73

Amateur Radio

February 1961

37¢

2 for 73¢

Gonset does it again!

Communicator IV for 220 mcs!

220 mc.

Now . . . another important "first" . . this time the first complete commercially-produced "package" operating on the amateur 220 megacycle band!

Here is no micro-power peanut whistle! An input power of 20 watts—**substantial** for VHF—capable of a man-sized signal. "Big ears" also—real ability to copy the weak ones—a sensitive, triple conversion receiver with a very good noise figure. This is 2-way equipment of the highest quality built for effective **communications** on an amateur band with great potential . . . "one-and-a-quarter-meters" . . . 220-225 megacycles.

This new model features a triple-conversion receiver which is continuously tunable over the frequency range of 219.7 to 225.3 mcs. In order to comply with OCDM requirements, additional provision is made for spot frequency reception on one crystal controlled frequency. Receiver sensitivity is 1 microvolt for 10 db signal-plus-noise to noise ratio. Noise figure of 3-5 db is exceptional for equipment of this general type.

Transmitter is crystal controlled, offers choice of six frequencies. (Required crystals are within the range of 8.148 to 8.333 mcs.) Power input to PA is 20 watts (power output approximately 10 watts), amplitude modulated by P-P 6BQ5's operating in Class AB-1. High-level speech clipping and audio shaping are incorporated.

All the many convenient features for fixed and mobile operation incorporated in the 2-meter Communicator IV are retained. The same, easily-carried, highly compact housing, the built-in 2-way power supply for 117V AC and 12V DC—the latter with transistorized power supply. A flexible, snap-back handle on one face of the housing facilitates carrying. Available universal bracket kit allows simple under-dash vehicular mounting.

Communicator IV-220 . . . . #3351 . . . . . 394 50

(Less microphone, crystals.)

CIVIL DEFENSE KIT Communicator IV-220 will meet OCDM requirements and will qualify for matching funds when supplied with #3361 CD kit. Latter consists of yellow-color canvas carrying case, telescoping antenna, C-D decal and crystal certificate.

GONSET *Division of Young Spring & Wire Corporation*

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New Climaster ZEUS TRANSMITTER

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175 WATTS

AM—CW

50 MC-54 MC   144 MC-148 MC

. . . with Automatic Modulation Control to outperform even many kilowatt rigs

(3.5 MC-30 MC and 220 MC adapters available soon)

GUARANTEED to outperform any other commercially available amateur VHF Transmitter

Note some of the many features found only in this outstanding new VHF Transmitter:

- High Level Plate and Screen Modulation
- Highly Efficient Type 7034 Final Amplifier
- Self-Contained Stable VFO
- Built-In Automatic Modulation Control
- Simple Band Switching and Tune-Up
- Two Unit Construction with Remote Modulator and Power Supply Conserves Space at Operating Position
- Attractive Styling

Amateur Net Price: Only **$559.** Completely wired and tested with all tubes, Modulator, Power Supply, VFO, cables, etc.

Coming Soon- Matching VHF RECEIVER!

Clegg LABORATORIES

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BULLSEYE BUYS at ARROW!

MOD. HT-40 HALLIKIT TRANSMITTER

Band Coverage: 80, 40, 20, 15, 10 and 6 meters
Output: 35 w. CW, 30 w. peak AM phone
Features: TVI filter, XTAL VFO, grid current meter RF output and AC on/off indicator

HT-40 Kit complete with tubes **79.95**
HT-40 wired and tested **99.95**

MOD. SX-140 HALLIKIT RECEIVER

Features: Covers all bands, 80 through 6 meters; tuning ratio, 25:1; high sensitivity; sharp notch selectivity.

Controls: Tuning, antenna trimmer, cal. reset, function (AC off, standby, AM, CW-SSB), band selector, cal. on-off, RF gain, noise limiter, selectivity/BFO, audio gain, phone jack, S-meter adjust.

