwidth at 6 db down to that at 60 db down) is 2.2, the closest approach to the ideal 1.0 factor yet realized to date.

A typical circuit for use of this filter (taken from the Collins 32S-1) appears in Fig. 5. Note that in this case the filter is used between two *if* stages, rather than directly at the output of a balanced modulator.

A receiver circuit using the mechanical filter (from the 75S-1) is shown in Fig. 6. Filter-switching circuitry has been omitted from this schematic.

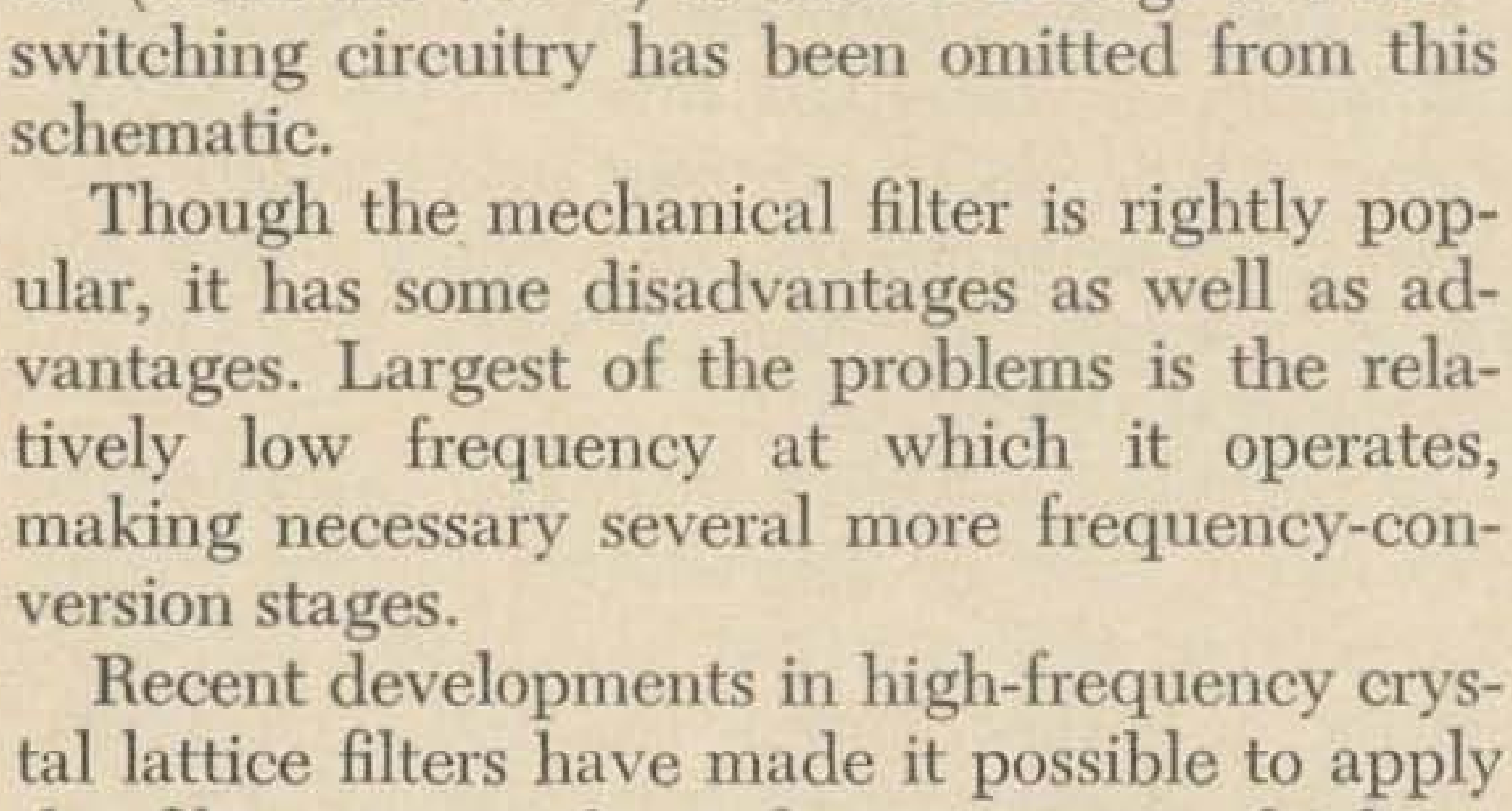
Though the mechanical filter is rightly popular, it has some disadvantages as well as advantages. Largest of the problems is the relatively low frequency at which it operates, making necessary several more frequency-conversion stages.

Recent developments in high-frequency crystal lattice filters have made it possible to apply the filter approach at frequencies as high as 9 Mc (the McCoy crystal filter is a typical commercial version), eliminating one set of conversion stages.

One of the pioneers of this approach was Benjamin H. Vester, W3TLN, whose article on "Surplus-Crystal High-Frequency Filters" in the January, 1959, QST stirred a storm of toroid-winding and experimentation. The extremely simple circuit he came up with is shown in Fig. 7. Resistance values R1 and R2 are critical; R1 is the apparent source impedance and should be as low as possible. Cathode-follower feed is ideal. R2 should be as high a resistance as will allow a smooth-topped passband; typical values are from 1000 to 4700 ohms. L1 is a bifilar-wound toroid, and you'll have to wind it yourself. Performance of this circuit was measured by Vester, who reported a shape factor of 2.0, with 6-db bandwidth of 2 kc and 60-db spread of 4 kc.

Some 18 months later, D. J. Healey, W3HEC, pointed out a possible shortcoming of the Vester circuit. If the crystals have spurious responses, they may allow spurious signals through the filter. He offered an alternative circuit, shown in Fig. 8. Shape factor of this one (measured at 30 db down instead of 60, so not comparable to the other figures) is 1.44, while bandwidth is just under 3 kc. Complete details of this one appeared in the October, 1960, issue of QST, with updating in the January, 1961 issue.

One of the more interesting applications of these high-frequency filters has been in the construction of transceivers. One of the first described was Vester's, which appeared originally in the June, 1959, QST and has since



BAND (METERS)	C (pf)
75	817
40	439
20	223
15	150
10	110

Fig. 13 SB-10 rf psn circuit details

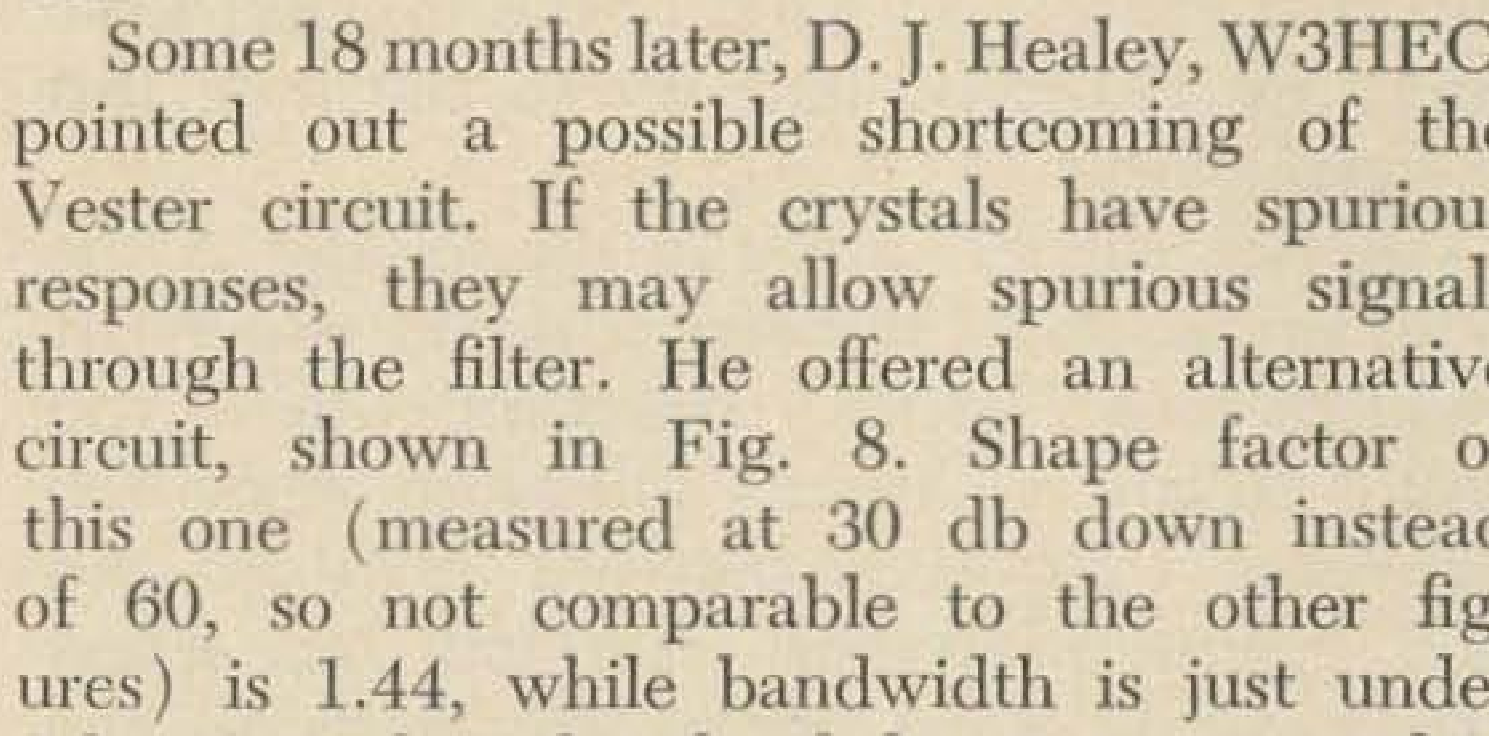
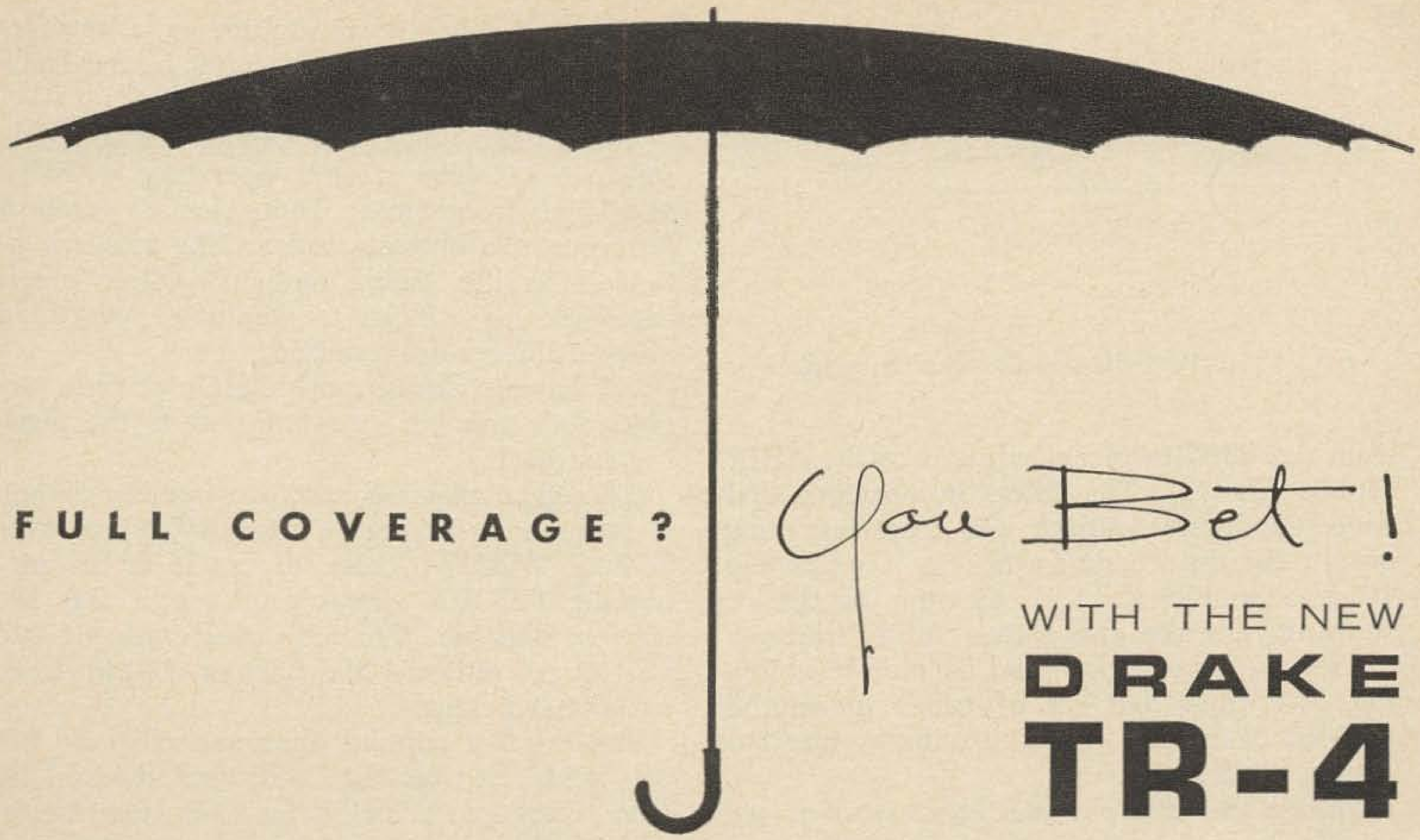


Fig. 14 Linear phasing unit arrangement



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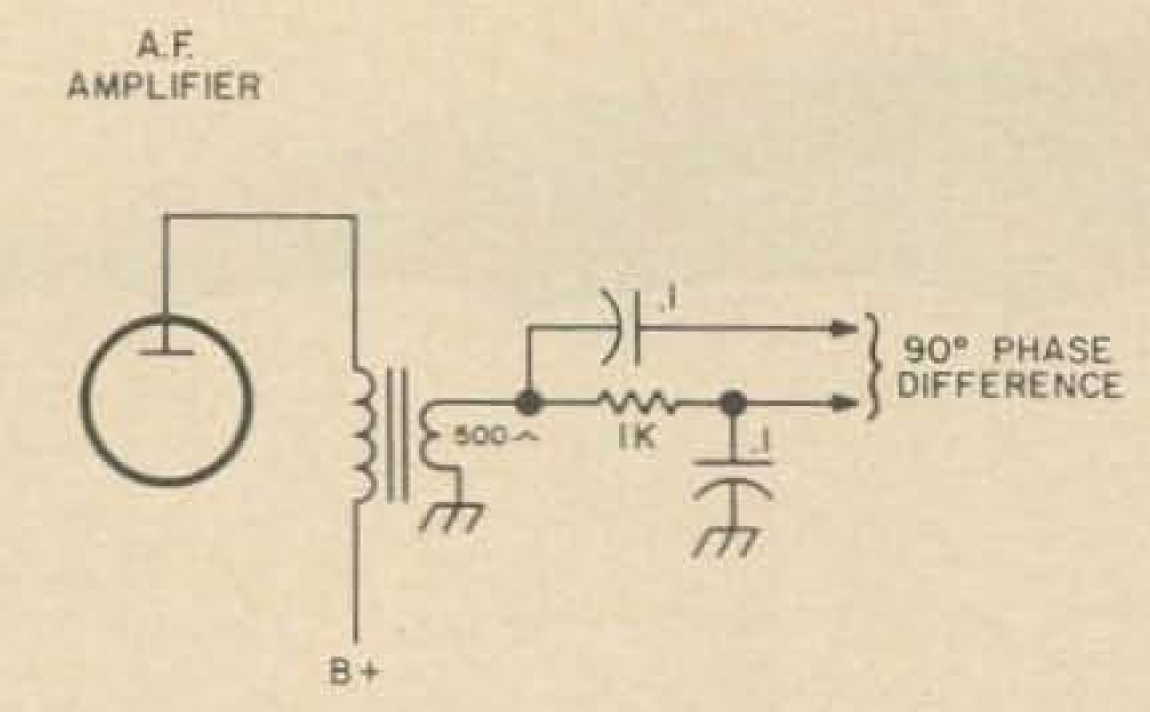

Fig. 15 Little Feller audio phasing network

been reprinted in recent editions of the ARRL Mobile Manual. The filter, *if* amplifier, balanced modulator output, and receiving mixer output circuits are shown in Fig. 9, while Fig. 10 is a simplified block diagram of the rig showing how the changeover from "transmit" to "receive" is accomplished by merely switching B+ from one set of tubes to another without disturbing signal-carrying connections except at one point.

Bridge and lattice crystal filters work as well at 455 kc as they do in the 9-Mc region, and existing sideband handbooks give ample information on the design and construction of such units. Like their higher-frequency brothers, these are medium-impedance devices, and passband shape may be most easily adjusted by varying the output load resistance. A typical circuit is shown in Fig. 11. This may be applied to either a transmitter or a receiver by substituting the proper circuit in the block marked "mixer."

Older texts on SSB devote considerable space to LC filter circuits operating at 50 kc and lower frequencies. These, for all practical purposes, are obsolete today. The sole exception is in the "third method" where sharp cutoff low-pass filters to eliminate everything above 1350 cps are required.

So, having looked more closely at filter circuits, let's turn our attention now to the phasing approach.

Though a phasing unit can operate at *any* rf frequency, it's been customary (since Wes Schum, W9DYV, chose to use it in his pioneering CE-10A exciter) to use a 9.0 Mc carrier. This can then be mixed with a 5-Mc vfo to get either 4-Mc LSB or 14-Mc USB, without switching.

But the first popular phasing exciter did *not* use 9 Mc. It was the "SSB, Jr." devised by Don Norgaard, W2KUJ, for G-E Ham News, and it operated at any chosen spot frequency in the 75-meter band.

This little 3-tube unit followed the same basic principles explained earlier; its block diagram appears in Fig. 12. Power output was some 2 watts. Any frequency change necessitated realignment of the rf phase-shift network.

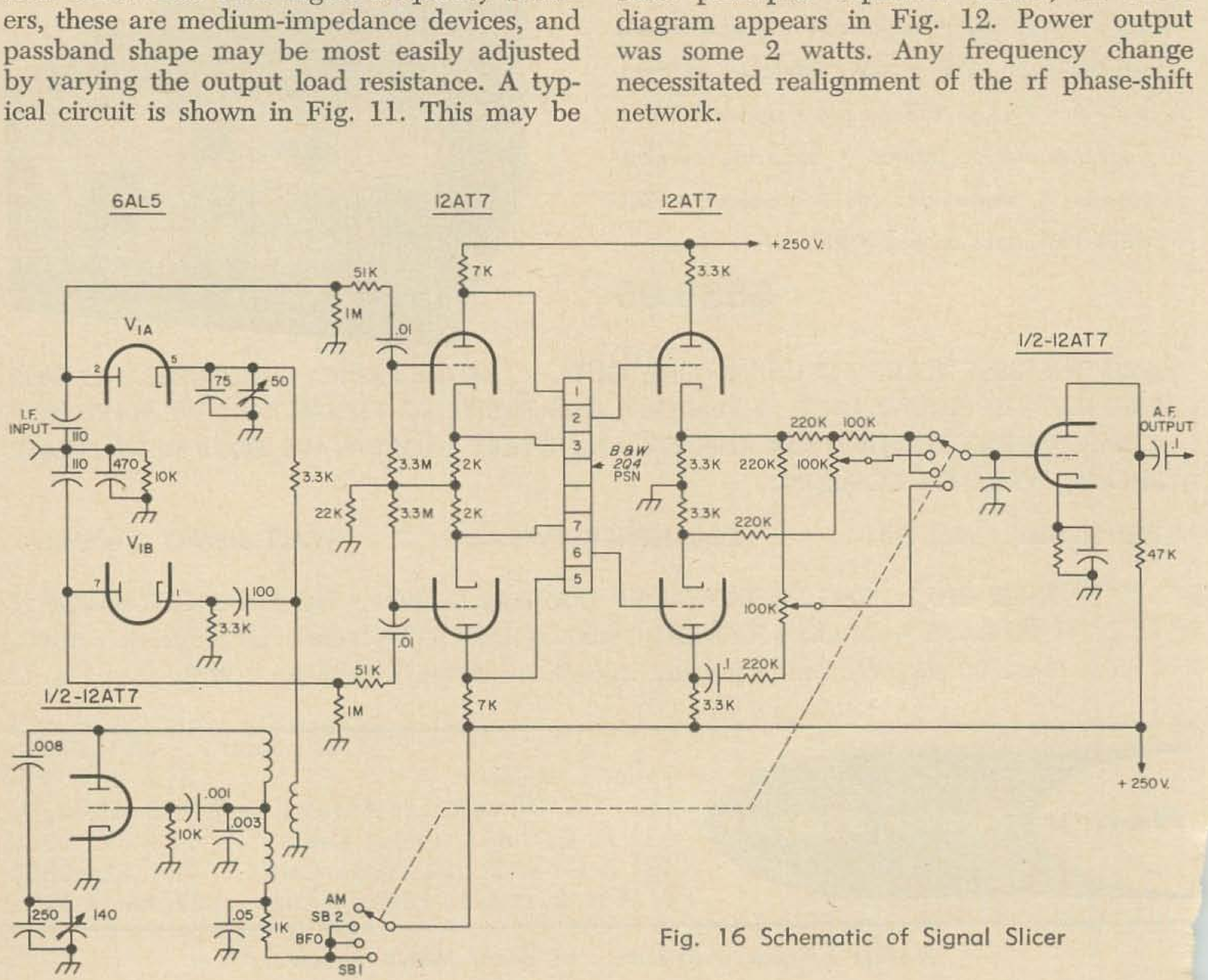

Fig. 16 Schematic of Signal Slicer

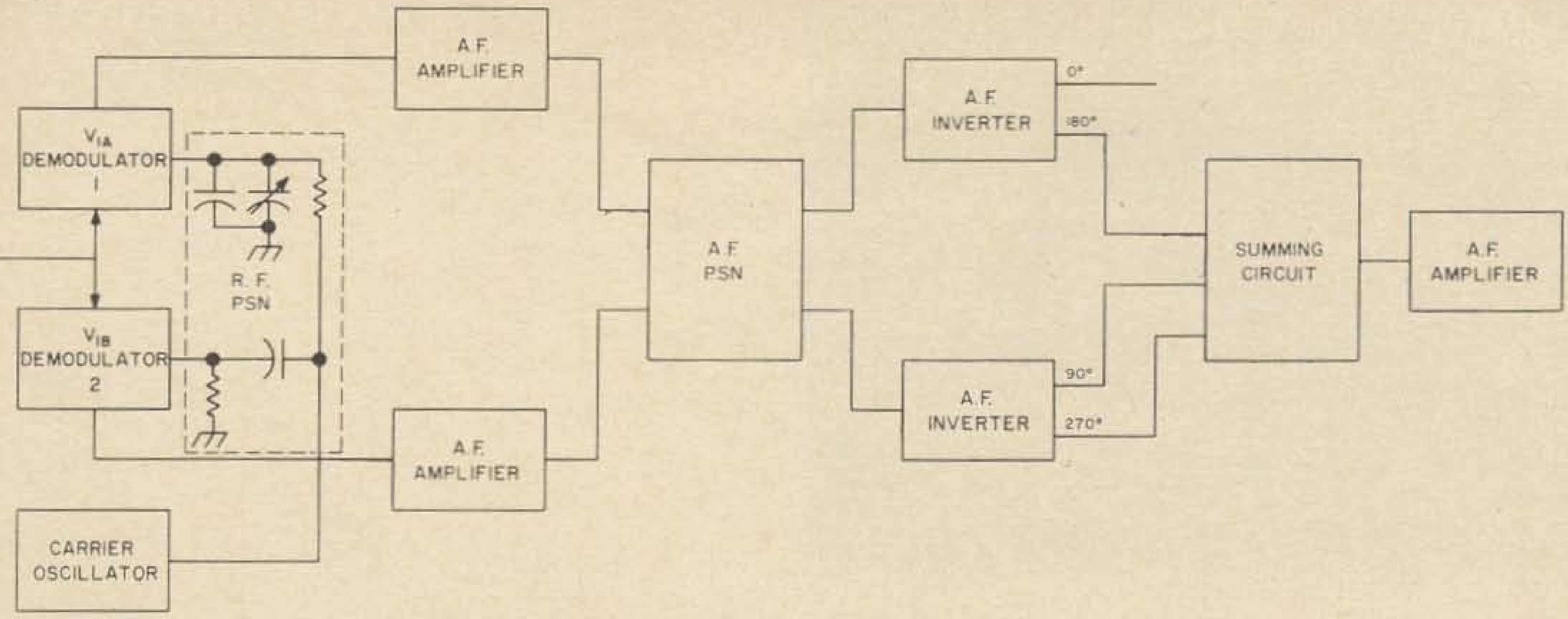

Fig. 17 Block diagram of circuit of Fig. 16 identifying component functions

The same basic circuit was adopted by W9DYV for the 10A exciter. He moved the operating frequency to 9 Mc and added a mixer, thus eliminating the need for realignment with every QSY. He also added a number of operating conveniences such as VOX—but those are apart from this discussion.