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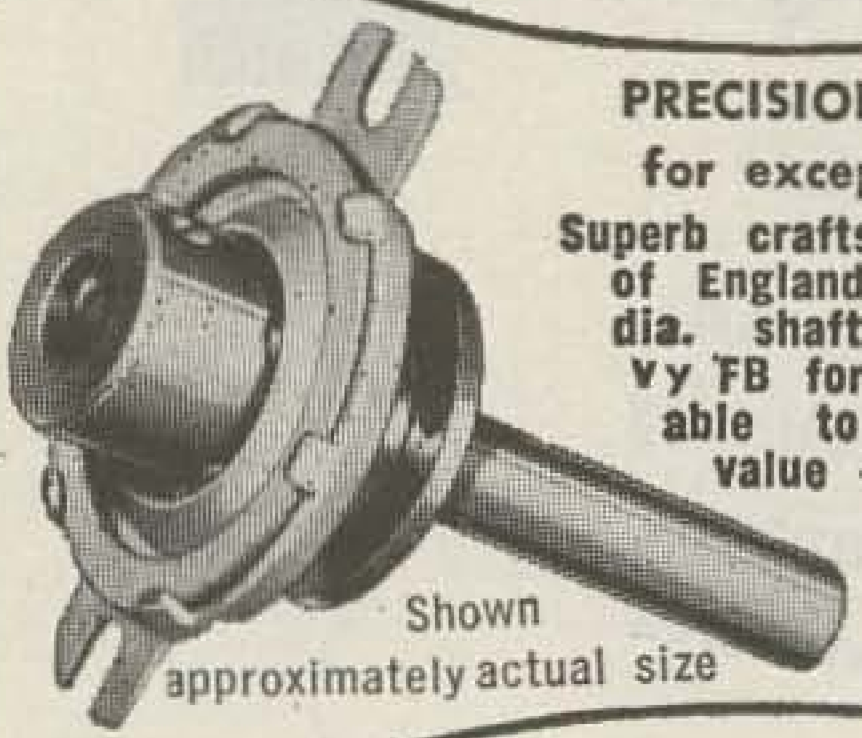
PRECISION PLANETARY-VERNIER



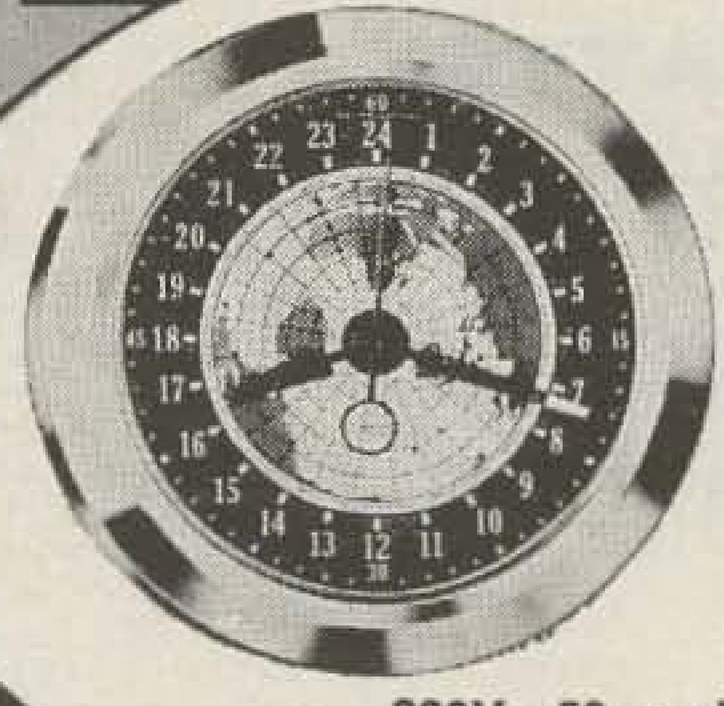
for exceptionally fine tuning

Superb craftsmanship by Jackson Bros. of England. Ball bearing drive, 1/4" dia. shaft, 1⅛" long, 6:1 ratio, vy FB for fine tuning. Easily adaptable to any shaft. Comparable value — $5.95.

Amateur Net $1.50 ea.
10 for $13.50

Shown approximately actual size

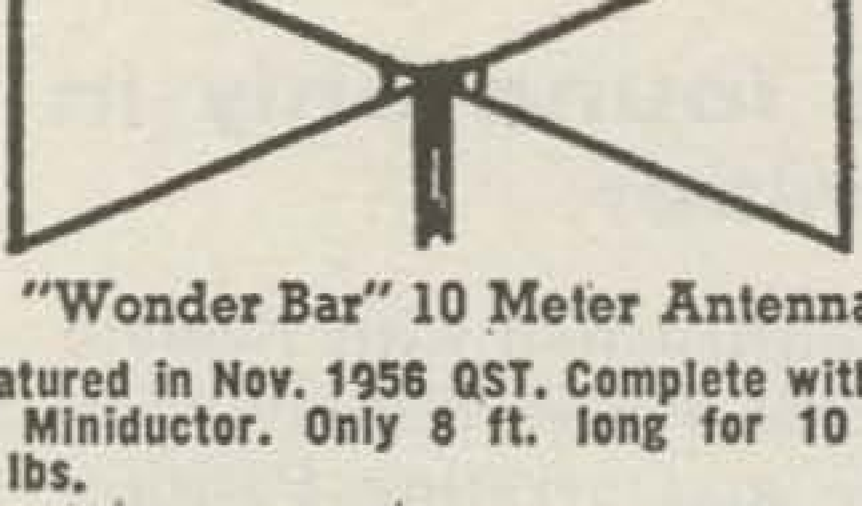
24 HOUR CLOCK



24 hr. chrome plated 8" metal wall clock. Inner dial with south polar projection map of world indicates time around world. Polar projection dial adjustable for various time zones. Shpg. wt. 2 lbs.

Amateur net $8.47 tax inc.

220V. 50 cycle model............9.95



"Wonder Bar" 10 Meter Antenna

As featured in Nov. 1956 QST. Complete with B & W 3013 Miniductor. Only 8 ft. long for 10 meters. Wt. 5 lbs.

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COMANCHE SIGN

Controllable, illuminated sign that tells the XYL and guests you're transmitting. Cuts down background QRM. Can hook right into coil of antenna change-over relay for controlled "ON THE AIR" signal when XMTG. Heavy gauge all steel construction with handsome black or gray baked finish. Can be used on desk or tabletop or mounted directly on wall. Dimensions 10½" long x 3½" high x 3" deep. Specify desired finish in black or gray and operating voltage: 6 or 12 VDC, or 110 AC.

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Same as used in W2EWL SSB Rig — March 1956 QST. Three sets of CT windings for a combination of impedances: 600 ohms, 5200 ohms, 22000 ohms. (By using center-taps the impedances are quartered.) The ideal transformer for a SSB transmitter. Other uses: interstage, transistor, high impedance choke, line to grid or plate, etc. Size only 2" h. x ¾" w. x ¾" d. New and fully shielded.

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SAY! YOU SAW IT IN 73

73 Magazine
1379 East 15th Street
Brooklyn 30, N. Y.

February, 1961
Vol. 1, No. 5

Table of Contents

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COVER: Circuit diagram of the Central 200V transmitter. We finally got an advertised product on the cover!

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Check these all New features . . . New and improved circuit for increased gain . . . New internal jumper for positive and negative grounds . . . New RF amplifier, mixer/oscillator . . . New separate input for broadcast and short wave antennas . . . Mounting bracket for under dash installation.

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for mobile short wave reception

Write for International's complete catalog of precision radio crystals, and quality electronic equipment—yours for the asking.

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Designed for 12 vdc, MOBILETTE 61 will operate on 6 vdc at reduced output. Power connector plugs into cigarette lighter socket.

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Complete $49.50

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See the Mobilette 61 at your dealer today!

Complete, ready to plug in and operate . . . . only $22.95

**Special frequencies 2 MC -50 MC .... only $25.95*

...de W2NSD

Bootlegging

Cheating is a tried and proven method of getting things that you don't want to bother to work for, so why should I make a big fuss because a few of the guys "fix up" a Technician test for someone? What's the harm? Who does it actually hurt? Isn't it better to forget about it and not wash our dirty linen in public?

Nuts! If you'd give it a little thought you'd see what a terrible long range effect this creeping prostitution of our hobby will have.

Have you ever stopped to think what it is that makes ham radio so different from every other hobby? After you get through with a lot of hemming and hawing you will recognize that it is the fraternal spirit that makes it so enjoyable. And where does this spirit come from? I believe that it stems from a common love of radio. Perhaps "love" is a bit strong for you, but how else can you describe the driving force that makes you spend a good portion of your life in such a highly technical pursuit?

It takes "love" to keep you up all night working DX or to get you to brave high winds and freezing snow to operate from a mountaintop during a VHF contest. It takes "love" to send 2000 messages a month over the nets. How else do you explain the thousands of unbelievable feats that make up amateur history every month?

When you meet someone else who shares your love you feel a rapport . . . we call it "fraternity." After experiencing this a few hundred times we get conditioned to accepting all amateurs as members of our fraternity. We accept them immediately as friends.

But what about the chap who doesn't have this love? How do we feel when we meet someone who has never cared enough about our hobby to learn the basics? We try to experience the usual rapport and we meet a cold rebuff. I was so shocked the first time that I ran into this in quantity that I didn't know what had happened. I felt shattered. What had happened to ham radio? I was among strangers.

As you know, I get to almost every large hamfest and convention that is put on. I go to sell subscriptions, to talk with as many people as possible and thus get ideas for the magazine, to promote more good articles, etc. After several years of this I have a pretty good idea what it feels like to talk and be with fellow hams.

Then recently I went to a VHF picnic. There I was rudely introduced to a new breed of "ham," the smirking Technician who arrogantly admits that he doesn't know anything about radio and doesn't want to know anything. He doesn't read the ham magazines because they are all too technical for him.