The next change of any significance in phasing exciters was introduction of Heath's SB-10 transmitter adapter, designed to accept the rf driver output of a standard AM transmitter and to convert it to SSB at operating frequency. The SSB signal is then returned to the original transmitter, where the final is readjusted to act as a linear amplifier.

The necessity for realignment of phase-shifting components with each frequency change is avoided by use of a broad-band passive rf phase-shift network, and switching a different such network into the circuit for every band covered. This part of the circuit, together with inputs to the balanced modulators, is shown in Fig. 13.

An interesting variant of the phasing type of exciter, especially suited for use at VHF, is the linear-phasing unit. This has not been fully described in print before, but most of the work on it has been done by a New York group. The rf phase shift is obtained by varying length of feedlines to the pairs of balanced modulators. For any frequency at which the two feedlines differ in length by 90 degrees, phase shift will be correct. As 90 degrees is ¼ wavelength, one line should be 12 inches longer than the other for operation on 144 Mc. At 50 Mc, the length difference would be 3 feet 4 inches. This line can be coiled up neatly and tucked out of the way.

A typical linear-phasing unit is shown schematically in Fig. 14. Although this unit is for 50-Mc use, it can be used equally well at frequencies up through 432 Mc by scaling line length appropriately.

A super-simplified phasing unit, especially for 50-Mc use, was described about a year ago by W5BCS and W5ORH who dubbed the entire unit "The Little Feller." Built around ZL1AAX's three-compartment audio phase shift network, together with a passive bridge rf network a la SB-10, the unit offered some 15 db suppression of the unwanted sideband provided a carbon mike with low response to higher frequencies was used. The phase shift network used in this rig appears in Fig. 15.

As we saw earlier, any phasing transmitting unit can be changed over to function as a receiving unit by simply moving the audio phase-shift network's location in the system. The original such unit was the General Electric YS-1 designed by Norgaard and described in QST in July, 1948. This unit was later simplified and described in G-E Ham News as the Signal Slicer, and in this version won immediate popularity. The schematic of the simplified unit appears in Fig. 16, while Fig. 17 shows a block diagram of the same unit to show which components perform what functions. This will allow you to substitute other building blocks, if you so desire, such as (for instance) the simplified audio phase-shift network of Fig. 15 instead of the specified commercial PSN.

Note that both the phasing and filter exciters described here provide only minute amounts of power. Most of them can perform nicely when connected directly to an antenna—but none of them will be rock-crushers used barefoot. How to get more power? Hook in a linear—and that's the subject of the next installment!

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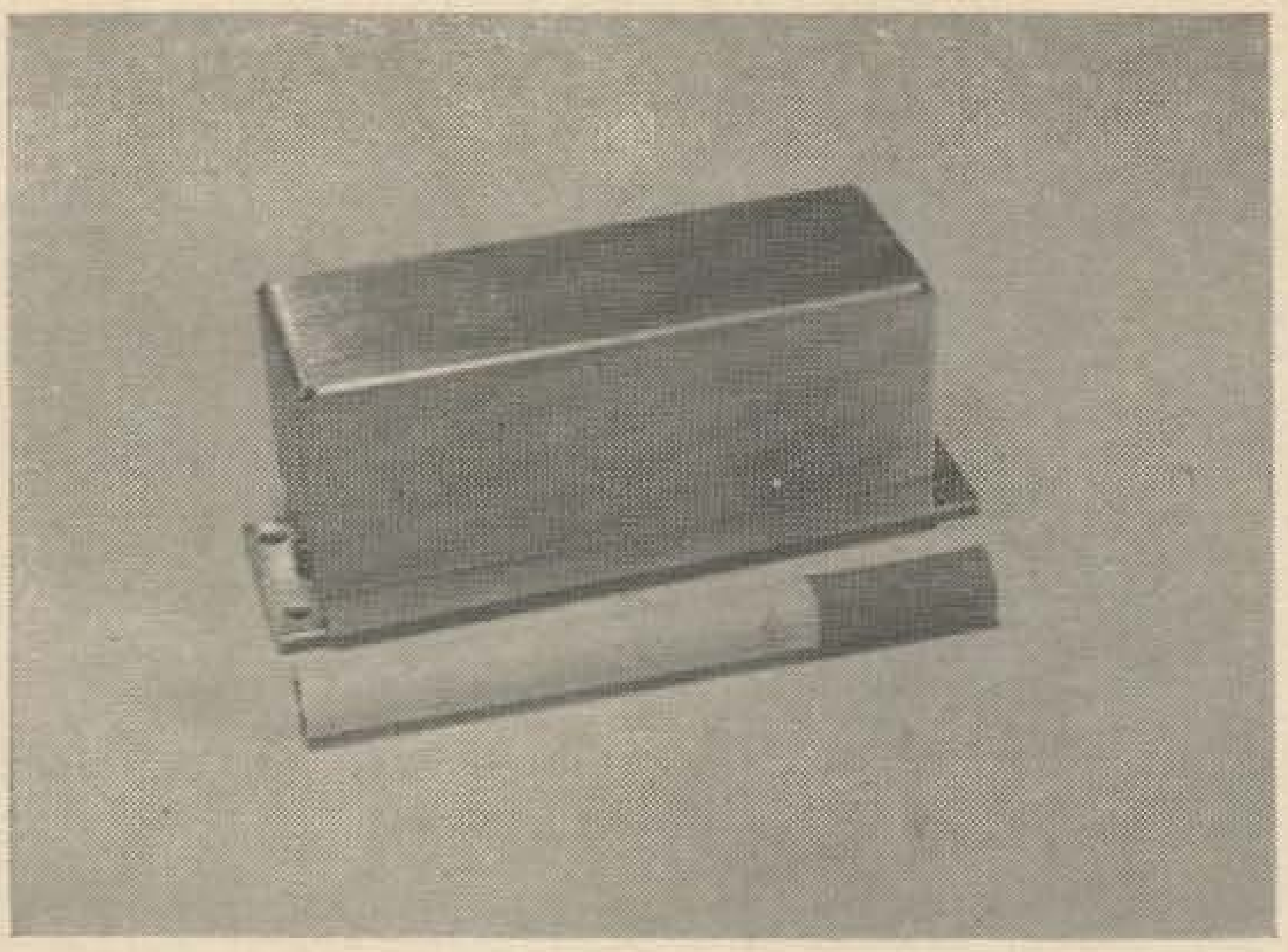

B. E. Harris W6ANU/4
444 Pine St.
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DC Transformers

Since the very early days of radio there has been a demand for equipment to transform an available source of dc power to a different voltage level. In the past, rotating machinery was used almost exclusively for this purpose. The vibrator has taken first place for low power applications in more recent times. The vibrator by nature has a relatively low reliability, and the sparking contacts make it a first class noise generator. The amount of power which can be obtained from a low-voltage source is limited because of the need for large contacts to switch the high currents involved. The mass of the contacts limits the frequency to fairly low values and, hence, the power transformer which performs the actual voltage changing is comparable in size to 60 cycle power transformers. Efficiency is not high, especially at light loads, because a fair proportion of the input power is used just to move the vibrator contacts.

With the advent of semiconductor devices, it has become possible to build dc-to-dc converters which are simple, reliable and efficient.

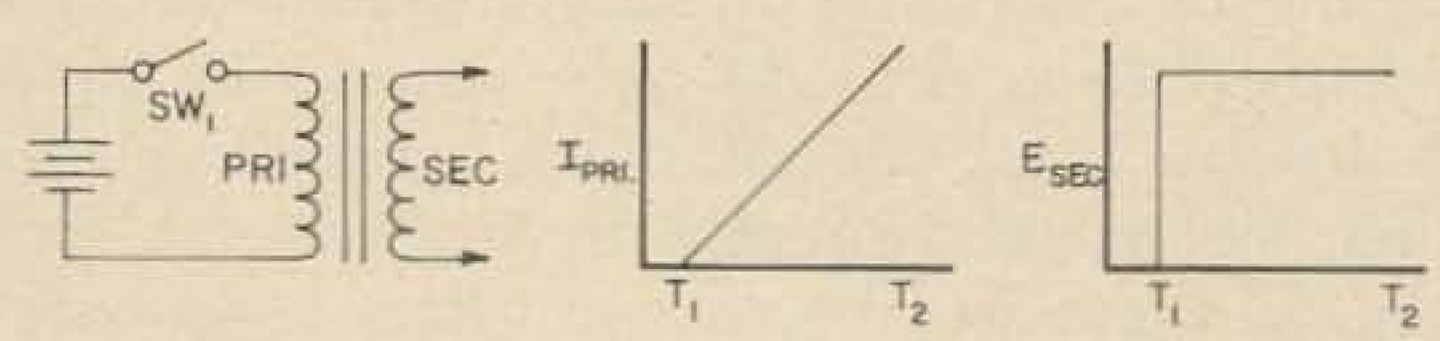

FIG. 1

T_1 - SW_1 CLOSES
T_1 TO T_2 - SMALL COMPARED TO TIME CONSTANT

They can be made to operate at input voltages of from one to fifty or more volts and there is essentially no limit on the output voltage. Power outputs can range from milliwatts up to a kilowatt or more. Overall efficiency and overall physical size including output filters are comparable to 60 cycle power transformers alone. Hence, the title of this article, "DC Transformers."

Applications

Numerous articles have been written on dc-to-dc converters suitable for supplying power at voltages of several hundred volts for the plate supply to mobile vacuum tube receivers and transmitters. There is an equally important application in power supplies for portable and mobile transistorized equipment. Transistor rf output stages can now be built to give power outputs up to 50 watts or more. In order to achieve these power levels, collector supplies of 25 to 50 volts are needed. Converters operating from 12 volt batteries can be used in mobile installations for supplying collector voltages of this magnitude. In hand-held portable transceivers a battery supply of 3 to 6 volts can operate the receiver and modulator stages very nicely. However, voltages of 15 to 20 are desirable for the rf output stage especially at power levels of a watt or more. Since battery costs are roughly proportional to the number of cells, a 3 to 6 volt battery is considerably more economical than a 15 to 20 volt battery. A converter can be

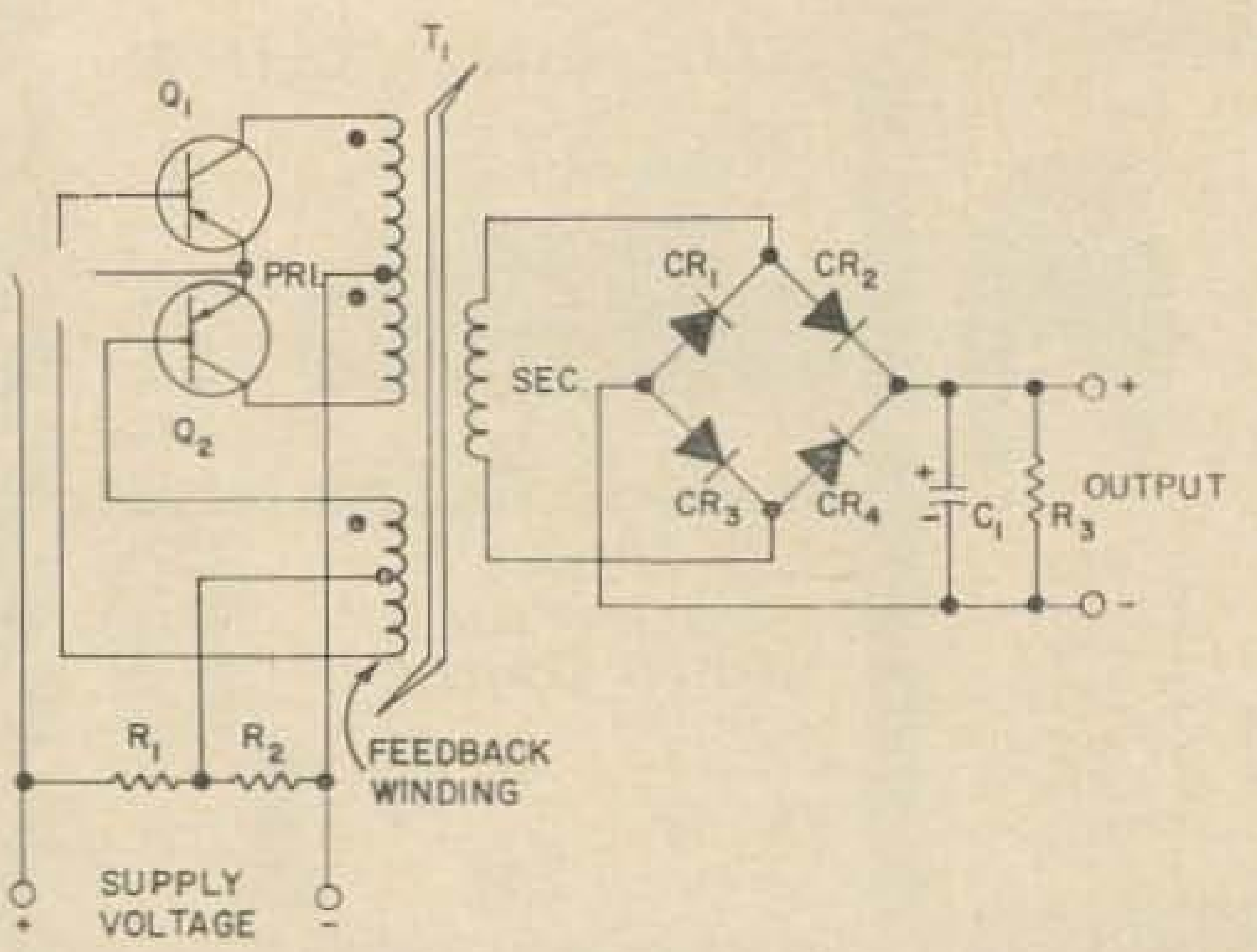

Fig. 2.

C_1—500 MFD 50 volt electrolytic

CR_1-CR_2-CR_3-CR_4—1N1219 Silicon rectifiers

Q_1-Q_2—Motorola 2N1544

R_1—3.3 Ω for 6 volt input, 6.8 Ω for 12 volt input. Both ½ watt

R_2—390 Ω for 6 volt input, 820 Ω for 12 volt input. Both ½ watt

R_3—3300 Ω for 25 volt output, 6800 Ω for 50 volt output. Both 1 watt

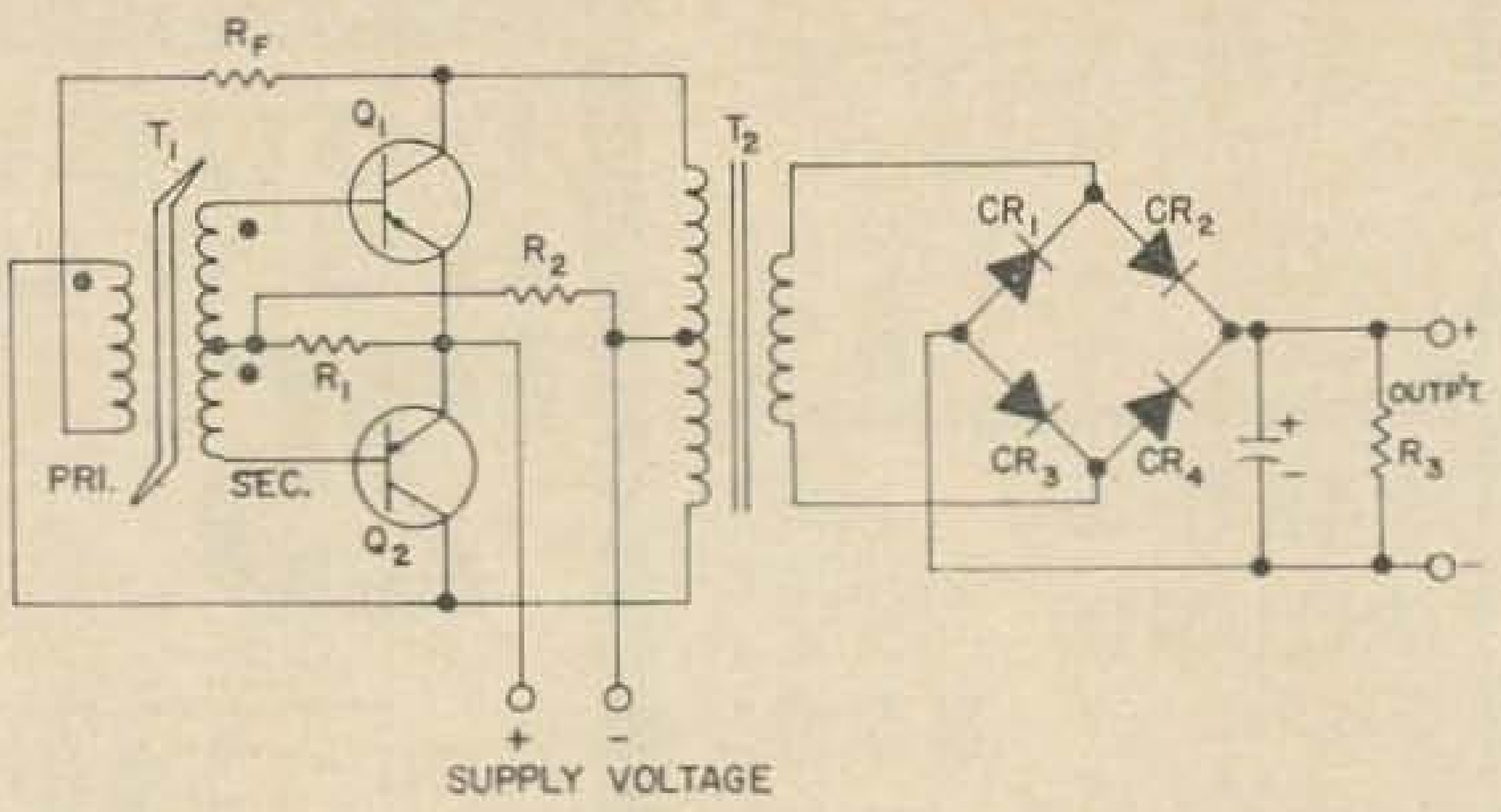

FIG. 3

C_1—100 MFD, 50 volt miniature electrolytic capacitor

CR_1-CR_2-CR_3-CR_4—1N645 miniature silicon diodes

Q_1-Q_2—RCA 2N1183 Transistors

R_1—22 Ω for 3 volt input, 47 Ω for 6 volt input, 270 Ω for 12 volt input. All ¼ w.

R_2—390 Ω for 6 volt input, 1800 Ω for 6 volt input, 6,800 Ω for 12 volt input. All ¼ w.

R_3—8200 Ω, ¼ watt

used to step up the battery voltage to 15 to 20 volts for the rf amplifier.

A third use for dc-to-dc converters is to provide opposite polarity voltages. Two voltage sources of opposite polarity are often desirable in transistor equipment but use of two separate batteries is inconvenient and uneconomical. Since the input and output of dc-to-dc converters can be completely isolated, they can be used to provide an opposite polarity source from a single battery.

Operating Principles

Before proceeding to a description of specific converter designs, it may be well to discuss some of the basic operating principles involved. Fig. 1(A) shows an iron core transformer, a battery and a switch. When the switch is closed, essentially the full battery voltage appears across the transformer primary. Because of the inductance of the primary, the current begins to increase at an essentially linear rate. This increase continues (not necessarily linearly) until the core either saturates or until the current is limited at some point below the saturation level by the coil resistance. During the time that the current is changing, a voltage is generated in the secondary. This voltage is constant during the time that the current is changing at a constant rate. Fig. 1(B) shows the current and voltage waveforms. If the battery polarity is reversed periodically at a rate such that steady state conditions are not reached between reversals, then a square wave of voltage is generated in the secondary. This polarity reversal is the function performed by the vibrator in a vibrator converter. In order to substitute transistors for the vibrator, the circuit of Fig. 2 is used. The primary is now divided into two sections by a center-tap and a third winding is added to provide drive voltage for the transistors. The symbol for the transformer core indicates that it is made of a material having a square hysteresis loop. In other words, it changes rapidly from the unsaturated to the saturated condition when the core flux reaches a specific level.

The transistors in this circuit operate as switches and here lies the explanation for the large power handling capability of even relatively small transistors. When the base is heavily forward biased, (base negative with

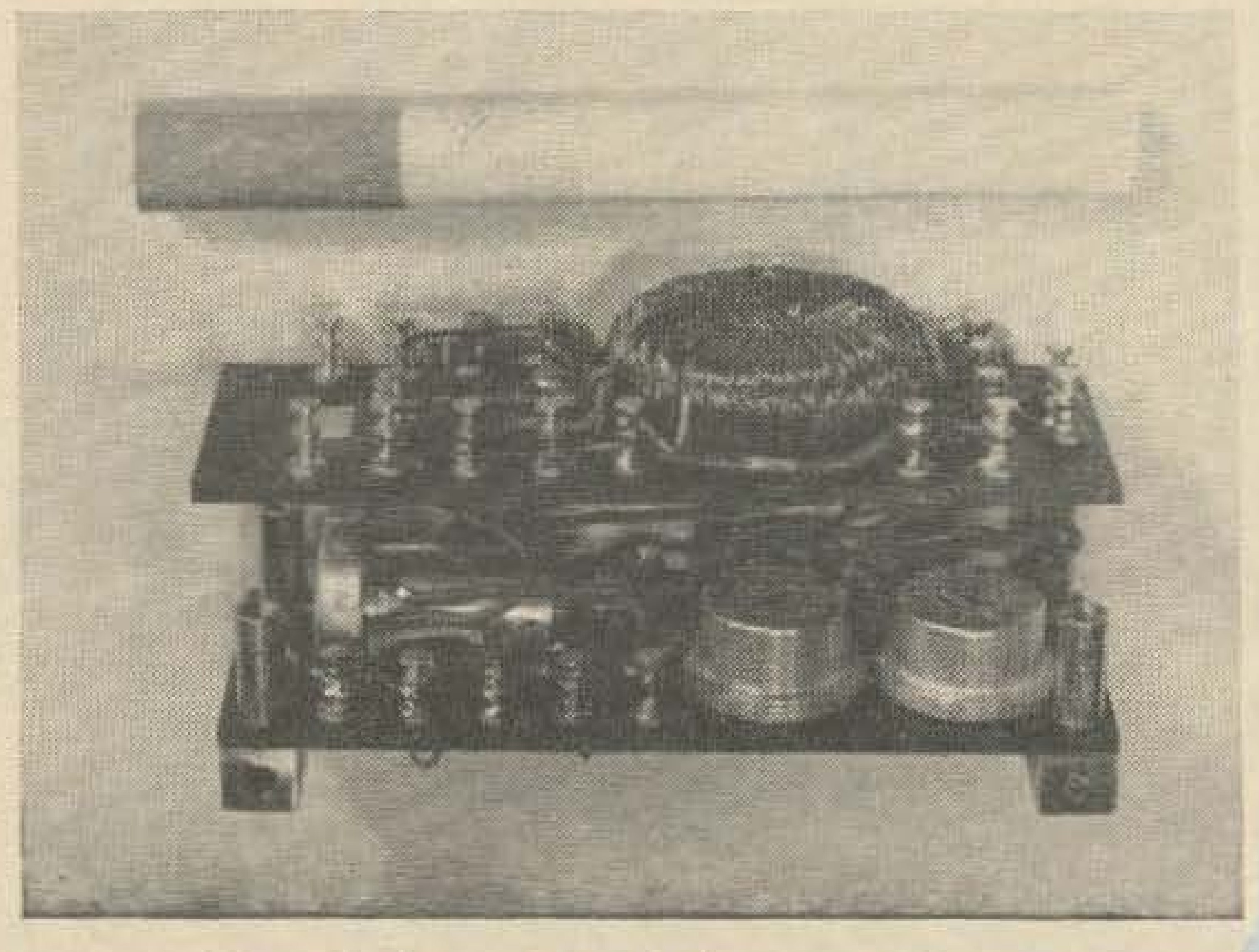

Fig. 4. Interior of dc transformer.

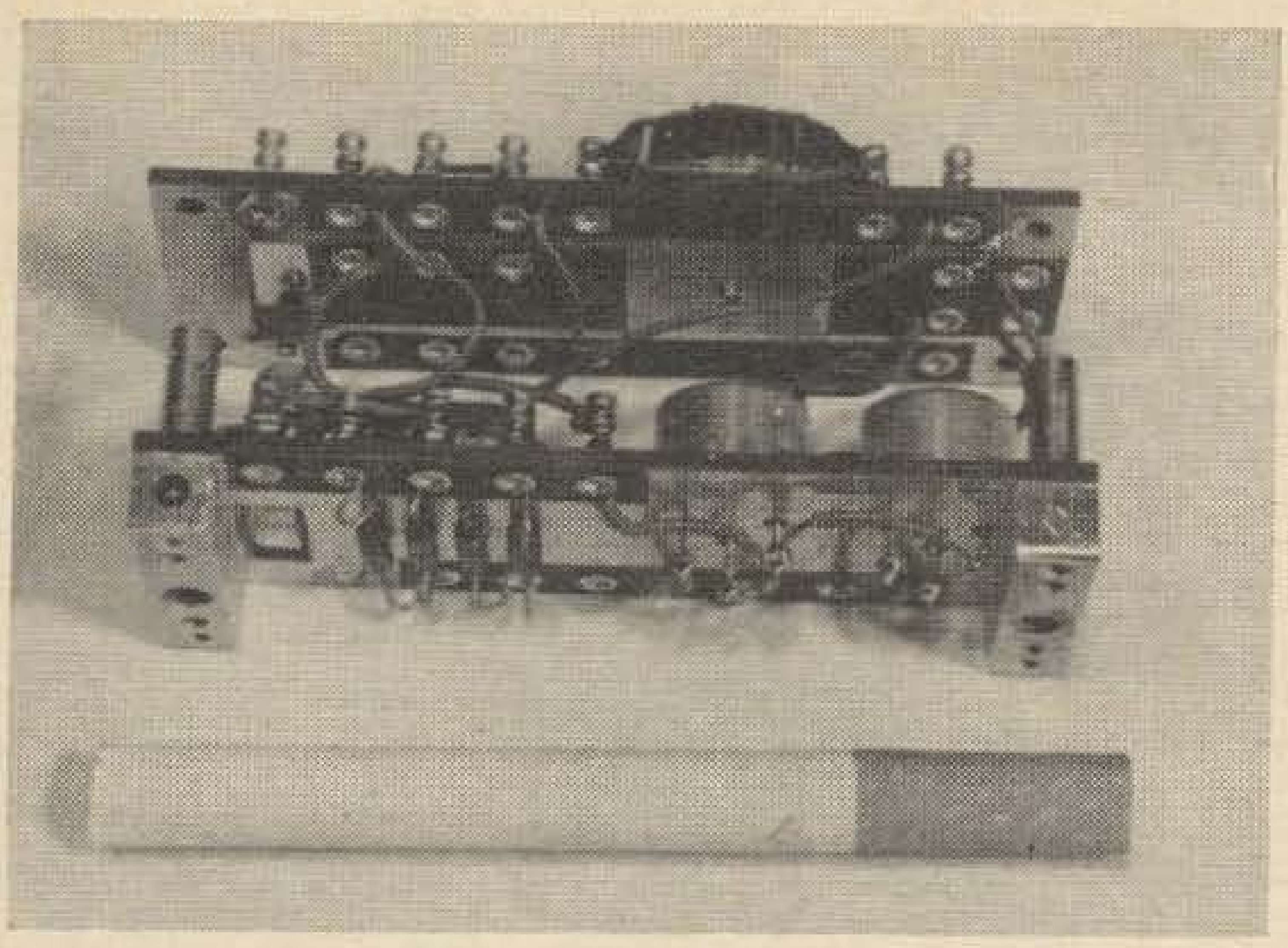

Fig. 5.

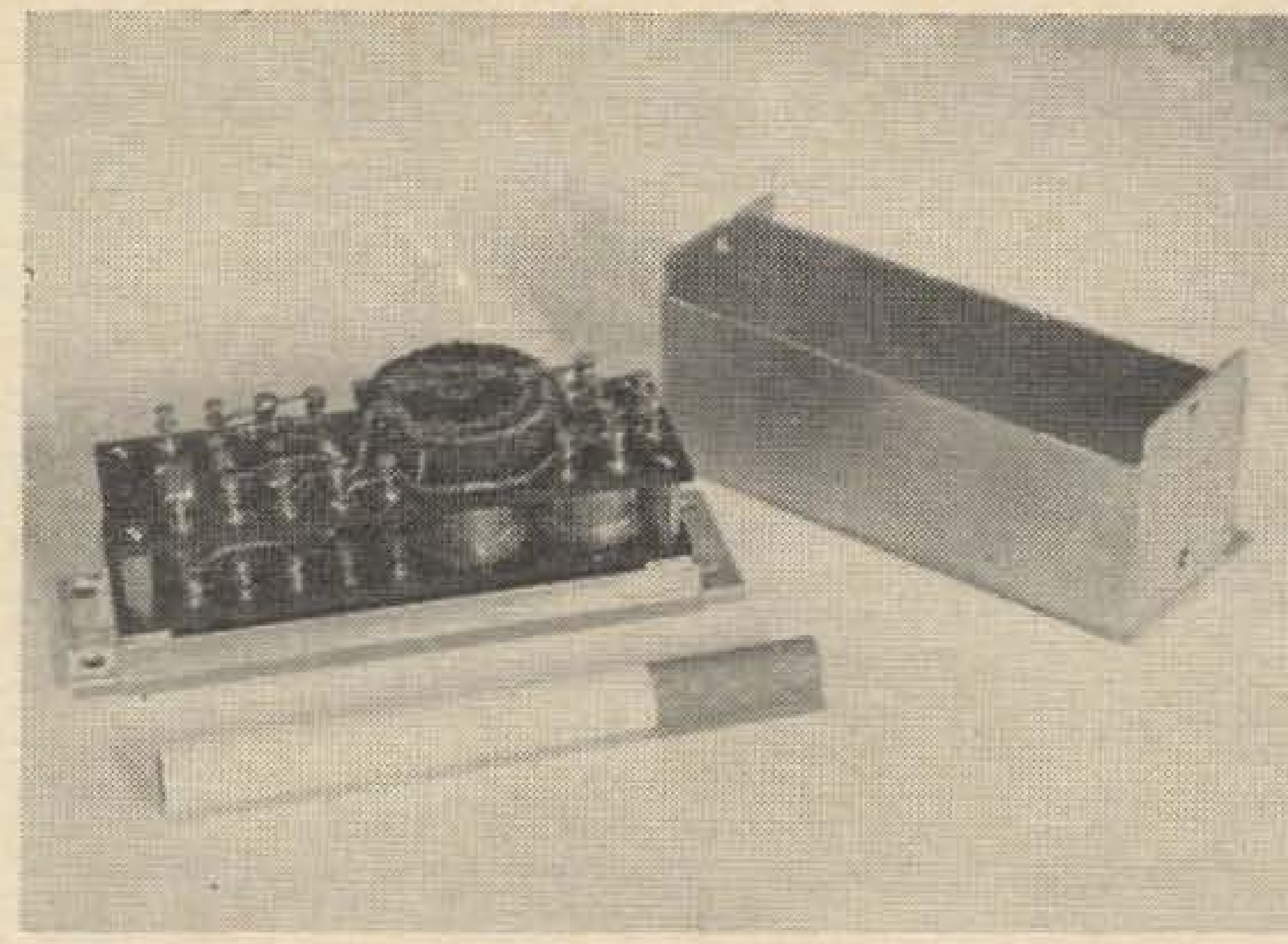

Fig. 6.

respect to emitter for PNP transistors) the transistor is switched on and the voltage between the emitter and collector is about 0.25 volts. In this condition, the collector dissipation is low ($0.25 \times I_c$) even though I_c (collector current) may be quite large. When the base is reverse biased, the transistor is switched off and the collector current is essentially zero. It is only during the transition period between on and off and vice versa that the dissipation is significant. If transistors are selected with frequency cutoff values ten or more times the maximum converter operating frequency, the transition time is small compared to the on and off times and the total dissipation is low. For this reason transistors used in converters can handle about ten times their normal Class A power rating. They must, however, have collector current ratings equal to or greater than the maximum input current. The current rating is the limiting condition for converters designed for very low input voltages.

The operation of the circuit of Fig. 2 is quite easy to visualize. When power is applied, resistor R_2 supplies a small initial forward bias to the bases of Q_1 and Q_2. This causes them to draw collector current through the primary windings of T_1. Small differences in Q_1 and Q_2 cause one or the other (let us assume Q_1) to draw slightly more current. The phasing of the feedback winding is such that current flow in the Q_1 half of the primary biases Q_1 on and Q_2 off. Q_1 is thus turned rapidly full on and Q_2 is turned full off. The current in the Q_1 half of the primary then increases until the transformer saturates. When the core saturates, the coupling between the windings is essentially zero and the bias on the bases from the feedback winding is removed. This turns Q_1 off and the flux in he transformer core begins to decay. This lecaying flux generates a voltage in the feedback winding of opposite polarity and Q_2 is thus turned on and Q_1 held off. The current through the Q_2 half of the primary then increases until the core is saturated in the opposite direction and the oscillatory action proceeds at a rate determined largely by the applied voltage and the primary inductance. The voltage across the total primary is twice the supply voltage minus twice the voltage drop between transistor collector and emitter in the on condition. In other words, about one-half volt less than twice the input voltage. Q_1 and Q_2 must have a voltage rating (collector to emitter) of twice the supply voltage plus a safety factor of about 25% to protect against the voltage spikes generated by core saturation. The feedback winding is arranged to supply a somewhat larger voltage than required and resistor R_1 is selected to drop this voltage to a value just sufficient to turn Q_1 and Q_2 fully on under maximum load.

The secondary voltage is a square wave equal to twice the supply voltage (minus about 0.5 volt) times the turns ratio (secondary to total primary). Silicon diodes CR_1 through CR_4 rectify this square wave and C_1 filters out the small switching transients. The frequency is usually selected to be in the vicinity of one kilocycle and C_1 need not be very large in order to provide sufficient filtering at this frequency. C_1 serves an additional purpose, however, in that it prevents stopping of the oscillator by momentary overloads. R_3 is selected to draw a very small current (one to a few milliamperes) which is all that is needed to prevent C_1 from charging up to the peak of the spikes present on the secondary voltage. The regulation is very good up to the maximum load because of the square wave input to the rectifier. The output dc voltage is equal to the secondary voltage minus the rectifier drop of one to two volts. The converter is not harmed by shorting the output. When the output is shorted, the feedback voltage drops and the converter stops oscillating. The input current drops to a low value under this condition.

The circuit of Fig. 2 is suitable for output powers up to 50 to 100 watts. Above this power level the circuit of Fig. 3 is more economical because only T_1 need have a core made of the more expensive square hysteresis loop material. T_2 is designed like a conventional power transformer in that the core does not saturate under any operating condition. The primary of T_1 and resistor R_f are proportioned so that the core of T_1 saturates and oscillation takes place in a manner similar to that described for the circuit of Fig. 2.

Typical DC-to-DC Converters

Figs. 4, 5, and 6 are photographs of a converter designed to supply 100 milliamperes at 20 volts or 200 milliamperes at ten volts from either a 3 volt or a 6 volt battery supply. It will also operate from a 12 volt supply and under this condition the output is 20 volts at 250 milliamperes or 40 volts at 125 milliamperes. The circuit is as shown in Fig. 2 except that the transformer has multiple primary and secondary windings in order to provide for the different input and output voltages. Fig. 7 is a schematic of the transformer construction and also gives component values for the circuit of Fig. 2. Full load efficiency ranges between 75% and 85% depending on which taps are in use. Frequency is nominally 1500 cycles at three or six volts input and 3000 cycles at 12 volts input. Exclusive of the mounting flanges on the baseplate, the converter occupies a volume of 3.9 cubic inches. The modular construction matches other units of a one watt output ten meter transceiver.

Fig. 8 is a photograph of a transformer designed to put out 40 watts at 12, 25 or 50 volts from either a 6 or 12 volt input supply. Fig. 9 is a schematic drawing of this transformer giving component information for the circuit

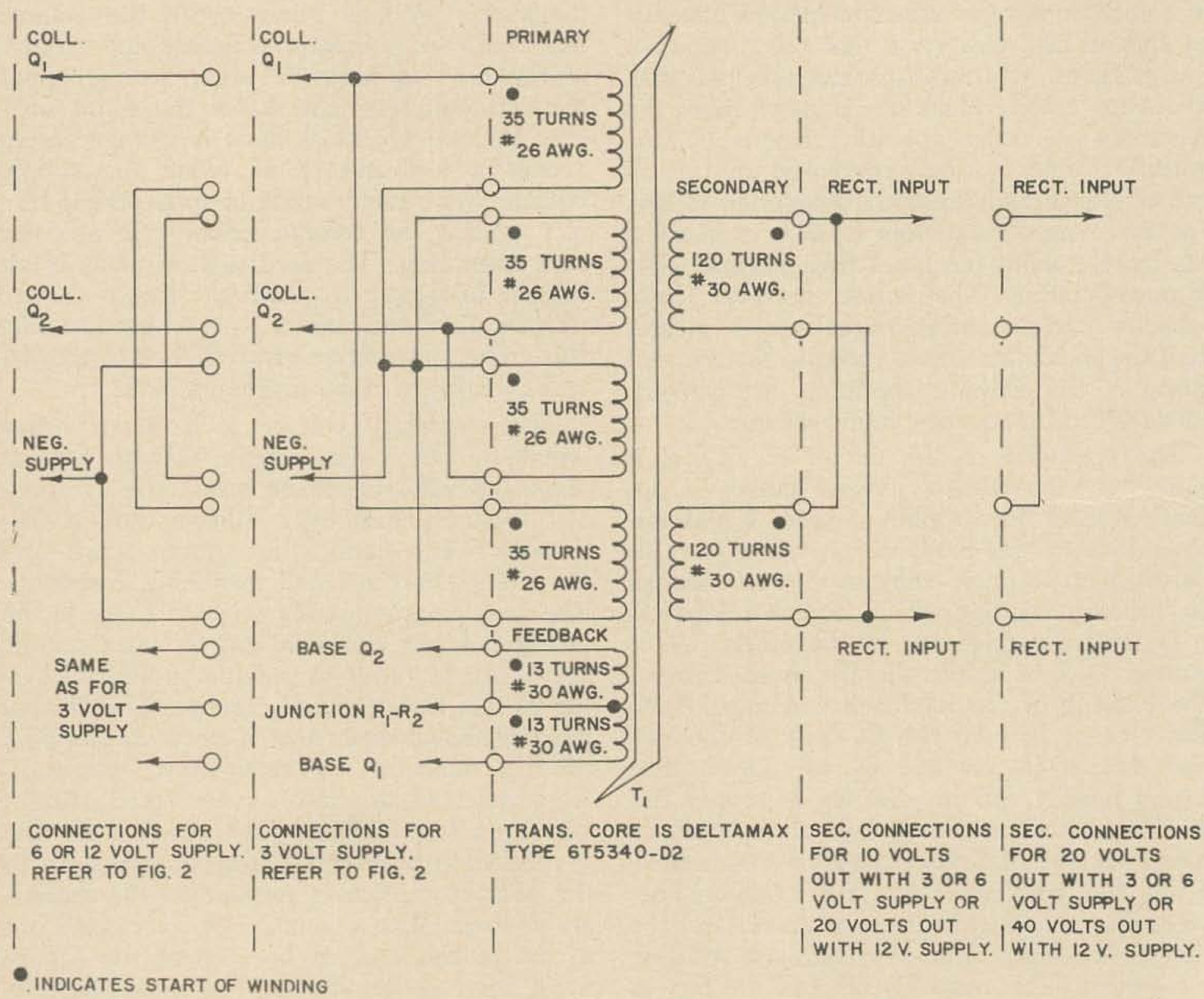

Fig. 7. Construction and connections for transformer used in dc to dc converter shown in photographs (Fig. 4, 5 & 6). Component values and connections refer to the circuit shown in Fig. 2.

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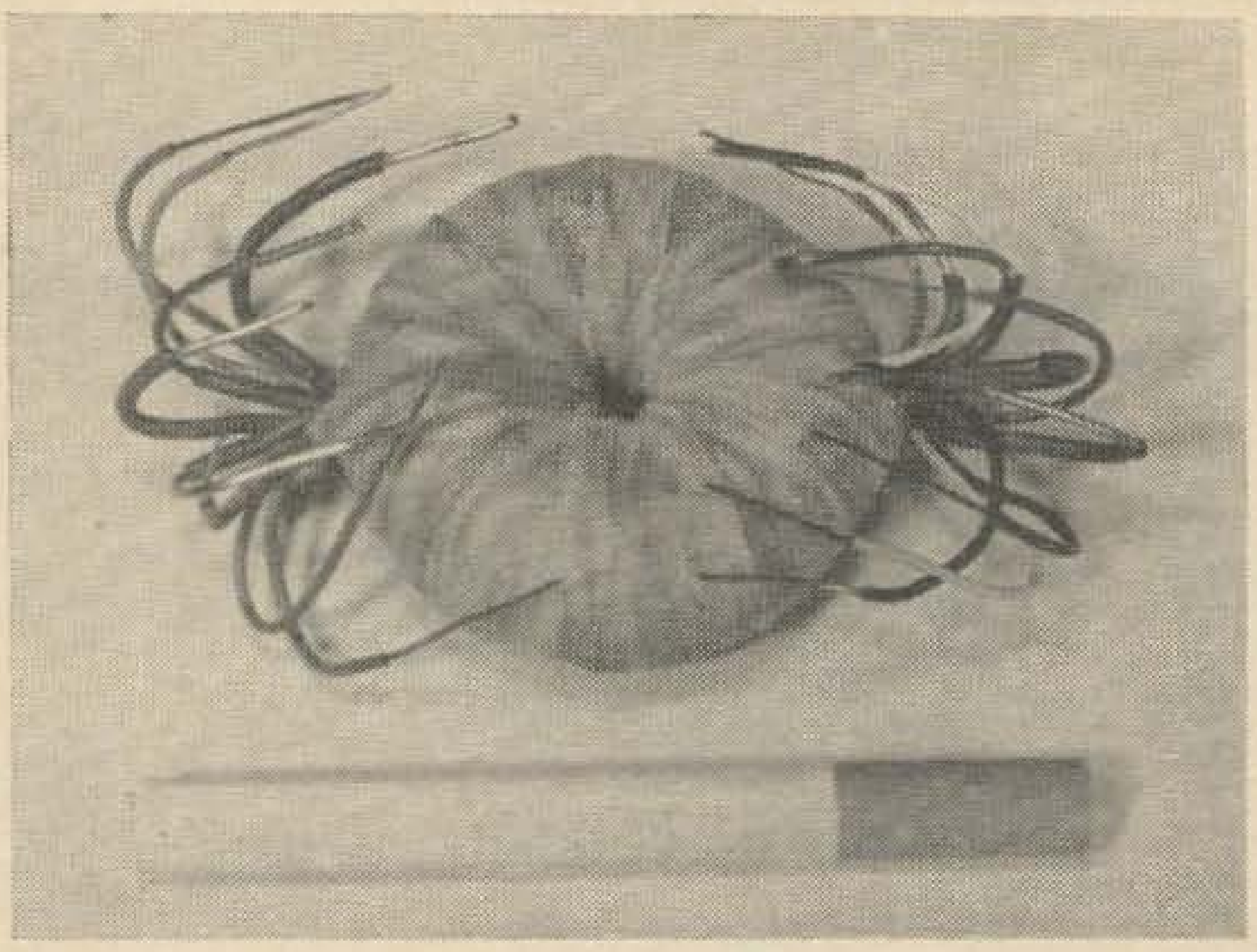


Fig. 8. Typical transformer.

of Fig. 2. The finished power supply including a 500 mfd, 50 volt output filter occupies a volume of 25 cubic inches. This unit is suitable as a power supply for a forty watt input mobile final amplifier using 2N1907 transistors.

Transformer Design

The most important component in these converters is the saturating core transformer (T_1). The core material is a grain-oriented alloy of nickel and iron. Grain-orientation is achieved by heavy cold rolling of the material into thin strip. The usual strip thickness for frequencies up to 2000 cycles is 2 mils. One mil material has lower losses at high frequencies and is used at frequencies above 2000 cycles. These thin materials are only practical when wound in continuous strip toroidal cores although six mil thick material can be obtained in the form of U shaped laminations. The material is strain sensitive and the finished cores are encased in aluminum, plastic, or epoxy coated aluminum cases to protect them from the strain from the windings. Complete, cased toroidal cores are available from a number of manufacturers. Two of the better known trade names for the material are Deltamax and Orthonol.[1]

Toroidal transformers are not difficult to wind by hand since relatively few turns are required. In order to understand the simple calculations involved, it is desirable to become familiar with some of the magnetic core terminology:

B—Magnetic induction or flux density per unit area measured perpendicular to the direction of the flux. In the CGS system of units, the unit of area is the square centimeter and the unit of magnetic induction is the gauss.