Somehow or other we have gotten a few amateurs into our hobby who have been giving these chaps their licenses. I mean *giving*, not adminstering. Every time this happens we turn loose a monster in our hobby who will permanently break for many amateurs the delicate rapport that makes our hobby so different.

What's to be done? For one thing you can take the bull by the horns when you run into an obvious bootlegger who has cheated to get a ticket. A note to the local FCC office suggesting that this joker be called in for a supervised test will probably bring a letter requesting him to come in in thirty days for retesting. Then he will have to buckle down and learn the necessaries or be exposed.

I'd like to see some changes in our regulations which would make this situation more unlikely. For instance, if it were required that three licensed amateurs be present for the exam there would be only a small fraction of the present difficulty. This would, in general, encourage clubs to give license exams and would help build up club activity. Bootleg Technicians don't go in much for clubs, it's too easy to get found out that way.

Another big step forward would be a drastic cut in that 30 day grace period that the FCC allows suspected cheaters, plus revocation of the license of the amateur who signed the test.

Lest there be a general rustling among the Technician ranks, let me point out that all this is about *bootleg* Techs, not honest ones. I have the greatest admiration for the job of developing the VHF and UHF frequencies that is being done by our Tech licensees.

Survey

Well, the Fearless Survey is now four months old and we haven't lost a scrimage yet. Every month since the inception of 73 we **have had more pages of technical and consruction articles than either of the other two ham magazines. Let's review the box score.**

	73 Magazine	Brand X	Brand Y
October 1960...	46 pages	37 pages	26 pages
November 1960.	38 pages	33 pages	35 pages
December 1960.	33 pages	28 pages	23 pages
January 1961...	39 pages	35 pages	30 pages

We've proven our point, so we'll shut up about the whole thing for a while.

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NEW FEATURES IN THE 200V

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NEW! Smooth as silk two speed tuning knob with 5 KC per turn vernier tuning ratio.

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ADJUSTABLE POWER OUTPUT control. 2" MONITORING SCOPE.

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GET THE MOST OUT OF YOUR HAM STATION

W2RID

SHORTWAVE PROPAGATION *by Stanley Leinwoll (Radio Frequency & Propagation Mgr.—Radio Free Europe).* Of special interest to those concerned with radiocommunications. This review in QST (May 1960) sums up the book's vital interest to all amateurs:

". . . written at just the right level for the amateur interested in ionospheric propagation . . . . There is . . . background material—necessary for an understanding of the subject—on the ionosphere, on radio waves, on sunspots and the sunspot cycle, all treated in language that is easy to follow. The section on ionosphere measurements introduces the ideas that are important to the detailed understanding of ionospheric propagation, leading to the use of ionospheric charts and predictions for the determination of maximum usable frequencies and optimum working frequencies. The calculation procedure for distances shorter than the maximum one-hop, generally neglected in amateur literature, is also included.

Of special interest to QST readers are chapters on amateur contributions to knowledge of wave propagation and a forecast—advanced with admitted caution!—of probable amateur-band conditions during the coming sunspot cycle. Throughout the book the reader is introduced to various interesting aspects of propagation: one-way skip, for example, scatter, meteors, auroral effects — all the things that hams continually encounter in everyday operation. It would be hard to find a question about propagation in the 3-30 Mc. region — at least the type of question that an amateur would ask—that isn't covered somewhere in this book, even if only (of necessity) by the statement that the answer hasn't yet been discovered." #231, **$3.90.**

HOW TO USE GRID-DIP OSCILLATORS *by Rufus P. Turner K6AI.* The first book ever devoted entirely to grid-dip oscillators tells you how to construct and use this very versatile instrument with best possible results. It is applicable to all kinds of radio receivers and transmitters, also to television receivers. The grid-dip oscillator is a troubleshooting device—an adjusting device—a frequency measuring device—applicable to circuits and components in circuits—to antennas; also a signal source of variable frequency. #245, **$2.50.**

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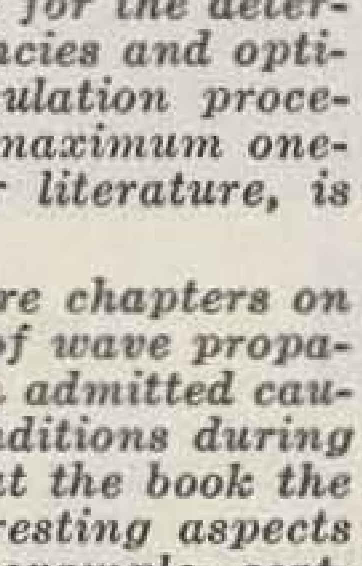

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Attend the 10th Annual Single Sideband Dinner March 21st . . . Statler Hilton, New York City

Phoenix in May

The Phoenixians are hosting a major gathering of the clan this May. The event will be held under the formal name of the Southwestern Division ARRL Convention. No wagon wheel (see photo) will be left unturned to make this an outstanding weekend. Of course all will not be joy and sunshine . . . the angry editor of 73 will be there just in case any non-subscribers dare to show their faces.