B_s—Magnetic induction per unit area at the core saturation level. This is the induction level at which a further increase in magnetizing force (current through the coil) does not produce a corresponding increase in induction.

ϕ—The magnetic flux existing in a given medium. The unit of measurement in the CGS system of units is the maxwell. Numerically equal to 2B or $2B_s$ times the effective cross-sectional area (A_{cnet}) of the core in square centimeters. The factor of 2 is present because ϕ is measured from the peak induction in one direction through zero to the peak induction in the other direction whereas B and B_s are measured from zero in one direction only.

A_c—Gross cross-sectional core area. For use with B_s and ϕ (CGS system), A_c should be measured in square centimeters.

A_{cnet}—A_c multiplied by a stacking factor which allows for the space between laminations (or turns of tape in toroidal cores). For 2 mil thick tape-wound cores, the stacking factor is usually 0.8. For one mil tape, it is 0.7.

Window Area—The area of the center opening in toroidal cores. Usually given in circular mils since this facilitates calculation of wire capacity. Area in circular mils is equal to 1.27×10^6 times the window area in square inches.

Winding Factor—The factor by which the window area must be multiplied in order to determine wire capacity. It allows for insulation between windings, space between wire turns, and the necessary residual hole left after the winding is completed. It is numerically equal to the total wire cross sectional-area including insulation divided by the window area with both areas given in circular mils. For machine-wound toroidal transformers, the winding factor varies between 0.2 and 0.4. The smaller number applies to the smaller cores and larger wire sizes. It is possible to achieve winding factors above 0.5 with hand winding and use of progressively smaller shuttles to carry the wire through the core window.

As a starting point for the transformer design, the desired wattage output and the nominal input and output voltages should be selected. Assume 80% efficiency and the input wattage is then:

[1] Deltamax cores are manufactured by the Arnold Engineering Company, Marengo, Illinois. Orthonol cores are manufactured by Magnetics, Inc., Butler, Pennsylvania.

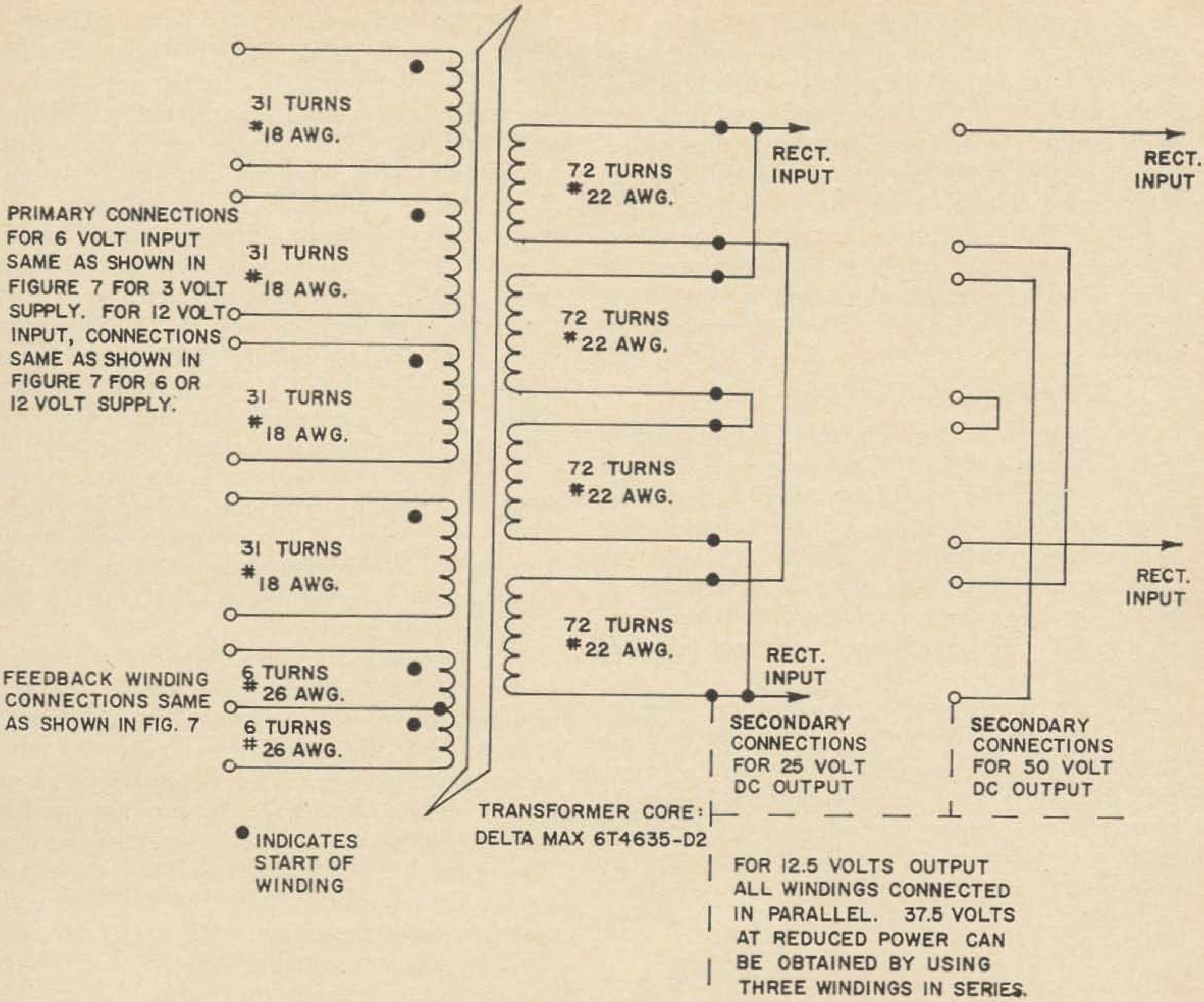


FIG. 9

Fig. 9. Construction and connections for 40 watt converter transformer shown in Fig. 8. Component values and connections refer to the circuit of Fig. 2.

$$\text{Input watts} = \frac{\text{Output watts}}{0.8}$$

The input current is then found from:

$$I_{in} = \frac{\text{Input watts}}{E_{in}}$$

E_{in} is the lowest supply voltage expected minus 0.25 volts to allow for the voltage drop in the on transistor.

The primary wire size is then selected based on 500 circular mils per ampere. 500 circular mils is used instead of the usual 1000 because the primary halves draw current on alternate half-cycles. The secondary wire size is selected based on 1000 circular mils per ampere after the output current has been determined from the relationship:

$$I_{out} = \frac{\text{Output Watts}}{E_{out}}$$

A standard core size is then selected from the manufacturer's catalog. The net core area (A_{cnet}) in square centimeters is determined from the catalog and ϕ is calculated from:

$$\phi = 2\, B_s\, A_{c\ net}$$

($B_s = 14{,}500$ gausses for the core materials mentioned above)

The number of primary turns is then calculated from:

$$\text{Turns } (\tfrac{1}{2} \text{ pri}) = \frac{E_{in}}{2\,\phi\, f \times 10^{-8}}$$

(In this equation, f should not be more than one-tenth of the transistor cutoff frequency or more than 2000 cycles for 2 mil thick core material. 1200 cycles is a good nominal value)

The transformer turns-per-volt is then calculated from:

$$\text{Turns-per-volt} = \frac{E_{in}}{\text{Turns } (\tfrac{1}{2} \text{ pri})}$$

The secondary voltage should be about two volts greater than the desired dc output voltage to allow for rectifier drop. An additional increase of 3% to 5% in secondary voltage will compensate for resistance drop in the windings if it is essential that the nominal dc output voltage be available at the minimum input voltage (E_{in}). Because the secondary waveform is a square wave, it is unnecessary to allow for the usual drop caused by rectifying a sine wave. Secondary turns are determined from:

Turns (sec) = E_{sec} x Turns-per-volt

The number of turns in the feedback winding is determined in the same way. Each half of the feedback winding should have an output voltage of from 1.5 to 2.0 volts for germanium transistors or 2.5 to 3.0 volts for silicon transistors. The wire size can be as small as convenient providing that the area in circular mils is at least one-tenth that of the primary wire.

Next, it is necessary to determine whether all these turns of wire can be fitted into the window of the core that was selected. For this purpose it is necessary to know the cross-sectional area (including insulation) of each size of wire to be used. This can be determined from a wire table or calculated from the overall wire diameter. The total wire area is then:

Total wire area = (Turns, pri. × Wire area, pri) + (Turns, sec. x Wire area, sec)
(The feedback winding occupies so little space that it can be neglected in this calculation)

The total wire area in circular mils as determined above should then be divided by the core window area in circular mils. The result is the winding factor. If it is between 0.3 and 0.4 the windings should go on with ease. It is possible to make it if the winding factor is as high as 0.55 but don't count on it. If the winding factor is too large, select another core with a larger window or a larger cross-sectional area or both and perform the above calculations again. Similarly, if the winding factor is below 0.2, a smaller core should be selected. Winding factors this small mean that an unnecessarily large and expensive core has been selected. Also, the efficiency is lowered if too much space is wasted.

Transformer Construction

The two halves of the primary winding should be tightly coupled. This can be achieved either by bifilar winding or by multiple layer winding with the layers connected in an interleaved arrangement. The larger wire sizes (No. 14 and above) are difficult to wind on small cores. Two or more windings in parallel of equivalent circular mil area can be used to get around this difficulty. This procedure of parallel windings can also be used to achieve tight coupling and the capability of accepting different input voltages. The transformers shown in Figs. 7 and 9 are examples of the procedure. The primaries in these transformers consist of four sections with the same number of turns in each section. Each section occupies half of the core circumference and this, of course, results in two layers. When connected for the lower input voltage, the primary section occupying the first layer of one half-circumference is connected in parallel with the section occupying the second layer of the opposite half-circumference. For the higher input voltage, the same arrangement is used except that the sections are connected in series.

The feedback winding should be arranged so that it has uniform coupling to the total primary. This can be achieved by spacing the turns so that the winding occupies the entire core circumference. The secondary can be wound either in sections to provide multiple output voltages or as one continuous winding. The order in which the windings are placed on the core is not critical, but it is generally easier to wind the larger wire sizes first. Since the transformers usually step-up the voltage, this means that the primary should be wound first.

Windings with very few turns can be put on simply by cutting the required length of wire and threading the free end of the wire through the window for each turn. Longer lengths of wire are not too manageable when handled in this way and it is better to make a shuttle out of a strip of thin wood or plastic by filing notches in the ends of the strip. The required length of wire is then wound on the shuttle and the shuttle threaded through the window for each turn. The length of wire required can be determined by making a rough measurement of the average length of each turn with a piece of scrap wire and multiplying this by the number of turns.

Even with machine winding, toroidal transformer coils inevitably become scramble wound after the first layer, so heavy formvar or nylon insulated wire should be used to prevent shorts. Insulation between windings is not essential but it does facilitate keeping track of the number of turns. Acetate tape is best for insulation providing that very thin tape is used.

. . . W6ANU/

John W. Myrna WA2QZH
222 Franklin Avenue
Wyckoff, N. J., 07481

Getting the Most from Your Two'er

Back in April of 1961, when my Novice License was but two months old and a newly earned 15 wpm C.P. Certificate graced my wall, the fone bug bit me. Upon the recommendation of WA2SAB, who worked nine states with one, I bought a Heathkit Two'er.

One of the first problems that came up after the rig was put together, other than some debugging that I'll mention later, was the inaccessibility of the crystal socket. Taking off the case every time I wanted to change frequency just took too much time so down I went to my workshop for a hacksaw and drill. I hate to disfigure equipment so I decided to do a neat job. The license holder on the side of the Two'er is held on by three or four rivets and if a screwdriver is wedged between the license holder and the main case a little leverage will "pop" the holder off.

After removing the license holder, flatten it to its former shape if it is bent in the operation, and set it aside. With a hacksaw or saber saw cut the unpainted area exposed by the removal of the license holder. Be sure to leave a ¾ inch border on the bottom so the hole you cut remains above the chassis.

Now trot down to the hardware store and buy four inches of piano hinge. Attach ½ the hinge to the top of the license holder, after drilling suitable holes, and attach the other half of the hinge to the case through the lowest set of air holes above the hole cut in the side of the case. I typed up a little plate giving my name, address, call, etc. and put it in the license holder thus identifying who owns the rig and at the same time covering up the rivet holes. With the trap door I can now change crystals, final tubes, and adjust the transmitter stages. It's also a handy place to tape a couple of spare fuses.

The only transmitter control that needs frequent adjustment is the plate tuning capacitor (C16) which is just below the chassis. Drill a hole in the case over the capacitor and install a rubber grommet in the hole. In this way you can adjust the transmitter tuning with a small screwdriver. CAUTION: There are 150-200 volts on that capacitor so don't touch the metal part of the screwdriver and ground or you'll get a nice little shock. The grommet will prevent the screwdriver from shorting against the case. You'll find that the "trap door" will cover the grommet hole and the crystal hole making a neat job.

When tuning up the transmitter an output meter is essential. A meter mounted on the front panel is more convenient than one plugged in the back, especially when mobiling. Any meter with a sensitive movement will do, but if O- 1ma movement is used, the S-Meter circuit used in the July 61 issue of 73 can be incorporated with the output circuit.

The best place to put the meter is in the space now occupied by the Heathkit emblem. Center the meter hole in the clear space there and cut away. A masonite hole cutter will go through the aluminum front panel like it was cheese, by the way. Connect the meter through a variable resistor to meter jack Z. See Fig. 1. The pot can be taped to the back of the meter and used to "set" the meter. Run the ground lead from the meter to the ground lug on the neon light terminal strip just below it and you're all set.

One possible cause of feedback in the

Two'er is the long lead between the modulation transformer and final. Replacing this lead from terminal strip N1 to strip S4 with shielded cable cleared up the feedback problem for WA2FFB and K2GHU, it could for you, too.

The screwdriver adjustment on the regen control was a bother so I replaced the pot with one with a small knob.

The phone plug used for an antenna jack is fine for base station use, but if you do any mobiling you'll find that the antenna cable keeps pulling out of the phone jack. The best connector to replace the phono jack is the Dow-Key Model DK60-P panel mounting coax connector. All you have to do is enlarge the old antenna jack hole and screw the new Dow connector in.

If you switch between mobile and fixed station use a lot, the chore of changing fuses can trip you. Forget to place a 8 amp mobile fuse in and the 1½ amp ac one will blow. Forget to put back the 1½ amp fuse when you take the rig out of the mobile car and you lose your fusing protection. WA2WZP got around this by putting a fused line plug on the ac cable and leaving the mobile 8 amp fuse in the Two'er. This way the proper fuse is always in the rig whether the ac or mobile cables are used.

If you desire to make the Two'er transmitting audio even better you can use this modification that worked wonders on WA2UCG and WA2WZP's Two'ers. Remove pin 3 of V1B (12AX7) from ground and connect a 680 ohm resistor and .01 mfd capacitor between it (pin 3) and ground. See Fig. 2. Remove the .001 mfd capacitor (C41) from pin 2 and ground and replace the 10 megohm resistor from pin 2 to ground (R26) with a 1.2 megohm resistor. The audio really sounds great efter this simple revamping.

When I'm asked how the Two'er works I always say that the transmitter is a dream and the receiver is a nightmare. While the receiver isn't quite that bad, the broadness of the superregen circuit does make for interesting contacts when the ham down the street comes on with his 200 watts and a whole megacycle of band disappears. To make the

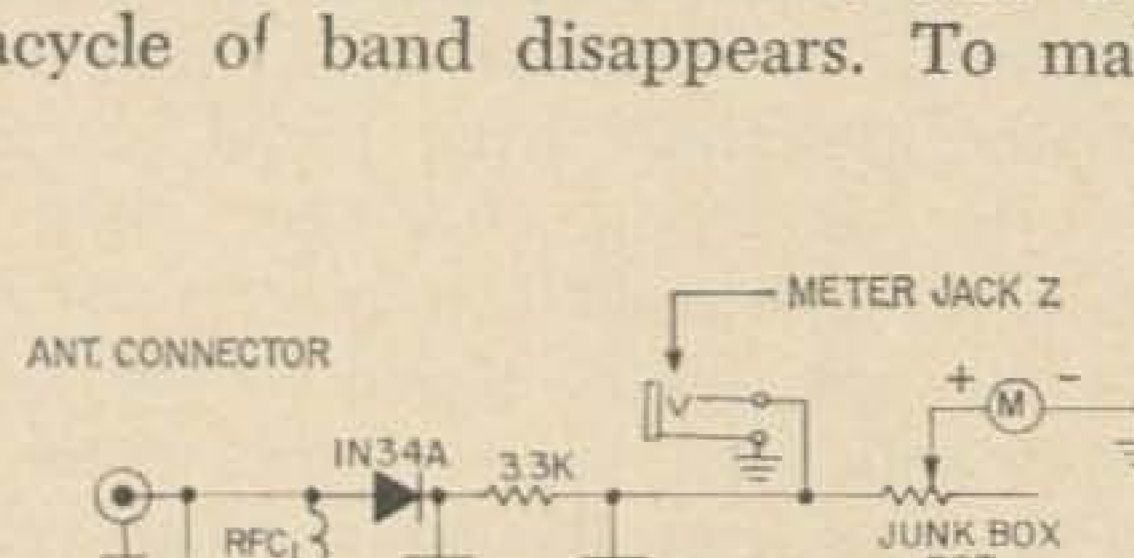


Fig. 1. Addition of tuning meter.

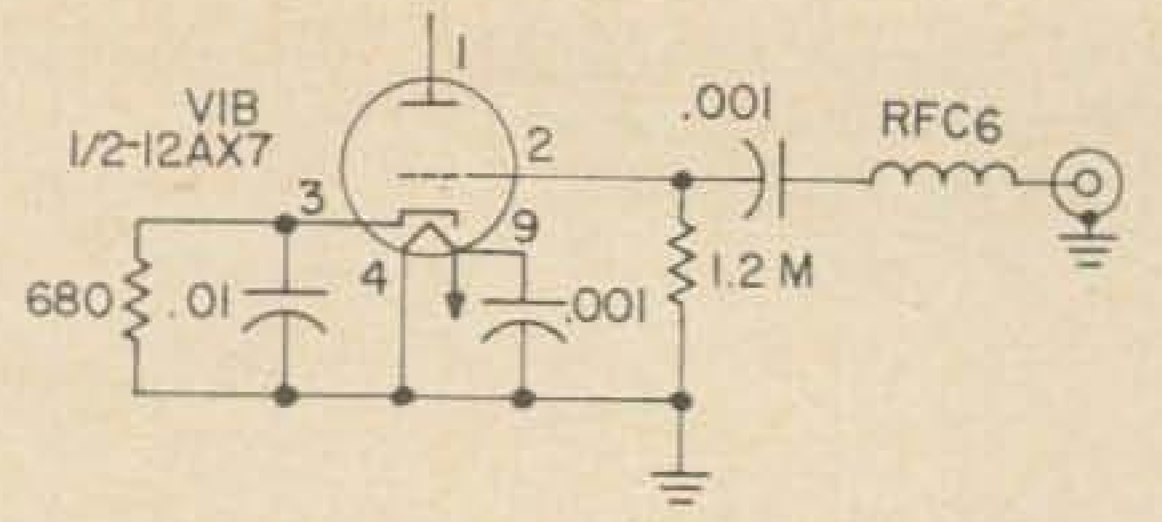


Fig. 2. Audio changes.

receiver more selective, change R10 to about 32 megohms. WN2HQE dug up the modification when he was borrowing my rig and "jerried" it in with four resistors that gave the best results. The precise value will be different for each rig but in all cases L6 will have to be retuned because the resistor(s) will change the calibration. Better yet see the June '63 issue of 73 for a fantastic improvement. You'll need a vernier after this one!

If you have a base receiver the next step in improving your two meter setup would logically be the building or buying of a converter. I've always had one switch operation and the Two'er/converter set up was no exception. One switch operation boils down to having the Two'er TR control operate a relay that changes the antenna from Two'er to converter and mutes the receiver. If contracts 2 and 3 of the Two'er's TR switch were used to activate a TPDT relay the problem would be solved.

With just a little planning, and one terminal strip, changing between using the Two'er barefoot or with a converter can be simplicity itself. Screw a 5 lug terminal strip under the mounting screw of tube socket V4 so that the strip faces the center of the chassis. Clip the lead going from contact 2 of the TR switch to the red neon light and attach it to lug 5. Clip the lead going from contact 3 of the TR switch to the power neon light and attach it, after adding a jumper wire to lug 1 of the erminal strip. Now trace out the wire going from contact 2 of the TR switch to the bottom of coil L2. Cut the wire so that there is enough lead to reach from contact 2 to lug 4 of the terminal strip. Wire a jumper on the other half of the wire and attach it to lug 5. Cut the wire going from contact 3 of the TR switch and the B+ so that the switch end will reach lug 2 and the B+ lead will reach lug 1 of the terminal strip. By using the original wiring you save the TR switch contacts from harmful resoldering. For normal transceiver operation connect lug 1 to lug 2 and lug 3 to lug 4. For a Two'er/converter combination connect the TR relay control wires to lug 2 and 4 while connecting a pair of switched contacts to lug 1 and 5. Wires to the relay can be brought out through the meter jack hole or, if you want a fancy job, the eight prong power plug can be exchanged with a ten prong one and the extra contacts used for the relay setup.

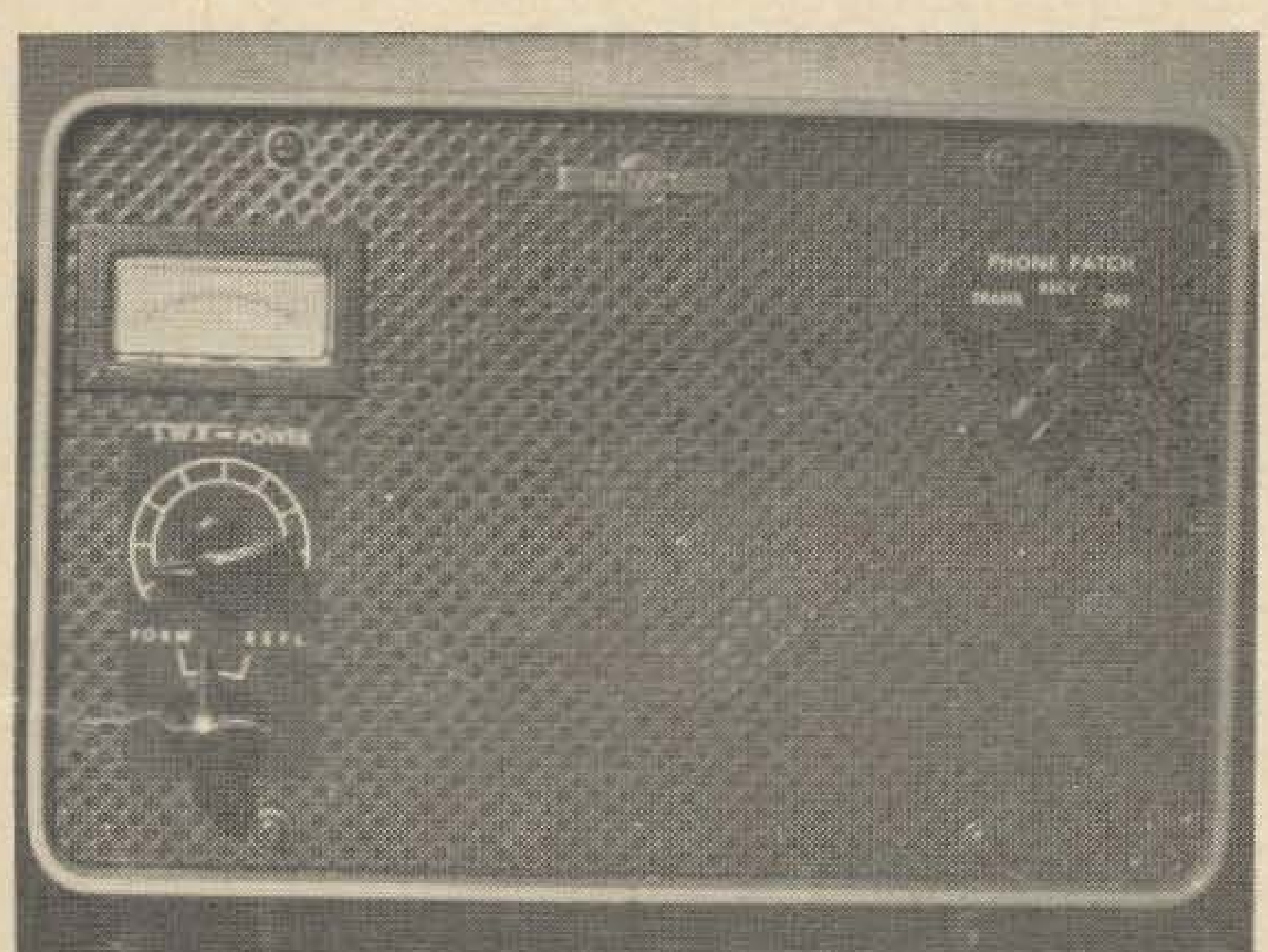
You could also connect a higher B+ relay, such as a surplus 100 volt job, between the plate of the 6BS8 and ground. With this set up the internally switched B+ would activate it. If you do so WA2WZP suggests you remove the 6BS8 for best results.

By the way, a perfect place to keep the Tower mike is under the handle of the top of the case. It keeps it safe from harm yet right at hand.

The Two'er has made two meters an easy to get on band. When you build the rig though, be sure to use a small soldering iron and small solder. I built the Two'er with a gun bigger than the case and had problems getting into the corners. The one bug that kept me from getting right on the air was a real dog. The one contact that Heathkit soldered to make sure it was done "right" was cold! So be sure to check everything if something goes wrong.

The Two'er is a nice little rig and with these changes it is a real pleasure to work with.

. . . WA2QZH



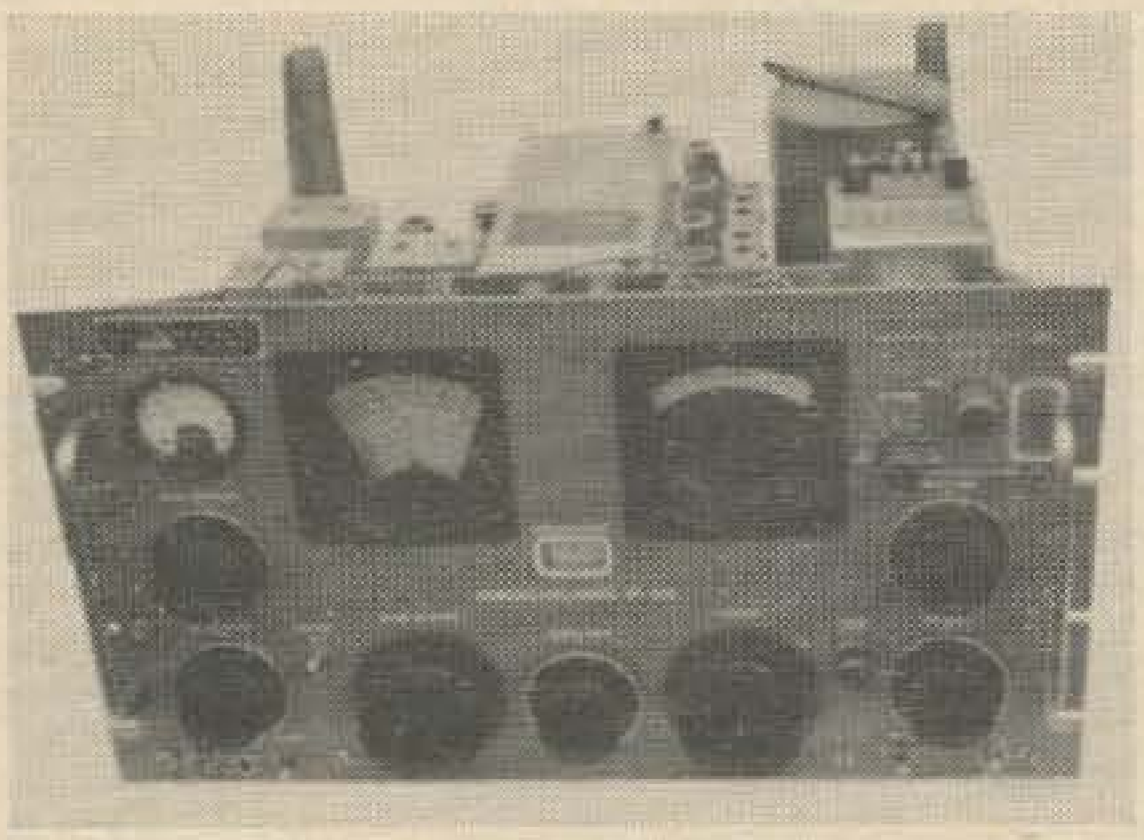
An SWR Bridge for the 32S-1

A false panel is set behind the perforated panel with a piece of black blotter between the two. The escutcheons are glued on the perforated panel with epoxy glue. On the right is a Knight SWR bridge. In the center is a 4" speaker. On the left is a Kwickpatch phone patch. Arrange the leads in the rear so the power pack can be removed without too much difficulty.

. . . W4NJF

SELECTRONICS

SUPER PRO RECEIVERS SP-600 JX & SP-600JX 17



For the first time SELECTRONICS is able to offer a superb receiver at a modest price. We agree these receivers are not cheap, however, they are one of the best available and, are in **excellent condition.** We have only a few to sell and they are all **unconditionally guaranteed.** Here are some of the Technical Spec.

Frequency range: 0.54 to 54 mc in 6 bands
Audio Power Output: 2.0 Watts @ 600 ohms
Power Required: 95 to 260V, 50-60 cycles at 130 Watts
Tubes: 20
Mechanical: Rack mounting 19"W X 10½H X 16½"D
Weight: 66 lbs.

Performance:

Sensitivity: 2.3 microvolts or better on all bands for S + N to N ratio of 10 db. (we checked one on 51 mc and its sensitivity was 1 microvolt).

Image Rejection: better than 74 db on all bands.
I.F. Rejection Ratio: at 600 KC is 2700 to 1.
A.V.C. Action: output will hold within 12db when input is increased from 2 to 200,000 microvolts.

Frequency Control: Continuous tuning plus a separate crystal control oscillator in which 6 crystals can be used for spot frequency operation.

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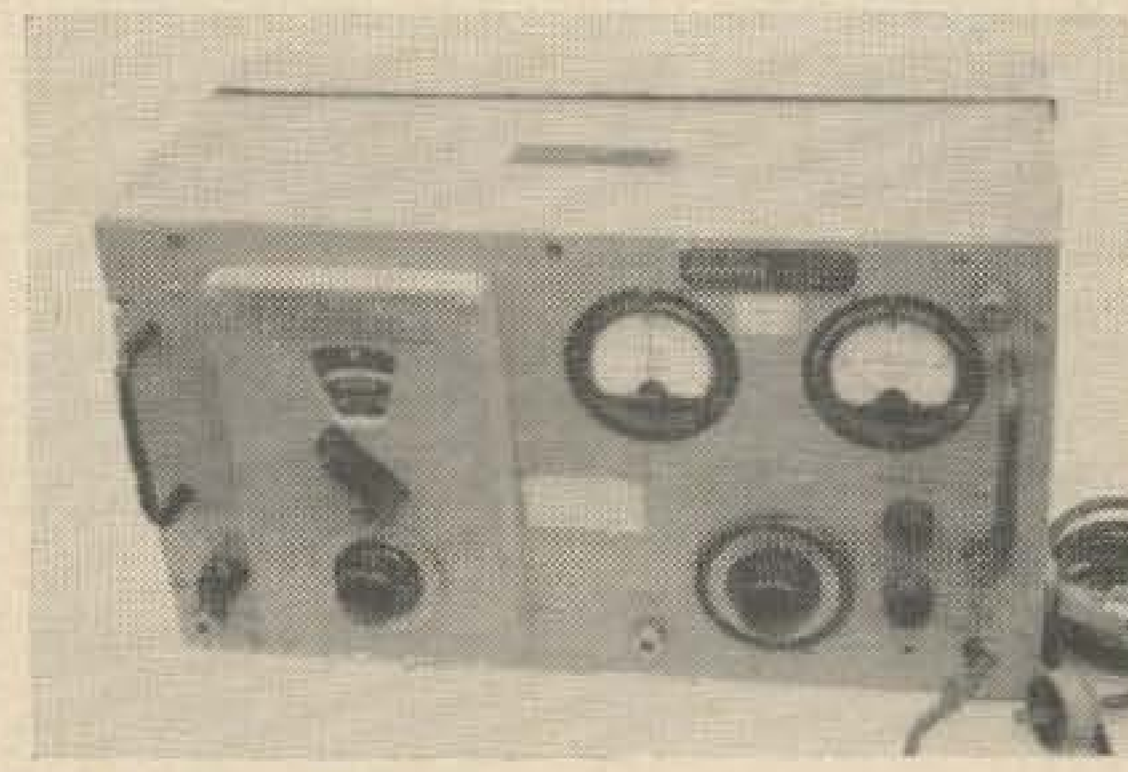
PRICE: SP 600 JX $349.95
SP 600 JX 17 .... $399.95

6 METER TRANSCEIVER TYPE BC-1000

These units are designed for operation on 40-48 mc FM, with ½ Watt output. They are battery powered using 4.5V & 90V on receiver & 4.5V, 90V & 150V on transmit. All are in excellent condition. These units are very easily converted to 6 meter AM by using the reactance modulator as a clamp tube modulator & a simple change of the FM discriminator to a diode detector. They also contain a very effective adjustable audio SQUELCH.

PRICE: $19.95 with WHIP ANTENNA. SHPT. WT. 18#

LABORATORY R.F. SIGNAL GENERATOR TS-497B/URR



FUNCTIONAL DESCRIPTION:

Signal Generator HS-497A/URR is a portable amplitude-modulated unit for laboratory and field use in testing radio and video equipment and is an electrical equivalent of the Measurements Model 80.

RELATIONSHIP TO OTHER EQUIPMENT:

This equipment, part of Test Set AN/MPM-23, is similar to Federal Model 6041X-1. Models of this signal generator are identical except for maintenance parts.

ELECTROMECHANICAL DESCRIPTION:

Power Requirements: 65 w, 110 v ±10%, 50 to 1,600 cy. 1 ph. ac
Frequency Range: 2 to 400 mc in six bands
Type of Emission: AM, pulse

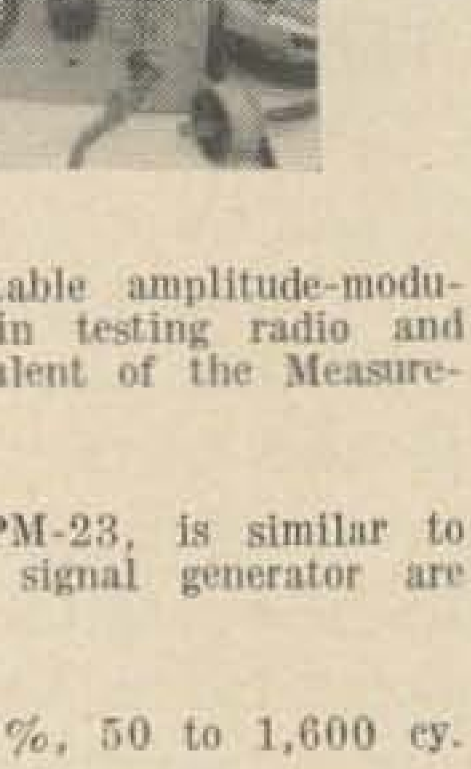
MODULATION:

External Pulse: 150 v (min. output); 1,000 ohms (max. impedance)
Frequency: 50 to 10,000 cy (ext); 400 to 1000 cy. (int)
Percent: 0 to 30 for sine waves
Output Impedance: 50 ohms

Attenuator Leakage: Less than .1 uv
Stray Field: Less than .2 uv
Accuracy: +.5% of indicated freq.

In excellent like new condition.
PRICE: $195.00 shpt. wt. 65#

SPECIAL DELUXE EMCOR RACKS



STANDARD 19" PANEL

Overall Height	51"
Panel space	43¾"
Overall depth	22"
Overall width	23½"

CASTERS and 18" x 23" table included with full rear door.

PRICE: $29.95 shpt. wt. 200#

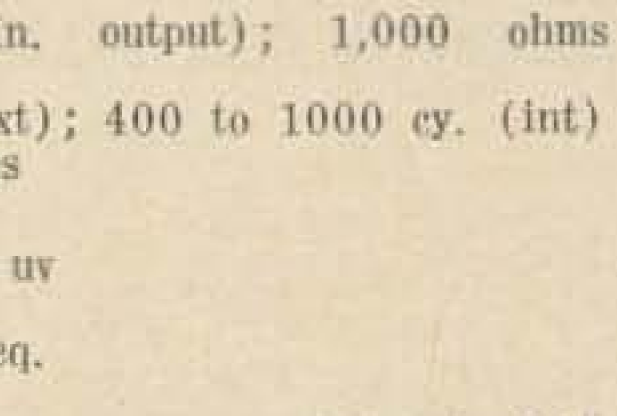
DESK TYPE RACK

Standard 19" Panel

Overall Height	13¼"
Overall Depth	19"
Overall Width	21½"
Panel Space	8¾"

PRICE: $14.95 shpt. wt. 35#

DOUBLE RACK for 19" PANELS



Overall width	44½"
" depth	22½"
" height	33½"
Panel Space	28"

PRICE: $24.95
shpt. wt. 175#

SELECTRONICS

1206 S. Napa Street
Philadelphia, Pa.
HO 8-7891 HO 8-4645

All prices are FOB our Philadelphia warehouse. All merchandise described accurately to the best of our knowledge. Your purchase money refunded if not satisfied. Terms are cash. Minimum order is $5. The public is welcome to browse. We're open weekdays 8 to 5 and Saturday 8 to 1.

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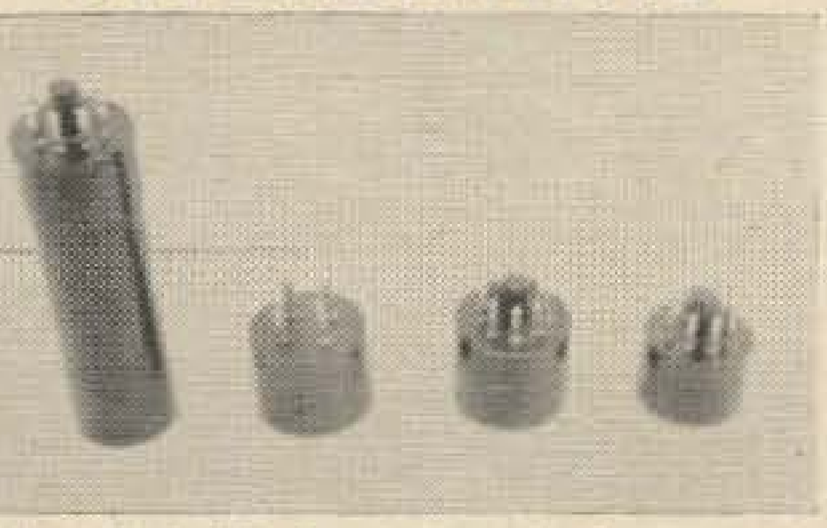
SILICON DIRECT PLUG-IN REPLACEMENTS



Compensation network built in as required.

5R4 PREMIUM (4000 PIV)	PRICE: $6.00	#SC
0Z4/6X4	" 1.95	SE
5X4/5Y4	" 1.95	SF
5U4/5Y3/5Y3GT/5V4/5V4GT/5AU4/5T4/5W4/5Z4/5AW4/5V3/5AS4/5AX4/5AZ4/5Y3G	" 1.95	SG
80/5Z3	" 1.95	SH

POWER TESTED SILICON RECTIFIER UNITS
(**1 amp.** @ 1 ma. max. leakage)

50-200 PIV	Price: .06 ea.
200-400 "	" .14 "
400-600 "	" .24 "
600-800 "	" .36 "
800 or better	" .44 "
1000 PIV	" .54 "

POWER TESTED SILICON RECTIFIER UNITS
(All 5 amps.)

200-400 V	Price: .39 ea.
400-600 V	" .49 "
700 V	" .69 "
800 V	" .84 "
1000 V	" 1.99 "

POWER TESTED SILICON RECTIFIER UNITS
(All 35 **amps.**)

50 V	Price: .84 ea.
100 V	" .92 "
200 V	" 1.94 "
300 V	" 2.68 "
400 V	" 2.99 "
500 V	" 3.28 "
600 V	" 4.08 "

APX 6 TRANSPONDERS
LESS TUBES — EXCELLENT CONDITION
PRICE: $9.95 — shpt. wt. 50#

RG 11 A/U COAX CABLE
75 ohm nominal impedance
.405 outside diameter
500 ft. spool .... Price $25.00
100 ft. lengths .... Price: $5.50
Price per foot .... .06

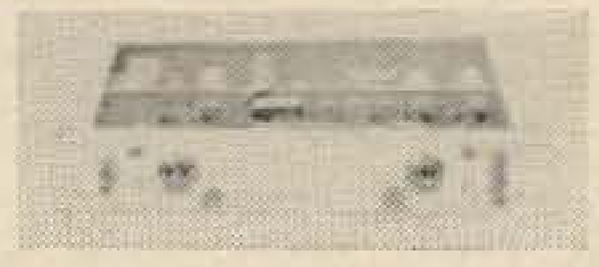
LINK 420 MC TRANSCEIVERS
The same as one we sold for $34.95 except the vibrators, 5894A, cables and mike are missing. Most of the small tubes are included. These units are excellent for stripping and using the tripler-amplifier chassis to get on 420 mc with about 2-3 watts drive on 2 meters. Type 829 tubes may be substituted for the 5894 at reduced output.
PRICE; $9.95 .... shpt. wt. 50# $9.95

APR-1 TUNING UNIT
30 to 90 mc. TN-1B Easy converted to 6 meters. EXCELLENT CONDITION
PRICE: $14.95 .... shpt. wt. 26# S-7131

SUPER PRO POWER SUPPLY
Rack Mounted — Excellent condition
PRICE: $19.95 .... shpt wt. 60# S-6609

BC-221 etc. POWER SUPPLY
Type RM-29
Input: 115 V 60 cy. 1 ϕ 35 watts
Output: 90 VDC @ 15 ma, & 6.3 VAC @ 2.5A
Price: $4.95 shpt. wt. 15# S-6601

ELECTRONIC MEASUREMENTS CO. POWER SUPPLY MODEL 212A



Input: 125 V @ 60 cy.
Output: 0—100VDC @ 0—100 ma.
ideal for transistor work.
Price: with covers $39.95
less covers 29.95
metered (2) 49.95
Shipping weight = 17#

MULTIPLE OUTPUT VOLTAGE REGULATED POWER SUPPLY

Here is a very fine little power supply for Receivers, Converters, Test eqpt. etc. Outputs are all well filtered. VR tube regulated
250V @ 30 ma
240V @ 30 ma
150V @ 30 ma
400V @ 60 ma not regulated. 6.3V AC @ 4.5 amps or remove regulators and get 400V at 140 ma with 5 U4G or 125 ma with 5Y3, uses 1-5Y3, 2-0D3/VR 150, 1-0C3/VR105, OB3/VR 90 contains a 750 VCT @ 150 ma power xfmr. and a 7 hy @ 140 ma filter choke plus **filter capacitors** and 4-25W adjustable resistors and a 25 W **pot plus a** Mallory 4W pot.
All in a nice grey crackle cabinet with top lid measures **8"H x** 16"W x 8"D. **USED-GOOD CONDITION WITH TUBES**
PRICE: $9.95 — shpt. wt. 40# — **S-6354**

REGULATED POWER SUPPLY Wickes Model PS—3

Power Input 105-125V, 50-60 cps. 370 W. Regulated D.C. output (adjustable) 270-300V. Max. output current—400 ma regulation: 100 to 400 ma—less than 0.5 V. AC ripple, peak to peak—less than 0.015V. Output impedance — less than 0.7 ohms. Overall Dimensions 19" x 10½"H x 12⅜"D. Recessed 19" rack mounting.
PRICE: $24.95 .... shpt. wt. 85# S-6425

LAMBDA POWER SUPPLY 19" RACK MOUNTING Model 28
Regulated P/S
Input: 105-125V 50-60 CPS.
Output: 200-325 VDC 0-100 ma., 6.3V @ 3 amp.
PRICE: $19.95 — shpt. wt. 25# — S-7145

TUBULAR HIGH CAP. ELECTROLYTICS

CAP.	W.V.D.C.	PRICE	2 for	CAT. #
20,000	MFD 25V	.95	1.50	S-7120
25,000	" "	1.25	2.00	7121
20,000	" 30V	1.25	2.00	7122
40,000	" 10V	.95	1.50	7123
40,000	" 30V	1.75	3.00	7124

WESTINGHOUSE FULL WAVE BRIDGE RECTIFIER 600 P.I.V.
1 amp. Supplied with heat sinks, mounting area 1½ x 3½" Height 2".
PRICE: $2.50 — shpt. 1 lb.

ELECTRONIC RESEARCH ASSOCIATES POWER SUPPLY
Model F25.
Input: 115 VAC @ 60 cys.; Output: 25.2 VDC @ 1 amp. size 4x4x4¾.
PRICE: $19.95 — shpt. wt. 10#

Model V135.
Input: 115 V @ 60 cy. Output: 135 V @ 75 ma. (size 2⅜ x 2¾ x 13/16.)
PRICE: $9.95 — shpt. wt. 5#

AERIAL WIRE—Reel contains approximately 138 feet of phosphor bronze, no. 16 standard, 200 lbs test antenna wire. Has galvanized clips on ends. Brand New.
PRICE: $1.50 or 4 for $5.00 — shpt. 3# — S-6313

RDZ POWER SUPPLY—D.C. power supply mfg. for **MARS** or **RDZ** receiver. Input 115 VAC 50/60 cy. Output 300 VDC @ 200 ma well filtered thru two 8 hy 200 ma chokes and two 10 mf. capacitors thru a VR-150. 6.3 v.c.t. @ 10 amps and 12 v.a.c. @ 3 amps. Meas. 5½" x 9" x 17". Complete with tubes.
PRICE: $12.95 — shpt. wt. 65# — S-6262

METERS

0-5	R.F. amps	2½" Rd.	@ $2.95
0-2	R.F. amps	2½" Rd. (Thermo couple)	@ 2.00
0-15	V.A.C.	2½" Rd.	@ 1.49

MOBILE POWER SUPPLY TYPE PE 120
Input: 6-12 or 24 VDC; Output: 90 VDC & 145 VDC. Fine for low power xmtr's or receivers such as our BC1000.
PRICE: $4.95 — shpt. wt. — S-7176

TELETYPE POLAR RELAY TYPE 255
PRICE: $3.95 — shpt. wt. 2#

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EICO 722 on Six

Having an EICO 722 vfo and a desire to use it on 6 meters, I discovered that by returning the vfo, 6 meter operation is possible.