Mrs. Sidney Peebles K7NOJ of Phoenix, Arizona, on her way to the fabulous Convention in Phoenix on May 26, 1961. Note Communicator in the English Governess Cart with her

December Feedback

The votes are in for December and the big winner is a stranger to our pages: Jim Kyle K5JKX/6. Jim also made third place with his second article. Quite a performance! When you consider that he won first place in the October 73, second place in November (he later pulled into first place, but the votes had been tallied and the results printed) and is doing very well in the January issue with his "Lost in a Tunnel" article, you can see that he is riding high. Second place in December, by only one vote, was the ZL1AAX Low Noise Two Meter Converter. All articles in the issue received votes in the first five places! K8ERV's Capacity Meter came in fourth and W3HIX's 220 mc Transistorized Converter right behind it in fifth place. All were very close together though and a few votes would have changed things completely. How about your vote for this issue? See page 51.

Short Wave Listening

Those of you whose literary horizons extend a shade beyond the ham magazines may have noticed ads in many popular magazines by the Hallicrafter's Company offering a record about short wave listening for 25¢.

(Continued on page 49)

★ WANTED ★

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6 to 80 meter TRANSMITTER by AMATEURS EVERYWHERE for

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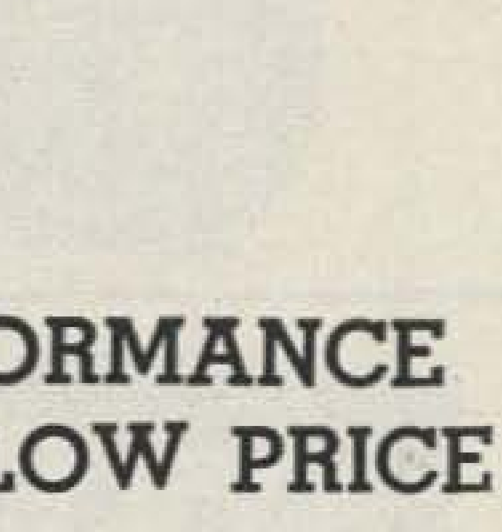

Send me the FREE Lafayette 324 page 1961 catalog 610

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that meets FCC regulations*

*EICO premounts, prewires, pretunes, and seals the ENTIRE transmitter oscillator circuit to conform with FCC regulations (Section 19.71 subdivision d). EICO thus gives you the transceiver in kit form that you can build and put on the air without the supervision of a Commercial Radio-Telephone Licensee!

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incl. mtg. bracket (Pat. Pend.)
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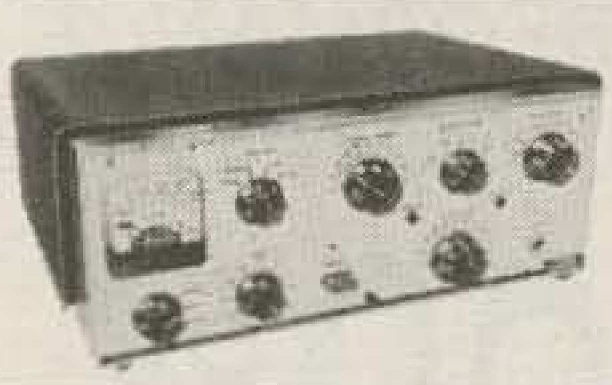
Kit $49.95 Wired $79.95
Ideal for novice or advanced ham needing low-power, stand-by rig. 60W CW, 50W external plate modulation. 80 through 10 meters.



90-WATT CW TRANSMITTER*
#720 Kit $79.95 Wired $119.95
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"Top quality" — ELECTRONIC KITS GUIDE. Ideal for veteran or novice. 90W CW, 65W external plate modulation. 80 through 10 meters.