Since the vfo oscillates always in the 80 meter band and multiples are used for other bands, it is possible to have the vfo oscillate above 4 mc and double to 8 mc on the 40 meter band. The procedure is quite simple: (1) By turning the slug in coil L1 all the way down as far as it will go, you can raise the oscillator frequency on the 80 meter band so that when the dial on the vfo reads 4 mc, it is actually about 4.25 mc. Coil L4 is now adjusted for a peak S meter reading. (2) Now switch to the 40 meter band and adjust trimmer C6 for the second harmonic. Any receiver that tunes around 8 mc is satisfactory. I used a Hallicrafter S38E. After trimmer C6 is adjusted for highest frequency which should be around 8450 kc, coil L5 is adjusted for a peak S meter reading. This completes the conversion.

On my vfo I can now cover from 50 mc up to 50.75 which is sufficient coverage since most of the operating is done between 50.1 and 50.4. To use it on the low bands, all that is necessary is to follow EICO's instruction manual.

This conversion is ideal for those who lack funds and who do not want to ruin a good 80 to 10 meter vfo.

. . . WB2EPB

Neater Decals

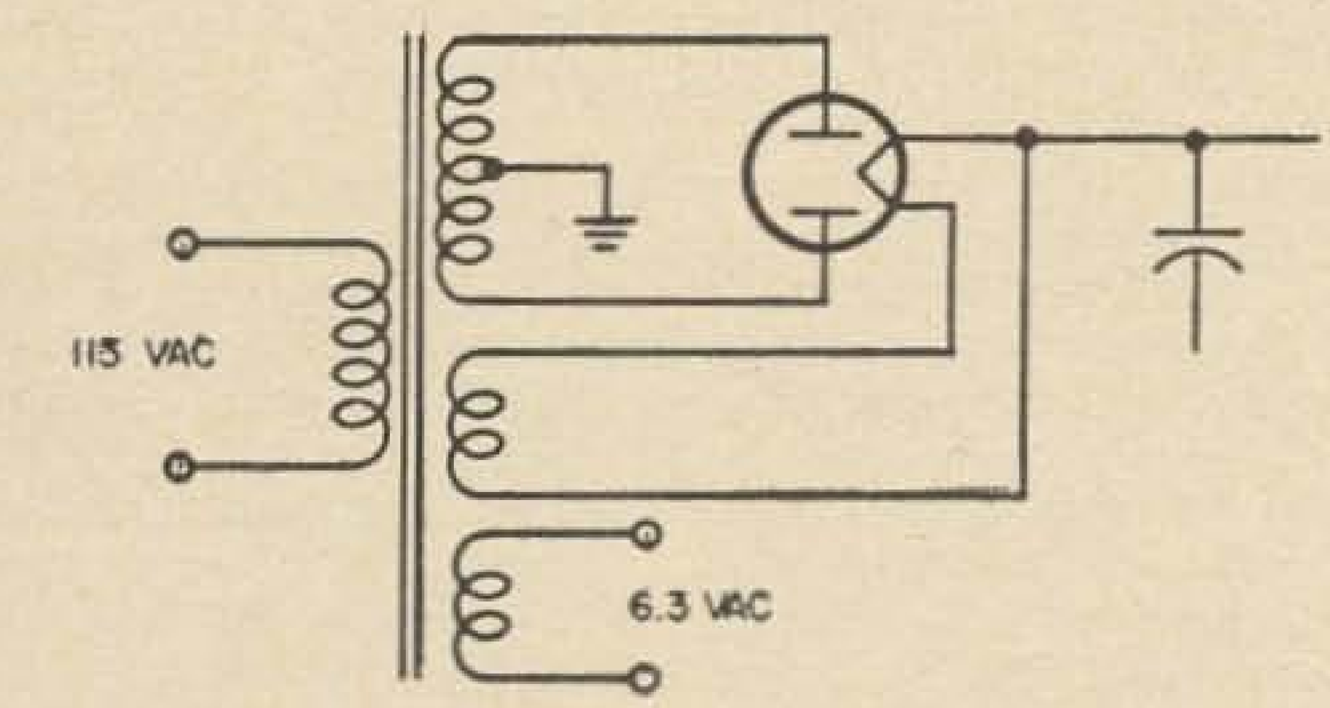
Most of the instructions furnished with panel marking decals tell you to spray the panel with clear spray after the decals are in place and dry. However I find that a careful appiication of lacquer thinner does the trick and does it better. By working carefully around the edge of the applied decals with a fine brush dipped in thinner, they will blend into the finish as perfectly as a factory job with no shiny area around them to give the gag away, especially on wrinkle finishes.

Applied in this way and without any further treatment or covering, they will withstand any normal abrasion, and if at some later date you wish to change any of the markings, you can remove any or all of them by going over them with a cotton swab dipped in lacquer thinner, and then apply new markings as required.

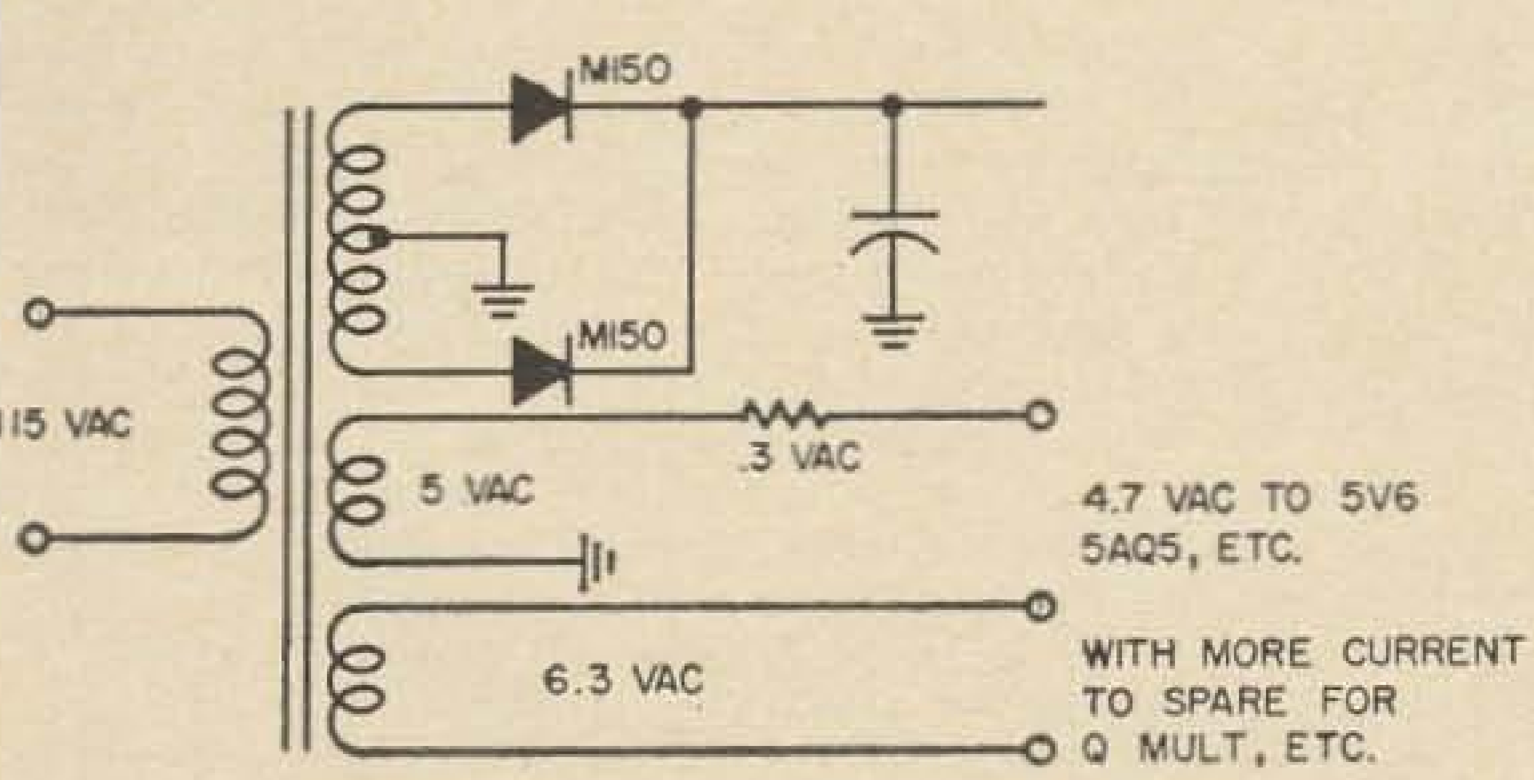
. . . WB2CCM

Transformer Tip

Statistics show that 99.44% of all amateurs /ho try to draw more than .15 a of filament urrent and 15 mils of B+ from their receiver ave gotten nothing but a charred power ransformer for their trouble. The alternative, separate power supply, is not much help o the fellow who wants to add internal acessories to his receiver. Fortunately, with the ise of silicon rectifiers, these pitfalls can be overcome. The conversion from tube to silicon ectifiers also results in higher B+ (because of lower internal voltage drop), less heat dissi-



BEFORE



AFTER

pation, and 5 volts at 2 or 3 amps of filament voltage becoming available. In the majority of cases 6.3 volts are needed for accessories. By changing some of the receiver tubes to their 4.7 volt counterparts, their filament current is made available. Most audio output tubes have 4.7 volt counterparts (5AQ5, 5V6, 5CZ5). A suitable dropping resistor must be added in series with the 5 volt winding. Make sure that the resistor is of adequate wattage! The current that formerly supplied the audio output tube can now be used to supply accessories. A good silicon rectifier for most replacements is the Sarkes-Tarzian M-150. These rectifiers are very small and may be mounted n a standard fuse holder. If your normal B+ over 250 volts, use two in each leg of the ower supply.

. . . WA2KYF

Letter from Gus

As I write this, Dick YA4A (W4UTE) is at the mike operating YA8A. Dick is the SSB man on this trip, and I am CW (YA8H). We are just across a river from UI8 land.

Last week when we were YA9H and YA9A, we were across a river from UH8 land. At both spots we could see the barbed wire entanglements and guard posts with machine guns at each place. I wished I had had a pair of field glasses so I could have gotten a better look at what was happening across the river. I'm sure they had their telescope trained on us though.

Life sure has been interesting here the past couple of weeks. I am getting to parts of this country that are certainly off the beaten path. We have been eating and almost living off such items as honey dew melons as large as South Carolina watermelons, peaches, and man! these big blue and purple plums, some as large as your fist. These are the best I've ever eaten! There are oranges and tangerines, cucumbers, eggplants, apricots, and a number of other fruits and vegetables I don't recognize. The weather here is hot in the daytime, about 105 to 110, I guess, and it gets downright cold after midnight.

Conditions have been reasonably fair. The US east coast up to the middle west is worked in the mornings from about 0030 to 0300 GMT and a few west coast stations a little later. Europeans every night come in up to about 2130 GMT. We are operating around the clock, when the band is open, we are on the air. 21 Mc doesn't seem to open here much at all, just a few JA's and UA's and even less Europeans, two or three Africans . . . and that's 21 mc here. 7 mc is for the birds, with all the commercial QRM and the usual summer QRN. Sandstorm static is sometimes very bad, up to S7 or S8 every day from about 1400 to 1600 GMT.

You never see any clouds in the sky here, but we do have a few breezes blowing during the daytime and it's not bad if you can stay in the shade. The water in the river is too cold for me to go in swimming, but Dick goes in a couple times each day, and he comes out covered with goose pimples. They tell us that cholera is almost at the epidemic stage around here, so we are very careful of what we eat and drink. So far both of us are in the very best of health.

Dick is a fine fellow to go on a DXpedition with. Since he speaks this language, he is a *must* if you want to get anything done here. No one in this part can speak English, all signs are in the native tongue, and all is Dutch to me.

The ladies all wear veils and all you can see is their eyes through a little piece of thin cloth. Their dresses are down to their ankles. I'll bet that in this hot weather, when they get back to their houses and take off that veil, they say, "Am I ever glad to get that thing off!"

Our big problem here is transportation from place to place; usually it's by one of those beat-up busses. Occasionally we can find some fellow with a car and pay him to take us to the next spot. We have an eye on a Neutral Zone over here between YA and AP land, only a few miles from the Khyber Pass. We are trying to get some sort of word from Bob White W1WPO as to whether it would be a new one. We may go there anyway just for the heck of it, but since it's not owned by anyone, we are in a quandry as to what call sign to use if we get there. We'll come up with something though.

Tomorrow we QSY to YAO land, right on the border of UJ8/BY/YA. I expect as usual we will be watched. I understand this one is right up there in some mighty high mountains, which should be FB since it will remind me of Bhutan.

It's still W3CRA and W5VA, neck and neck. When they are S6, the band is closed to the States. When they are S7, you might hear a few weak Stateside stations. When they are S8, the band is reasonably fair, and when they are S9, the band is in good shape. I must inspect these fellows' stations and steal their secret so W4BPD will be in there with them when and if I ever get going again.

My Hy-Gain 14 AVQ vertical sure does look beat-up, bent, crooked, but believe it or not, it still has just about 1:1 SWR on all the bands from 10 through 40. But the shape it's in, I certainly would not put it up at home, because Peggy would run me back to Tibet! I tell the customs fellows that it's my deep sea fishing rod! And so far, they believe it too! I call the rig an SSB signal generator. I wish I had a turntable and tone arm mounted on it, and then I could tell them it's my record player. This would kind speed up the usual customs delay. . . . G

VHF

Meteor scatter buffs watched the passing of the annual erseids meteor shower with varying thoughts. Some, such as /ØENC, said that the shower was poor. Others worked everal states. K41XC in Florida added K1UGQ and W5UGO Oklahoma for two new ones giving John 29 states on two. ther interesting QSO's: WØENC worked WB6KAP and /AØFDY for 30 states; WAØFDY worked K5TQP; W4WNH orked seven stations (W4AWS three times!), WØCUC orked W7PUA/2, K2RTH and K8AJF; KØCER QSO'ed /2AZL, W3BYF and VE3DIR.

One interesting thing is that all three South Dakota ieteor stations worked stations only on an east west path nd all within an 18 degree beamwidth. Each station had iany skeds in other directions, but very little was heard. nyone else have this problem?

During each shower the question arises, "Did I work him?" 'wo meter DX men have been long known for their honesty n making valid contacts. Now just what is a contact? Ponder hat one for a minute. The consesus is that there must be n exchange of information. Going by that, merely exchang- ng calls and a "roger" would fulfill the requirement. Granted hat one for a minute. The consensus is that there must be his, two meter men have come to generally accept a form stablished by a W3 a few years ago. In it, four pieces f information have to be exchanged. Some of this I be- ieve to be repetitious. I refer to sending calls and a signal eport, then the signal report with a "roger," then a separate roger." The rules say you send the "r" until you receive an ng on this and are beginning to use the calls only, signal eport only and then the "roger" only.

This "roger" business can get silly very fast. You have ex- hanged all the necessary information except the confirming "roger." The rules say you send the "r" you receive an "r." Okay, I'm sending an "r" to, say, WC2ABC. He re- eives it and quits sending, but I may not have heard this "r." How many QSO's have YOU lost this way? On the other hand, if someone doesn't cease sending "r" when he copied "r" this silly exchange would go on, rogering the roger, rogering the rogering roger . . . you get the idea.

Some fellows send a 73 or SK after the "r" so the guy on the other end knows he got the two way "r." This is fine if there are still a few meteors around. I for one am going to send the "r" (if I get that far) until I hear an "r" and then I'm going to quit, get a cup of coffee and wait until the next sked. In my book, I've worked him. If you want an interesting discussion sometime, ask W1FZJ what he thinks on this topic. By the way, I'm braced for the flood of protests that will probably come my way after this discussion. As K5JKX would say, "What do you think?"

The next showers to try something new—and perhaps more reasonable—are the Orionids, October 18-23; Leonids, November 14-18 (they should be excellent this peak year) and the December 10-14 Geminids. Good pingin'.

Another form of propagation which could start to show some life this fall with the sun spots on the increase again is aurora. These signals, reflected off the Aurora Borealis (Northern Lights) usually peak around sundown and then return again about 2 AM. Distances covered can range from a few miles to several hundred miles. If you've never heard an aurora signal you won't believe your ears the first time you do. Next time WWV is sending a forecast of "W" or "U" followed by a number, swing your beam slowly across the northern sky and listen for something that sounds like a buzz saw going through one foot knotty pine. That is aurora! Incidentally, forget AM (and maybe FM) for aurora. Try CW or SSB.

The boys at project Oscar are looking for reception reports on the 145.95 mc coherent beacon. It has been reported by W6OJW and other observers about 3 db out of the noise and 20 or more db down from the 145.85 mc beacon. If you hear it, tell them.

And don't forget to get that antenna work done now. It ill be cold before long and although antennas with hide ozen to them seem to work best, it's rough on the CW fist. on't forget to write.

. . . KØCER

Letters

Peter Volpe, Ted Guernaras (Deputy Registrar), John McCarthy (Commissioner of Finance and Deputy Governor), Governor Volpe, Father Dan Linehan, Pat Volpe, Bob Waters, Russ Ringland

Dear Wayne:

The issue of call letter plates to all the amateurs in Massachusetts was announced at the ARRL New England Division Convention in April of this year when it was announced that Father Dan WIHK would receive the first set of plates. On the second of June we were told that the Registrar had decided to issue license plates as public service plates at no extra charge to all amateurs in Massachusetts. We were asked to furnish him a list of amateur radio operators who wanted plates by June 15. As we didn't have the time to make a direct mailing to all amateurs in Massachusetts, we decided the only way we could do it was through the use of Amateur Radio. After all *we are communication people.* (We were asked not to use the newspapers). With the help of FEMARA, The Quannapowitt Radio Association and many other amateurs and nets, we turned in a list of 2018 amateur calls to the Registry. Many more than the seven or eight hundred they expected. These plates are being issued for 1965.

Our thanks to all the amateurs and their communication systems who made this endeavor so successful.

The License Plate Committee
Russ Ringland WIEYZ, Chairman

Dear Wayne:

The 1215'er (May) is the greatest thing since the APX-6, and twice as much fun. Thanks for renewing my interest in home brewing. Keep up the sarcasm, too! !

Jim Waldorf WA8GAJ
Canton, Ohio

Dear Wayne:

I would like to take this opportunity to say that I agree thoroughly with your editorials and views concerning the ARRL. *Oscar* was one of the greatest opportunities amateur radio has ever had to receive favorable public recognition. The league should practice what it preaches. In the April 1964 issue of *QST* W8GUL wrote an article entitled "Come Blow Your Horn." The author says that "publicity must be persistent and regular." All the other satellites get publicity, why not Oscar? Those amateurs who take pleasure in writing you nasty letters should consider points such as this seriously.

Your surplus conversion articles were superb. Keep up the good work.

Neale C. Hightower WA4NAI
Charleston, S. Carolina

I take it back, Neale, Oscar II finally did get some publicity. The June 22nd National Review had a nice little nine line squib on it. I'll bet Barry sent it in for them . . . hi ear Wayne:

I want to spout off about our local form of democracy evidence during my recent encounter with the local lanning Commission. To make a long story short, I pplied to the local County Planning Commission for a ariance to the height restriction in the zoning ordinance. he zoning limit is 35 feet but I requested a variance of nother 6 feet so I could erect a crank-up tower. The lanning Commission decided there should be a public earing on the matter, so I prepared my case complete with hotographs, diagrams, design computations, reference ooks, Weather Bureau wind roses (to show the prevailing inds), proof of liability insurance, and anything else I ould think of to support my case. The fellow living behind ne was objecting so the Board gave him time to make is statements which he did not have to prove. When it as time for my side, I started presenting my side but the oard (2 members) cut me off saying time was running ut and my request was denied.

My Attorney has advised me to procede with the building ermit up to the 35 foot zoning limit because the objections ere not valid. While applying for the permit I got a hance to see the letter that was filed objecting to my re-uest. He had made several points which could have been efuted if someone had bothered to check the objections gainst my application but I think that the last objection vas a real gem. My antenna could be used by enemy air-raft or missles to home in on. Hi.

Anyway, this is what happens when you try to follow ocal building ordinances and do everything by the book. Have to say 73's for now and get busy on my homing eacon. Hi.

Richard M. Schreiner WA7ACN
Portland, Oregon

Dear Wayne,

When I visited K2US, after walking through hallways nd up stairways, I was confronted by a picture window nd a locked door. When I knocked on the door the lone perator looked up and shook his head. I continued to nock and he came to the door, opened it a crack and aid I couldn't come in until I got rid of my Coke. I drank it, walked back down the hallway to a receptacle and returned. I was then allowed to enter. I asked what band he was working and he said "none." He called a short CQ (no answer) and I again asked him what band he was using. The reply again was "none." I asked for a QSL card and was refused. I asked to sign the visitors register and was refused when I mentioned that I did not yet have a license. I think I would have been received better at a Moscow amateur radio station.

John English
Sherman Oaks, California

V	T	V	M				M	E	T	E	R
A	T	I	O	S		B	E	C	O	M	E
C	■	P	O	T		E	G	O	■	E	I
U	T	■	N	O	D	E	S	■	P	E	G
U	E	S	■	O	U	R	■	B	U	R	N
M	A	N	A	G	E	■	H	A	T	S	
		A	L	E	■	M	R	S			
P	I	C	A	■	L	O	S	E	R	S	
A	N	K	■	B	E	D	■	S	U	P	S
R	K	■	C	L	O	U	D	■	B	A	T
L	■	Z	O	O		L	O	G	■	R	E
A	M	B	I	C		E	L	D	E	S	T
Y	R	O	L				T	O	N	E	

Continued from page 2

him to watch out for me. Since I waited until the last minute, as I usually do on things like this, I was very grateful when I got a call on twenty from PJ3CD and instructions on how to get a license when I arrived. It seems all I had to do was send a copy of my U.S. license down to Chet and everything would be taken care of for me.

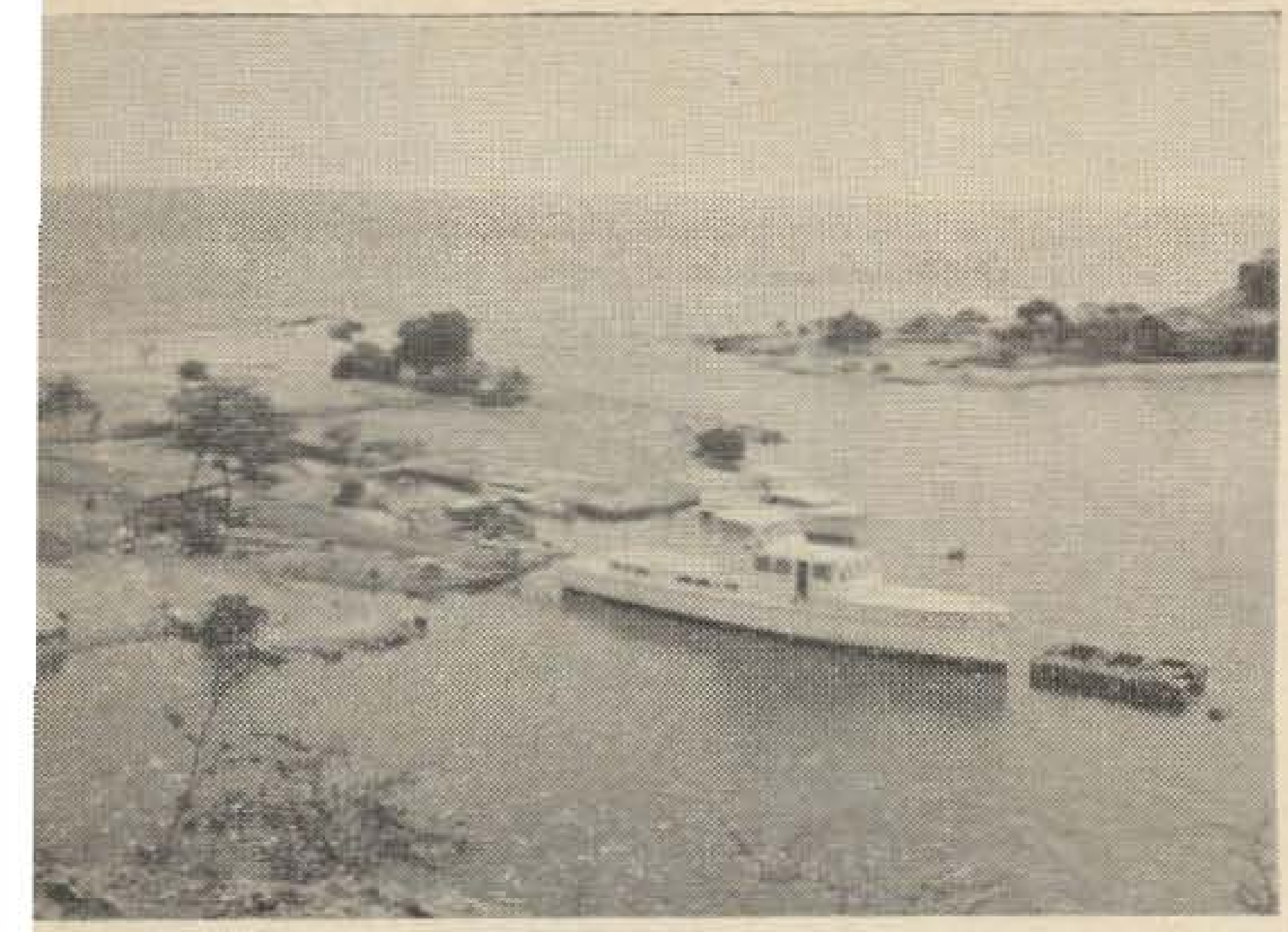
There are only a couple of flights from Puerto Rico to Curaçao a week, so I had to make do with one that left late at night and arrived near midnight. They were right there to greet me and drive me to the hotel, even so. It was quite a drive out there because Chet picked a completely isolated area to build his hotel.

The hotel is quite different from what I had expected. It is made up more like a motel, with five buildings, each with seven rooms. The rooms were large, nicely furnished, air conditioned, had beautifully done bathrooms with showers and tub, and a private balcony overlooking the Caribbean. A few steps away from the rooms is the recreation building . . . something like a hotel lobby with lots of chairs and couches for sitting and talking and playing games . . . plus the ham station with a picture window in front of it looking out to sea. The next building over was a dining room and bar.

Chet had the OK for my ticket and I spent a good deal of time operating PJ3CC. I did get out for some skin diving and a sail. They have facilities for water skiing, deep sea fishing, tennis, and all that sort of thing, but I'm afraid that most of my time was spent on the rig and eating. Good food.

Chet tells me that he is going to be pretty crowded this winter so you might plan well ahead if you want to visit there. Chet, with his brother and their wives run the place and it is a nice family atmosphere.

The weather was fine when I was there in late July . . . about 90° temperature and 70% humidity. It was very comfortable for taking



t easy and for water sports.

I did take one day off and visited town. onas PJ3CD quickly arranged a hamfest and ight PJ's came over that evening. We had a ery enjoyable talk which didn't break up ompletely until after 2 am. The next time ou work PJ2CD, PJ2CE, PJ2CO, PJ2CR, PJ2CZ, PJ3CB, PJ3CD, or PJ3CH give them egards from Wayne.

You can bet that I'm going to get to Curaçao about 40 miles north of Venezuela) again as oon as I can.

Skin Diving

While I was down in the Caribbean area doing the piece on the Arecibo dish and the Coral Cliff Hotel, it seemed like a waste not to stop over and say hello to Dick Spenceley KV4AA and, heh, heh, go on a short skin diving trip while I was there visiting.

Dick is doing well. He reports that he has finally managed to kick the DX habit, at least to the extent that he can allow a new country to get on now and then without his having to be the first to work it. Dick was a little vague, but I think that there are a couple that he has completely missed recently.

So there's this little (65 foot) boat that goes for a one week skin diving trip every other Monday out of St. Thomas. There were seven of us along as passengers plus four crew and we cruised all through the British Virgin Islands and had a very good time. The chap in charge of the skin diving (John) turned out to be an old acquaintance . . . we'd gone diving together in Bermuda about eight years ago. I haven't been skin diving for about six years, so it was particularly enjoyable to get back in the swim.

Unfortunately the boat only had 32 vdc so I didn't bring along a transceiver . . . maybe next time.

. . . W2NSD

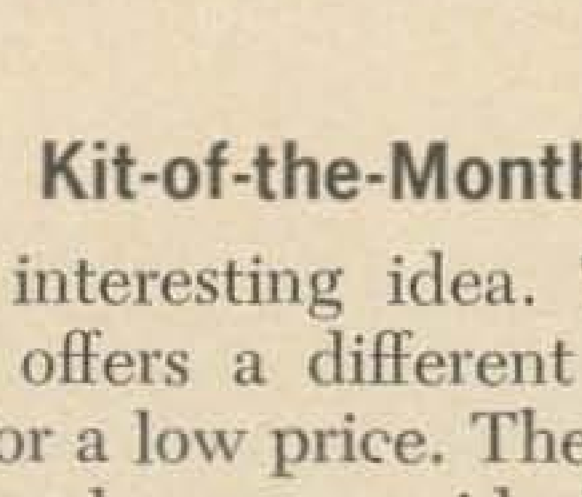
NEW PRODUCTS

Telrex Catalog

Telrex Laboratories' new PL-66 short form catalog contains lots of interesting goodies. They have antennas for all bands, from an eleven element yagi for 432 to a three element optimum spaced beam for 40. They also have Duo-, Tri- and four band beams and some CB antennas. Not to mention the broad-band baluns, inverted V kits, masting and very heavy duty rotator. Send now: Telrex, Asbury Park, N.J. 07712.

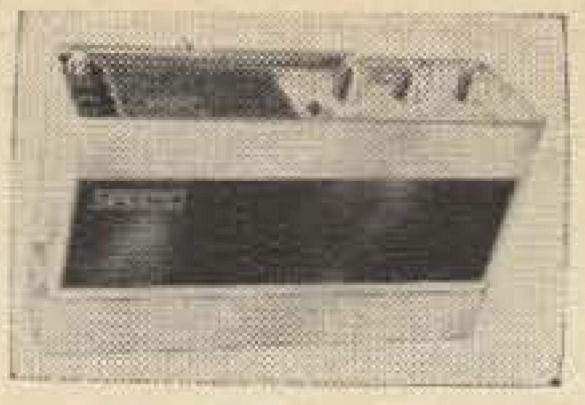
Kit-of-the-Month

Here's an interesting idea. The Kit-of-the-Month Club offers a different electronics kit each month for a low price. The kits are simple and easy to make, so are ideal for beginners and those with limited experience, yet could be a lot of fun for old hams as well. Incidentally, you don't have to buy a minimum number of kits. Get more information from KOTMC, P.O. Box 44718, Los Angeles, California 90044.



Waters Attenuators

The new Waters wide range attenuators provide up to 61 db of attenuation in 1 db steps. They may be used to check S-meter calibration, relative signal levels, antenna gain, front-to-back ratio, receiver sideband suppression, image and *if* rejection, and measure filter respone. Maximum power is ¼ watt and VSWR is less than 1.3 from DC to 225 mc. The model 371-1 with UHF connectors is $27.95 and the 371-2 with BNC's is $29.95. For more information contact Bob Waters at Waters Mfg., Wayland, Mass.

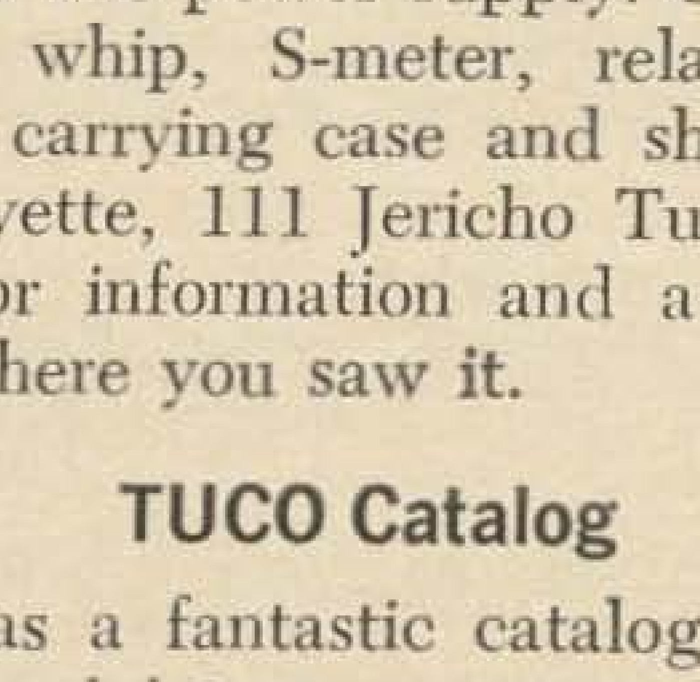


Lafayette 6 Meter Transistor Transceiver

Lafayette has introduced their model 650 Solid-State 6-Meter Transceiver for only $119.95. The fully modulated transmitter features 1.5 watts output with 6 crystal controlled channels (8 mc crystals.) The tunable receiver covers 50-52 mc with a sensitivity of 1.2 μv and a series gate noise limiter. It uses a zener voltage regulator and can easily be operated fixed with the external antenna connector and optional 115 vac power supply. Other features telescoping whip, S-meter, relay switching, PTT mike, carrying case and shoulder strap. Write Lafayette, 111 Jericho Turnpike, Syosset, N.Y. for information and a catalog and tell them where you saw it.

TUCO Catalog

TUCO has a fantastic catalog of semiconductors, subminiature components and electronic kits. Many of these parts aren't available elsewhere—at least, not at the reasonable prices TUCO offers. Among their products is a completely built regulated power supply that furnishes 12 volts at 1 amp and costs only $15, and a 12 watt transistor amplifier for only $20. Be sure to write and get their catalog if you do any building and experimenting. Transistors Unlimited, 462 Jericho Turnpike, Mineola, N.Y. 11501.



PIC Air Wound Coils

Polyphase has developed a new line of 55 standard types of air wound coils for many ham and industrial uses in transmitters, receivers and other equipment. The Polycoils feature special "D" section supports for minimum power absorption for lower losses and higher Q. They are available in lengths up to 10", diameters from ⅛" to 3", and pitches from 4 TPI to 24 TPI. Special larger Polycoils and variable Polycoils with ratings to 15 KW are also available. Write for bulletin CP1001, Polyphase Instrument Company, Bridgeport, Pa.

Caveat Emptor?

★ Price—$2 per 25 words for non-commercial ads; $5 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

★ Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

★ We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

★ For $1 extra we can maintain a reply box for you.

★ We cannot check into each advertiser, so Caveat Emptor . . .

CQ LIBRARY for sale. Sept, Oct 1953, May, June, July, Sept, Oct, Nov 1954, All but Feb-Dec 1955 and 1956 through 1964 solid. Will ship. F. J. Krauss W8SPR, 906 Morris St., Salem, Ohio 44460.

TTY CHANNEL FILTERS, new surplus Northern Radio, 595, 765, 2635 cycles. 2 for $5. Audio filters, 300 to 3300 cycles, UTC 500 ohm, 20 watt 2 for $5. Lock City Electronics, R. 1, Sault Ste Marie, Mich.

C. FRITZ back on the job! Bringing hams greater QSL returns over a quarter century! Samples 25¢ deductible. Box 1684, Scottsdale, Arizona 85252 (Formerly Joliet, Illinois.)

SELL/TRADE: Complete parts for KW linear. 2-813's, 2-866A's. 10-80m. Cost over $175. Other items. Stephan Clifton WA2TYF, 800 West End Avenue, New York, N.Y. 10025.

RCA 6V FM30-44 mc. 60 watt model MI transceivers. Complete with heads, mikes and cables. $35. Sid Nelsen, Leeds, N.D.

QST LIBRARY for sale or trade. Sept 1953, all but Jan, Feb, April, Aug 1954. 1955 through 1964 solid. Will ship. W8SPR, Morris, Salem, Ohio.

GALAXY 300 with AC power supply in excellent condition, $275 FOB Sacramento. Tony Assenza, 10724 Campana Way, Rancho Cordova, Calif.

QSL SAMPLES?? 25¢ (Refunded.) Russ 73 Sakkers W8DED, Holland, Michigan.

RADIOPHONE 44 PANADAPTOR. Ideal for Collins or any other 455 kc if receiver. Also will monitor transmitter. Will take best offer! Walter Reid, VA Hospital, Wood, Wisconsin.

PREPAID USA: Heathkit HM-11, $10; MT-1, $45; HX-20, $140; HR-20, $90; HP-20, $23; HP-10, $35; SBA-300-3, $15; SBA-300-4, $15; Eico 147A, $33; 950B, $20; 352, $10. Will consider any offers. W9FQC, 1612 W. Columbia Terrance, Peoria, Ill.

KNIGHT T-60. Excellent condition with five Novice crystals. Real nice Novice transmitter. $35 plus shipping. Ron Hallmark, 656 Rothrock Ave., Attalla, Ala. 35954.

COLLINS 32S3 $500. 516F-2 power supply $75. 75S $450. Lot price $975. RTTY model 28RO $150. Delivered 150 miles. K9HUK, RR1, Box 303v, Brownsburg Indiana.

---

432 MC PREAMPLIFIER. 5 db noise figure, 17 db gain transistor. Great for ATV. Ready to go, $12.50. Two for $23. W6ORG, 10253 E. Nadine, Temple City, California.

SX-111. Almost new, $155. DX-60, ½ year old, $50. Box $200. Want Galaxy V with AC. Will trade, WN6OGG 3171 Walker, Rossmoor, California 90720.

GALAXY V, 115/230 volt supply, deluxe console, VOX, calibrator, remote VFO, $695 new, take $495. 75A1, speaker, excellent $85. Don Payne W4HKQ, Box 525, Springfield, Tenn.

MOSLEY 10-20 vertical, $10; used 14AVS, $15; Webster Band Spanner and chain mount, $15; Heliwhip 6 meter cowl mount, $10. KØDQG, Box 156, Boone, Iowa.

GONSET COMMUNICATOR III. 6 meters, PTT mike, 110 vac and 12 vdc, 3 crystals. Immaculate. $120. WA9BYR, 627 Dundee Avenue, Barrington, Illinois.

COLLAINS 75S3, $400; RME 4300 with RME 4301, sideband adapter, $100; Utica 650 with matching VFO, $100; HT33 modified to HT33B, $235; HT37, $240; BC221M with matching calibration book and built-in power supply, $45; DB22A pre-selector, $20. W4ZRZ, P.O. Box 6742, Birmingham, Alabama 35210.

HG-10 VFO and PS $20, Dow Key DK60-G2C $8, Ameco CN-144 two meter converter and PS $35, Gonset code oscillator and CW-phone monitor $12, 5 position coax switch $5, IO-12 scope $45, manuals. Prefer local deal. Jim Minikel WB6MQE, 517 East Emerson, Monterey Park, Cal. 213-280-8202.

FLATBUSH RADIO CLUB—AUCTION, October 18th, 8 PM, at the Sgt. Meyer Levin Hall, 1628 East 14th Street, Brooklyn, N.Y. For information call 771-5852.

ART-13, $40. BC-348, AC power supply, $50. 4-amp variac, $5. 10-henry 500 ma. filter choke, $5. Dave Babcock, WA2RJY/2, 397 California Avenue, Uniondale, N.Y.

CONVERT Command Xmtr to 100+ watt Transverter. Work AF MARS, CAP. Your hamband SSB Transceiver as exciter/receiver. Simple, Inexpensive. Plans-Schematics $1.25. W5NSN

HEATH HW32 w/cal, Knight T-60 xmtr, Eico 722 VFO all mint condx, best offer, WB2IIA 2574 Wallace Ave. Bronx TU26693

MONITOR SCOPE: Heath HO- 10. AF-RF Trapezoid pattern monitoring. New; less than four hours use. $45 G. L. Wettlaufer, Box 422, Almond, N.Y.

FREE Sales Catalog—laboratory and microwave test equipment—including military types. Wanted—your surplus equipment, tubes, components. LECTRONIC RESEARCH, 715-17 Arch St. Phila., Pa. 19106 215-627-6771.

S & H GREEN STAMPS. Needed for Missionary Ham Station. Have your friends help too. Father Jude, WA2YNO, St. Paul's Abbey, Newton, New Jersey 07860.

KIT-OF-THE-MONTH CLUB, New, unique, low cost electronic kits for novice or advanced hobbyists. Free information, Leader Enterprises, Box 44718-KF, Los Angeles, Calif. 90044

TWO TONS of Equipment and Components must go. Send for list. SB300, all filters and speaker, ex. condx. best offer over $285. G. Petrilak K2SWI 132 Fifth Ave. Kings Park, N.Y. 11754

TELETYPE TEST SET I-193C. Government rebuilt, still crated. Tests RTTY transmitters, converters, relays, $14.95 each, two for $27.40. F. O. B. Harrisburg, Pa. Satisfaction guaranteed. Telemethods International, 3075 E. 123rd Street, Cleveland, Ohio 44120

TV CAMERAS. Model 400 complete with good vidicon and lens. Used as demonstrators. Only $200 F.O.B. Vanguard Labs, 190-48—99th Ave., Hollis, N.Y. 11423.

TELETYPE SH25A tape unit, new, never used, works perfectly. I have no use for it. $100. David Edsall, W1TDD, 3 Berkeley St., Cambridge, Mass.

RTTY gear for sale. List issued monthly. 88 or 44 Mhy toroids. Five for $1.75 postpaid. Elliott Buchanan, W-6-VPC 1067 Mandana Blvd., Oakland, California. 94610.

QSLS—New designs—$2.55 per 100 postpaid in U.S.A. Samples 10¢ K9RFZ PRESS, 1127 Eastman St., Oshkosh, Wis. 54901

FM FOR 2, 6 AND 432. GE 12 volt, 40-50 mc receiver-transceiver 4ER6-4ET5, 30 watts output. Transmitter are fully narrow-banded but easy to wideband. These units were removed from service this year and are clean and in excellent operating condition with all accessories except antenna $39.95. 432 mc transceivers three frequencies, 12 volt, 15 watts output from 5894 tripler and 5894 amplifier. Complete with all tubes, accessories to put receiver on 432.9 mc. Five pages of information. $28.85. Same rig, but may need minor repairs $17.50. Less 5894's and accessories $5.50 each. 5894's checked and guaranteed $6.50 each. Manuals for 432 mc rigs $2. Motorola T44A6A, all tubes and accessories, $50.00. Motorola 41V front mount, 12 volt operating on 146.94 mc. Excellent complete, $95.00. Motorola Handie-Talkie on 146.94 (FHTRU1VDL) with batteries and operating, $65. Motorola transistorized 136-174 mc pocket receiver (17 transistors) with one watt pocket transmitter (2 transistors, 8 tubes, vibrasender) HO3ANC-XH23NAC, fully narrow banded, excellent condition, $125. Motorola 150 mc base station (desktop) $95. Motorola 150 mc, 250 mc output transmitter complete (will not ship this one) $150.00. Also Motorola T43-GGV-1. Wanted: Wheatstone Perforator, lab type test equipment-HP, GR, etc. two way equipment, Motorola, GE, etc. All items shipped FOB Trenton. Ray Newsome K8TJP, 2670 Pinetree, Trenton, Michigan 48183. Phone 313 -676-7460.

HARS HAMFEST in Rowlett Park, Sunday October 17. Lots of prizes, swap tables, free lunch. Plenty of free parking. P.O. Box 8373, Tampa, Fla.

GREATER BAY AREA HAMFEST, Peacock Gap Country Club, San Rafael, Cal. October 16 and 17. More information from WA6QVS, P.O. Box 113, Hayward, Calif.

WE WILL PAY CASH. Wanted-popular, late model unmodified amateur equipment. Highest prices paid for clean, good, operating gear. Write Graham Radio, Dept. 10, Reading, Mass.

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INDEX TO ADVERTISERS

Alco, 125
Alltronics-Howard, 124
American Crystal, 116
Amperex, 20-21
Amrad, 124
Arrow Sales, 121
ATV Research, 73
BC Electronics, 124
Budwig, 118
Burghardt, 82, 83, 86, 87
Callbook, 32, 59
Cush Craft, 36-37
Design Industries, 3, 33
Diw Key, 128
Dow Trading, 121
Editors and Engineers, 43
Edwards, 74-75
Ell-Conn, 124
Electro Voice, 4-5
Evans, 95
Fair, 123
Finney, 15
Freck, 78-79
Fugle, 123
Gift Shop, 120
Goodheart, 127
Govt. Warehouse, 123
Harvey, 57
Heath, 16-17
Henry, 45, 99
Int. Crystal, Cover II
Invertronics, 121
Jefftronics, 118
Liberty, 107
Maxim, 119
Meshna, 113
Mission, 70-71
Mosley, 51
National, Cover IV
Newtronics, 64-67
Parks, 122
Poly Paks, 103
Quement, 90, 91, 118, 119, 122
Rohn, 69
Selectronics, 114-115
Selectronix, 89
SIRDC, 77
Space, 120
Swan, Cover II
TAB, 129
Telco, 51
Telrex, 41
Texas Crystals, 55
Transcom, 24-25
Tuck, 85
TUCO, 125
Two Way, 120
Unadilla, 116
Vanguard, 49
VHF Antenna Book, 116
VHF'er, 123
Waters, 28-29
Western, 125
WRL, 60-61, 130
73 Books, 117
73 Subscriptions, 72

Propagation Chart

October 1965

J. H. Nelson

EASTERN UNITED STATES TO:

GMT →	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7*	7	7	7	7	7	7#	14	14	14	14
ARGENTINA	14	7	7	7	7	7#	14	21	21	21	21*	21
AUSTRALIA	14	7#	7#	7#	7#	7	7	14	14	14	14	21
CANAL ZONE	14	7	7	7	7	7	14	21	21	21	21*	21
ENGLAND	7	7	7	7	7	14	14	14	14	14	14	14
HAWAII	14	7*	7	7	7	7	7	7#	14	14	14*	14
INDIA	7	7	7#	7#	7#	7#	14	14	14	14	7#	7
JAPAN	14	7#	7#	7#	7#	7	7	7	7#	7#	14	14
MEXICO	14	7	7	7	7	7	14	14	14	14	21	21
PHILIPPINES	14	7#	7#	7#	7#	7#	7	14	14	7#	7#	14
PUERTO RICO	7	7	7	7	7	7	14	14	14	14	14*	14
SOUTH AFRICA	14	7	7	7#	7#	14	14	21	21	21	21	14
U S S R	7	7	7	7	7#	7#	14	14	14	14	7#	7
WEST COAST	14	14	7	7	7	7	7	14	14	14*	14*	14

CENTRAL UNITED STATES TO:

GMT →	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	14	7#	7	7	7	7#	14	21	21	21	21	21*
AUSTRALIA	21	14	7#	7#	7#	7	7	14	14	14	21	21
CANAL ZONE	14	7	7	7	7	7	14	21	21	21	21*	21
ENGLAND	7#	7	7	7	7	7#	7#	14	14	14	14	7#
HAWAII	14	14	7	7	7	7	7	7#	14	14	21	21
INDIA	7	7#	7#	7#	7#	7#	7#	14	14	14	7#	7
JAPAN	14	14	7#	7#	7#	7	7	7	7#	7#	14	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14	14*
PHILIPPINES	14	14	7#	7#	7#	7#	7	7	14	7#	7#	14
PUERTO RICO	14	7	7	7	7	7	14	14	14	21	21	21
SOUTH AFRICA	14	7	7	7#	7#	7#	14	14	14*	14*	21	14
U S S R	7	7	7	7	7#	7#	7#	14	14	14	7#	7#

WESTERN UNITED STATES TO:

GMT →	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	21	7#	7#	7	7	7	7#	14	21	21	21	21*
AUSTRALIA	21	21	14	7#	7#	7	7	7	14	14	21	21
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	21
ENGLAND	7#	7	7	7	7	7#	7#	14	14	14	14	7#
HAWAII	21	21	14	7	7	7	7	7	14	21	21	21
INDIA	14	14	7#	7#	7#	7#	7#	7	14	14	14	14
JAPAN	14	14	14	7#	7#	7	7	7	7	7#	14	14
MEXICO	14	7	7	7	7	7	7	14	14	14	14	21
PHILIPPINES	14	14	14	7#	7#	7#	7	7	14	7#	7#	14
PUERTO RICO	14	7	7	7	7	7	7#	14	14	14	21	21
SOUTH AFRICA	14	14	7	7#	7#	7#	7#	14	14	14*	14*	14
U.S.S.R.	7#	7	7	7	7#	7#	7#	7#	14	14	7#	7#
EAST COAST	14	14	7	7	7	7	7	14	14	14*	14*	14

Very difficult circuit this hour.