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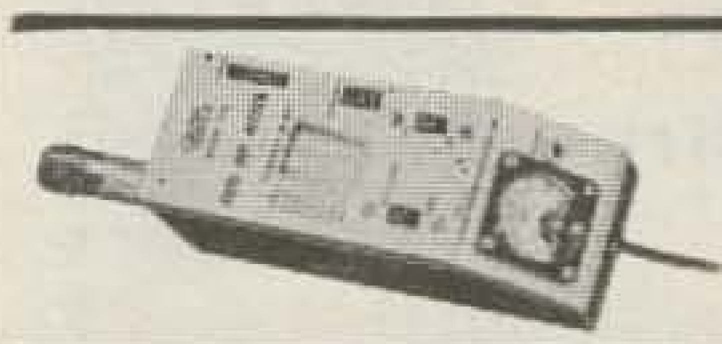

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Kit $29.95 Wired $49.95
Includes complete set of coils for full band coverage. Continuous coverage 400 kc to 250 mc. 500 ua meter.

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Kit $29.95 Wired $49.95
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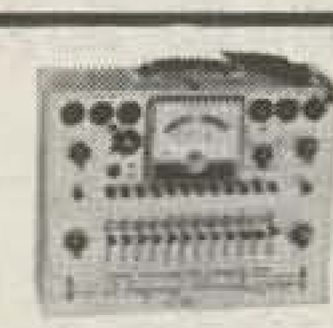
RF SIGNAL GENERATOR #324
(150kc-435mc)
Kit $26.95 Wired $39.95

TV-FM SWEEP GENERATOR & MARKER #368
Kit $69.95 Wired $119.95



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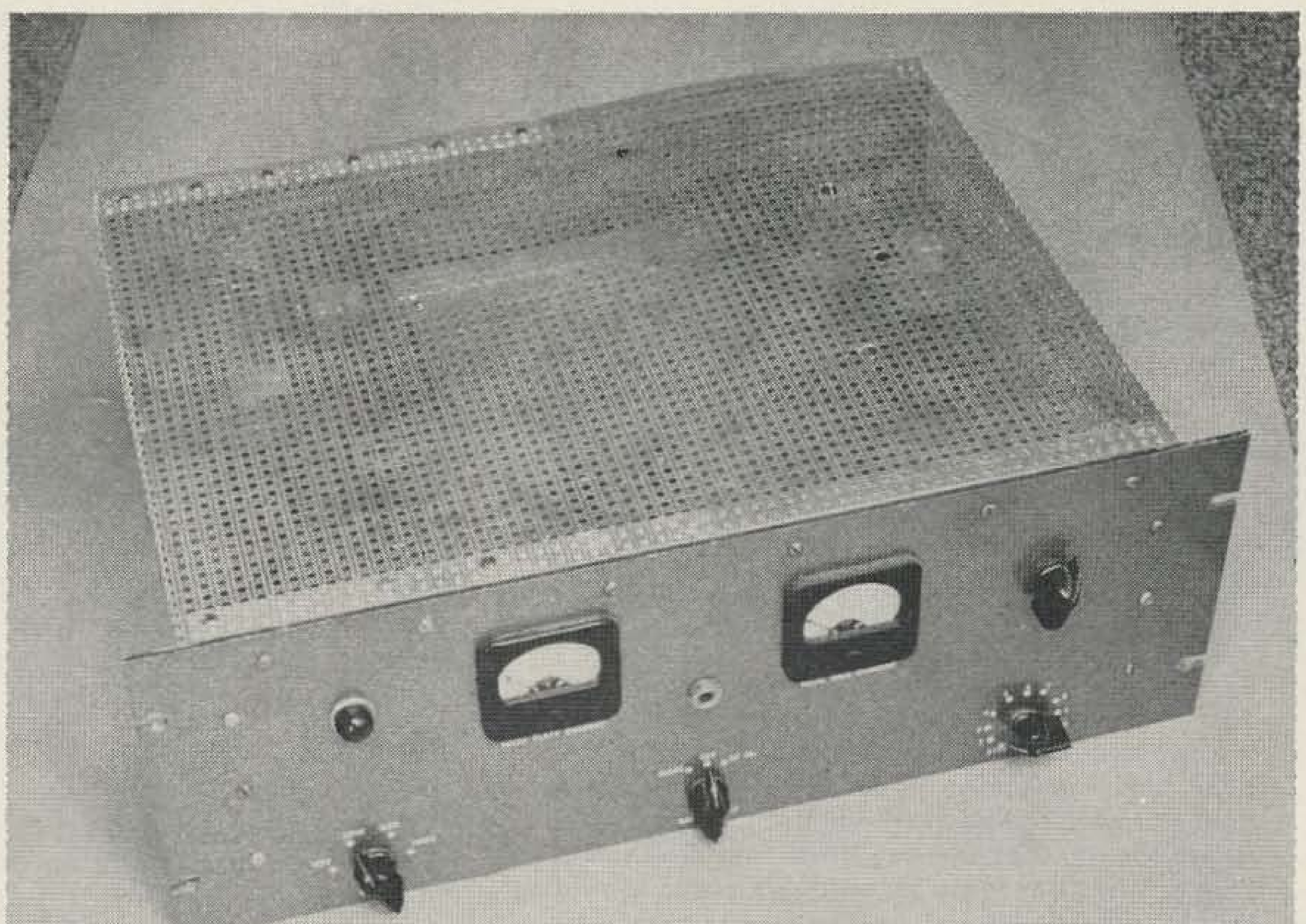
Maybe you've entertained the idea, and decided it took a few engineering degrees as well as a complete technical library and well-equipped test laboratory.