* Next higher frequency may be useful this hour.

Good: 1, 2, 6-10, 15, 16, 18, 19, 24-26

Fair: 3-5, 10-14, 17, 20, 23, 27-30

Poor: 21, 22, 31

VHF DX: 1, 9, 15, 26-30

"TAB" • TRANSISTORS • DIODES!!
GTD! FACTORY TESTED — FULL LEADS.

PNP 100Watt/15Amp HiPower TO36 Case! 2N441, 442, 277, 278, DS501 up to 50 Volts/VCBO $1.25 @. 5 for $5. 2N278, 443, 174 up to 80V $3 @. 2 for $5.

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PNP 2N670/300Mw 35c @. 4 for $1
PNP 2N671/1Watt 50c @. 3 for $1

PNP 25W/TO 2N538, 539, 540, 2 for $1
2N1038 6/$1, 1039 4/$1, 1040 .$1
PNP/TO5 SIGNAL 350Mw 25c @. 5/$1
NPN/TO5 SIGNAL IF, RF, OSC 25c @. 6 for $1

Silicon PNP/TO5 & TO18 25c @. 5 for $1
2N1046/$1.40 @. 3/$4. 2N1907/$2@. 4/$6
Power Heat Sink Finned Equal to 100 Sq" Surface $1 @. 6 for $5
TO36, TO3, TO10 Mica Mtg 30c @. 4/$1
Diode Power Stud Mica Mtg 30c @. 4/$1

ZENERS 1Watt 6 to 200v 70c @. 3/$2
ZENERS 10Watt 6 to 150v $1.45 @. 4/$5
ZENER Kit Asstd up to 10w 3 for $1
STABISTORS up to 1watt 5 for $1

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Untested Pwr Diamonds/TO3 10 for $1
Untested TO36 up to 100Watts 3 for $1
Untested TO5/SIGNAL/sistors, 20 for $1
Untested Power Diodes 35 Amp 4 for $1
Untested Pwr Studs up to 12Amp 12 for $1

D.C. Power Supply 115v/60 to 800 Cys. Output 330 : Tap 165V up to 150Ma. Cased $5@. 2 for $9

SILICON POWER DIODES • STUDS

DC AMP	50Piv 35Rms	100Piv 70Rms	150Piv 105Rms	200Piv 140Rms
3	.08	.14	.17	.24
12	.30	.55	.70	.85
18*	.20	.30	.50	.75
35	.70	1.00	1.50	2.00
100	1.65	2.05	2.50	3.15
240	3.75	4.75	5.75	8.75

DC AMP	300Piv 210Rms	400Piv 280Rms	500Piv 350Rms	600Piv 420Rms
3	.29	.30	.40	.48
12	1.00	1.35	1.45	1.70
18*	1.00	1.50	Query	Query
35	2.15	2.45	2.75	3.33
100	3.75	4.60	5.50	8.00
240	11.70	17.10	23.94	29.70

*P.F. PRESS-FIT AUTOMOTIVE TYPE!

18 Amp Press Fit up to 200Piv 4/$1
2 to 3 Amp Studs up to 600Piv 6/$1
35 Amp Studs 150 to 200Piv 5 for $5

"TAB" • SILICON 750MA DIODES
NEWEST TYPE! LOW LEAKAGE

Piv/Rms	Piv/Rms	Piv/Rms	Piv/Rms
50/35 .05	100/70 .09	200/140 .12	300/210 .14
400/280 .15	500/350 .19	600/420 .23	700/490 .27
800/560 .35	900/630 .45	1000/700 .65	1100/770 .75

GTD ALL TESTS AC/DC & LOAD!

1700 Piv/1200 Rms/750 Ma/$1.20 @. 10/$10
Same 1100 Piv/770 Rms 75c @. 16/$11
3 Kv/2100 Rms/200 Ma/$1.80 @. 6/$10
6 Kv/4200 Rms/200 Ma/$4 @. 3/$9
12 KV/8400 Rms/200 Ma $8 @. 2/$14

SCR—SILICON CONTROL RECTIFIERS!

PRV	7A	16A	PRV	7A	16A
25	.60	1.00	250	2.70	3.00
50	1.00	1.35	300	3.00	3.45
100	1.50	2.15	400	3.75	3.90
150	1.95	2.45	500	4.75	4.80
200	2.20	2.80	600	5.45	5.65

UNTESTED "SCR" Up to 25 Amps, 6/$2
Glass Diodes 1N34, 48, 60, 64, 20 for $1

Two RCA 2N408 & Two Regulators RCA 1N2326 on prtd ckt. 30c @. 4/$1

"TAB" THAT'S A BUY

"TAB" Tubes Factory Tested, Inspctd. Six Months Guaranteed! No Rejects! Boxed! GOVT & MFGRS Surplus! new & Used

Low Prices! New XMTTG Tubes!

4-65A	$7.00	4X150A	$6.75	0B2	.55
4-125A	15.00	826	Query	5R4WGA	3.50
4-400A	25.00	829B	7.20	24G	Query
4-1000A	75.00	872A	3.50		
		0A2	.65		

We Swap Tubes! What Do/U Have?

0A3	.80	5R4	1.00	6F7	.99
0C3	.70	5T4	.90	6F8	1.39
0D3	.59	5V4	.89	6H6	.59
0Z4	.79	5Z3	.89	6J5	.59
1L4	.82	6A7	1.00	6J6	.59
1R4	5/$1	6A8	.99	6K6	.59
1S4	.78	6AB4	.59	6L6	1.19
1S5	.68	6AC7	.72	6SN7	.72

Send 25c for Catalog!

1T4	.85	6AG5	.65	6V6GT	.90
1T5	.95	6AG7	.75	12AU7	.69
1U4	6/$1	6AK5	.69	12A6	.45
1U5	.75	6AL5	.55	25L6	.72
2C39A	Q	6AQ5	.66	25T	4.00
2C40	5.50	6AR6	1.95	28D7	.89
2C43	6.50	6AS7	3.49	50L6	.59
2C51	2.00	6AT6	2/$1	83V	.95

We Buy!		We Sell!		We Trade!	
2D21	.65	6BA6	.59	250TL	19.45
2K25	9.75	6BE6	.59	VR92	5/$1
2K28	30.00	6BK7	.99	388A	3/$1
2V3	2/$1	6BQ6	1.19	416B	16.00
2X2	.48	6BY5	1.19	450TL	43.00
4X250B	30.00	6BZ6	.91	813	9.95
5BP4	7.95	6C4	.45	815	1.75

Top $$$ Paid for All Tubes!

"VOLT-TAB" 600Watt Speed Control 115VAC $4.50 @. 2 for $8

866A Xfmr 2.5V/10A/10Kv/Insl $3 @
Ballentine #300 AC/Lab Mtr. $54
(Sd) Choke 4Hy/0.5A/27Ω $40 @. 2/$6
"VARIACS" L/N 0-135v/7.5A $15
"VARIACS" L/N 0-135v/3A $10
TWO 866A's & Fil. Xfmr. $6

SILICON TUBE REPLACEMENTS
0Z4 UNIVERSAL $1.75 @. 2/$3
5U4 1120Rms/1600Inv $2 @. 3/$5
5R4 1900Rms/2800Inv $9 @. 2/$15
866 5Kv/Rms - 10.4Kv Inv $11 @. 2/$20

Mica Condsr .006 @ 2500V 4/$1
Snooperscope Tube 2" $5 @. 2/$9
Mini-Fan 6 or 12Vac/60Cys $2 @. 3/$5
4X150 Ceramic Loktal $1.25 @. 2/$2
Line Filter
Line Filter 50Amp/250VAC $10 @. 2/$16

DC 3½"/Meter/RD/800Ma $4 @. 2/$7
DC 2½" Meter/RD/100Ma $3 @
DC 2½" Meter/RD/30VDC $3 @. 2/$5
AC 3½" Meter/RD/130VOC $5 @. 2/$9
DC 4" Meter/RD/1Ma/$5 @. 2/$9

Battery Charger 6&12V Charges up to 5Amp "Approved" Heavy Duty Design with Klixon Circuit Breaker. Operates 220 or 110VAC @ 50 or 60 Cys $8. 2 for $15. 7/$49

Transformers—All Input 115v/60Cys VCT @ 250Ma. 6V/8A/5A/3A $6. 2/$10
400VDC Supply @ 200MA & Silicon Rect & Filters $10
20VAC & TAPS/.8,12,16. 20V @ 4A. $3
32VCT/1A or 2X16V @ 1A. $8 @. $2/$5

Line Filter 4.5A @ 115VAC 4 for $1
Line Filter 5A @ 125VAC 2 for $1
Converter Filter 400 Ma @ 28VDC 4 for $1
Converter Filter Input/3A @ 30VDC 4/$1
2.5MH PiWound Choke/National 5 for $1

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Kit 65 Tubular Condensers
Kit 500 Lugs & Eyelets
Kit 10 Bathtub Oil Cond's.
Kit 5 lbs. Surprise Package
Kit 10 Transmit Mica Cond's.
Kit 3 Phone/Patch Xfmrs
Kit 10 Insltd Tuning Tools
Kit 6 "SunCells" Battys
Kit 10 Sub-Min Tubes
Kit 12 Alligator Clips Asstd
Kit (6) Tube Clamps Asstd
Kit (32) Transistors PNP & NPN
Kit (12) 2Amp Stud Rectifiers
Kit 75 Mica Condensers
Kit 10 Crystal Diodes
Kit 200ft Hook Up Wire
Kit 4 Rolls, 500ft/ea. Assorted Color
Kit 5 FT243 Xtal Holders
Kit 10 Xtal Osc. Blanks
Kit 4 Asstd Rectifiers
Kit 100 Self/Tap Screws
Kit Adj Wire Striper & Cut
Kit Hi Gain Xtal Mike
Kit 2 pair SO239 & PL59
Kit 12 Binding Posts Asstd
Kit (3) TO36/50Watt Untested
Kit (50) TOPHAT 3/4A/Diodes Untested
Kit (12) TO3/3A Transistors Untested
Kit (4) PF/PressFit 18Amp Studs

Order Ten (10) Kits—We Ship Eleven

One Each Above Kit Only. Each Kit 99c

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Toroids 88Mhy New Pckg $1 @. 6/$5
6.3VCT @ 15.5A & 6.3VCT @ 2A $4 @. 2/$6
200KC Freq Std Xtals $2 @. 2/$3
Printed Ckt Bd New Blank 9x12" $1 @. 6/$5
Klixon 5A Reset Ckt Breaker $1 @. 3/$5
2K to 8K Headsets Good Used $3 @. 2/$5
Xtal Blanks Asst Types 12 for $1

WANTED TEST SETS & EQUIPMENT

Bandswitch Ceramic 500W 2P/6Pos $3 @. 2 for $5
6Hy-305Ma Choke Cased $3 @. 2/$5
7-½Hy-400Ma Choke Cased $7 @. 2/$12
250Mfd @ 450 Wv Lectlytic 4/SSB $3 @. 4/$10
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Cndsr Oil 6Mfd @ 1500V $4 @. 4/$10
880Vct @ 735Ma for SSB $9 @. 2/$16
480Vct @ 40Ma & 6.3 @ 1.5A CSD $1.50 @. 4/$5
10Vct @ 5A & 7.5Vct @ 3A CSD $6 @. 2 for $10

WANTED LAB METERS! BRIDGES! K-POTS!

Pwr Sup Kit 900VDC @ 500Ma & 4/Silicon Diodes 1700Piv FWB $12
Pwr Sup Kit 1200VDC @ 200Ma/Xfmr & FWB Silicon Rect $10 @. 2 for $18
Modulation Xfmr 60W/15K to 5.7K $5
Headset Rubber Bunyon Pads pair $1
Socket Ceramic 1625 Tube 4/$1
Socket Ceramic 866 Tube 4/$1
Socket Ceramic 4X150/Loktal 4/$2

WANTED YOUR - ORDER - TODAY!

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XMTTG Mica Cndsr .00025 @ 8Kv 75c @. 4/$2
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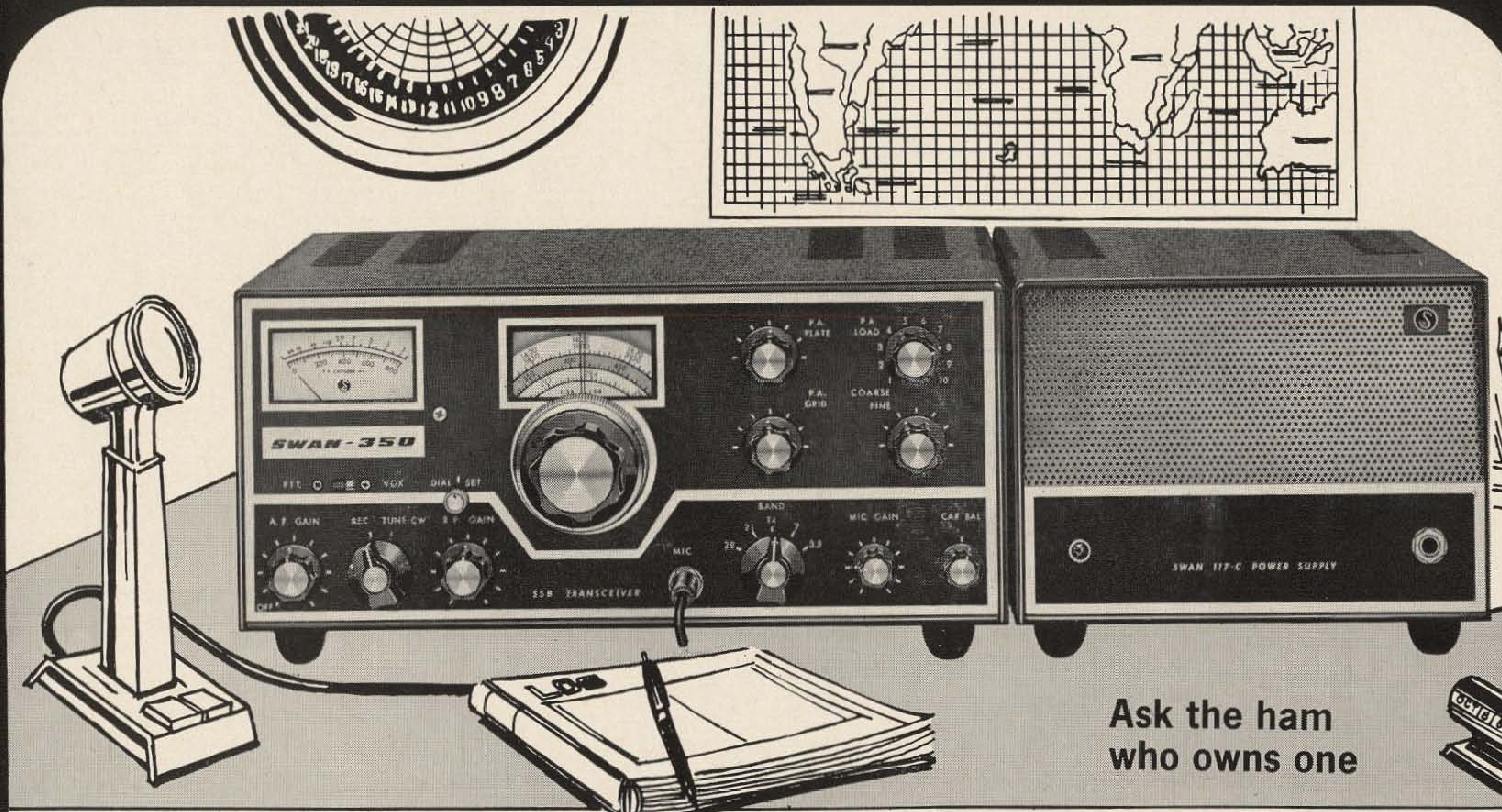

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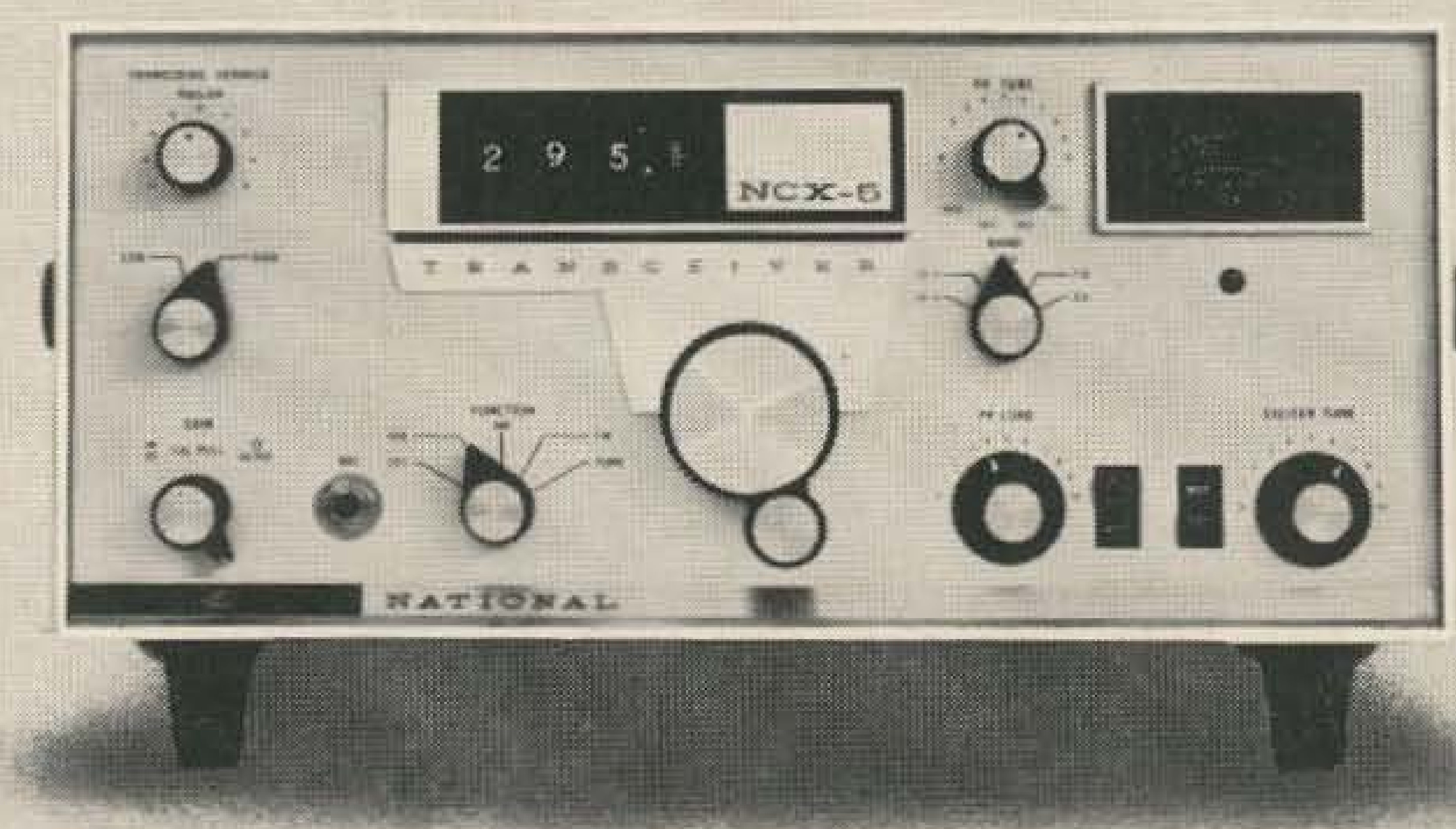

improved

One thinks long and hard before making a change in a rig like the NCX-5 — after all, it has proven itself as the finest transceiver ever offered the amateur at any price. But we have designed a new balanced modulator circuit which offers such high performance that we felt it should be incorporated in new NCX-5 production. The new balanced modulator is a solid state ring-type device which is totally unaffected by external or magnetic influences, on-off cycling, aging, or warm-up time. Minimum carrier suppression is 50 db through all of these variables, and typically can be adjusted to provide even 65 or 70 db! In fact, the circuit cannot be unbalanced far enough, using the carrier balance control, to provide sufficient carrier for AM or CW operation of the NCX-5. We therefore replaced the carrier balance control with a new Carrier Insertion control to provide a gradual increase in carrier as the control is turned clockwise. Carrier is also now inserted automatically in the AM or CW positions of the NCX-5 mode switch. "Carrier balance" has become an internal factory adjustment which need never be touched.

The new NCX-5 is designated Mark II, and is identical in appearance to previous units. The superb dial calibration, stability, selectivity, and all other maximum performance features of the NCX-5 are, of course, unchanged (including the remarkable price of only $685).

When we make performance improvements during production we try to make certain that owners of earlier units can similarly improve their equipment, if they wish. So our Customer Service Department has a Mark II kit available for satisfied NCX-5 owners so that they can become satisfied NCX-5 Mark II owners. The NCX-5 is the finest transceiver on the amateur market, proven in operation by amateurs the world over. The Mark II NCX-5 is even better.

NATIONAL RADIO COMPANY, INC.

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