If that's the situation, hitch up a chair, you've got a surprise coming.



Jim Kyle K5JKX/6
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Santa Susana, Calif.

The people who design rigs featured here—and elsewhere—aren't high-paid engineers. Most of them are hams just like you. Designing any piece of radio equipment from a crystal set to a kilowatt sideband rig, is a simple process when you break it down to fundamentals.

And by doing it yourself, all the way, you'll get more out of hamming. There's a special feeling you get when the fellow at the other end tells you, "Best signal I've heard for a while!" and you know every bit of your gear came right out of your brain.

If this feeling isn't enough, there's always a chance of making a buck. Wayne and the editors of the other radio magazines are always in need of good, original construction articles.

So let's take a look at this business of rolling your own. To start with, what do you need?

You can get as many answers to that question as there are amateur designers, but my answer is this: a ream of scratch paper, a dozen long, sharp pencils, a set of tube charts, and an inventory of your junk box.

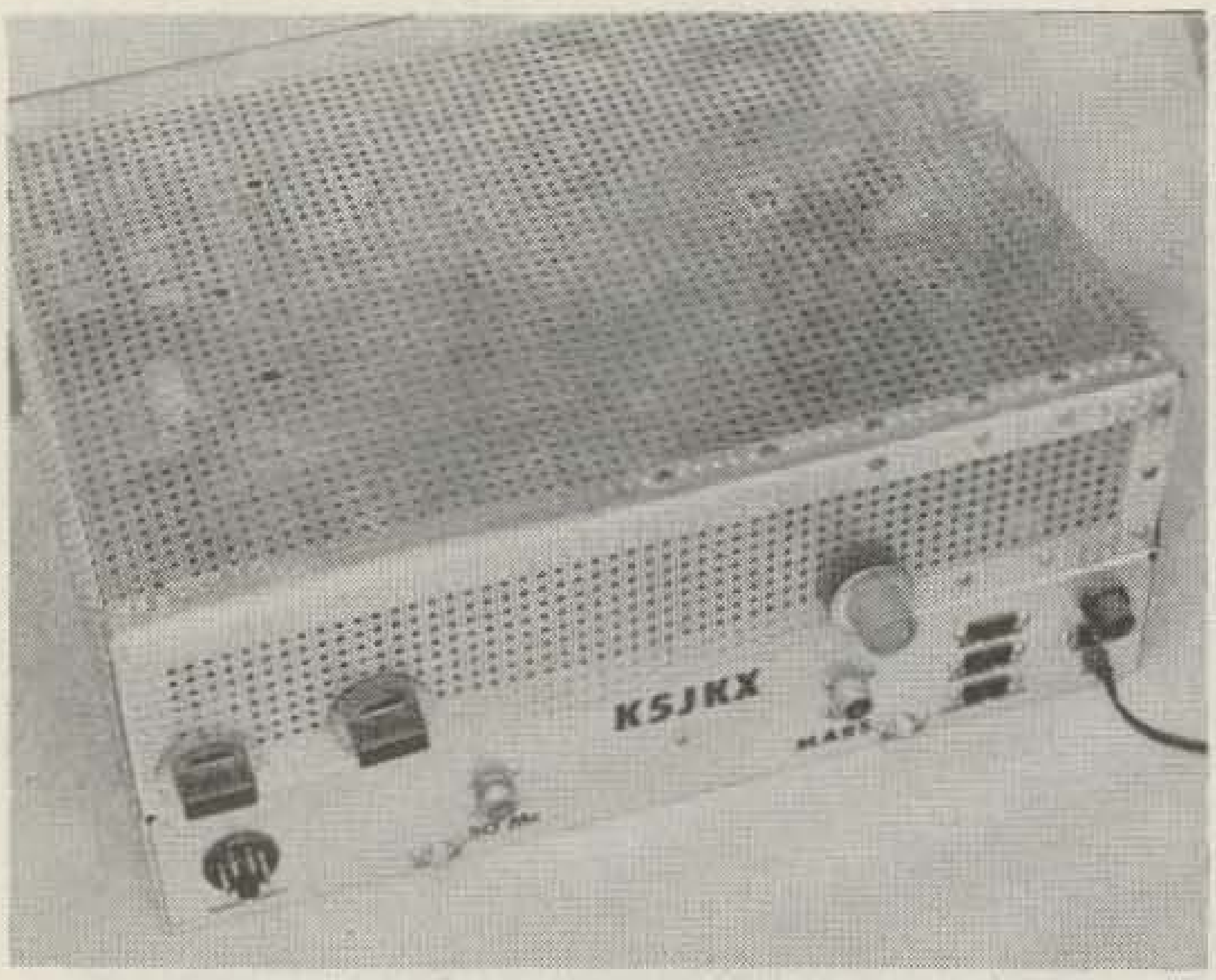
Sure, there are other things which will make it a little easier. If you have a good-sized technical library, or drafting equipment, or a slide rule, and know how to use them, bring them along. But you don't really have to have them.

The first step is to take pencil and paper and list the five basic things about the piece of gear you're going to design. You can unplug the soldering gun, incidentally, for this is a lengthy process—but it's the most important step of all.

These five basics are: Purpose, power, cost, size and features. They determine everything which follows.

Under purpose list exactly what you want the finished item to do. At this point, never mind if it sounds impractical. You never know what's practical and what isn't, and at this stage you're drawing up the exact specifications you're going to work toward.

The purpose will help determine the power, and so will the cost. This is frequently a difficult item to decide on—it may help to remember that in case of transmitters, a kilowatt is only 10 decibels more powerful than a 100-watter, and only 20 db above a 10-watt rig. In S-units this figures out to less than 4 S-points—and band conditions in operation can easily make that difference smaller.



Rear view of the rig shows control circuit connections and little-used controls. Knobs protruding through shielding are, from left, 6-meter final tuning, 6-meter pi-net loading capacitor, and at right, MARS final tuning. MARS pi-net capacitor is trimmer set from under chassis. Plug at left connects to modulator and power supply. Phono jacks at bottom are to receivers. Coax connectors are for antennas. Three AC sockets at right are receiver muting, top; control line (for accessories) and control switch, bottom. Beneath fuse plug is auxiliary 115-volt outlet for receiver, etc. Shield cover is normally buttoned down as at right; left was loosened for internal photos.

Power sources also fall into this heading. There are three basic types: ac line, storage battery, and dry cells. Obviously no one will try to run a kilowatt from dry cells, but careful consideration of available power in relation to the power output you want is necessary in every case. After all, kilowatt-hours cost money, too, even if you're strictly in fixed operation.

Cost is virtually self-explanatory. The junk box can help here, as can scrounging from fellow hams. But it's well to put down on paper exactly how much you're willing to spend on this piece of equipment. This helps in case you have to buy some special part to get the performance you want. And at this stage, nothing is definite yet.

Size is something to think about, too. You can pick a cabinet and try to stuff everything inside, or you can figure out the circuit and then discover you've built a "Mack truck portable." And in case of mobile gear, sometimes the space available determines all the rest of the circuit.

Most difficult of the basics to decide on is "features." This includes consideration of VFO or crystal control, VOX operation, differential keying, all the little "extras" which sometimes add to convenience of operation and sometimes are nothing but a nuisance. The sky's the limit, but it helps to take a few days and be certain you want what you want before you waste time going ahead.

About here is a good place to give you an example from my own experience, showing how to list the basic items.

I wanted a six-meter rig which would also operate on air force MARS frequencies, and since at the time I held a Technician license I had no special use for the lower ham bands.

Purpose of the unit was defined as: operation from 50-54 mc. and on spot frequency of 4.4175 mc. with enough power to give reliable communication at all times.

Power was a question. Since I had a good supply of 6146 tubes, they were certain choice. At this stage, I chose to use two in the final stage for a nominal 100-watt power.

Cost was simple. "As small as possible." However, I was prepared to spend up to $100 on the rig if necessary.

Size, also, was to be as small as possible within reason. I had a seven-inch opening on my relay panel, and took a seven-inch relay panel as the target to shoot for.

Features was the point where I went to town. I chose first simplified controls with broadband tuned circuits. Bandswitching between MARS and VHF. Self-contained crystal bank. Power selection. Operation on phone only.

With these points listed, I mulled the idea over for several weeks, taking every opportunity to doodle out new ways of achieving the aims.

The first major change was to recognize that 100 watts was only 3 db better than 50 watts, and cut down to a single tube final. This was for purposes of easier operation, by eliminating possible unbalance problems and high

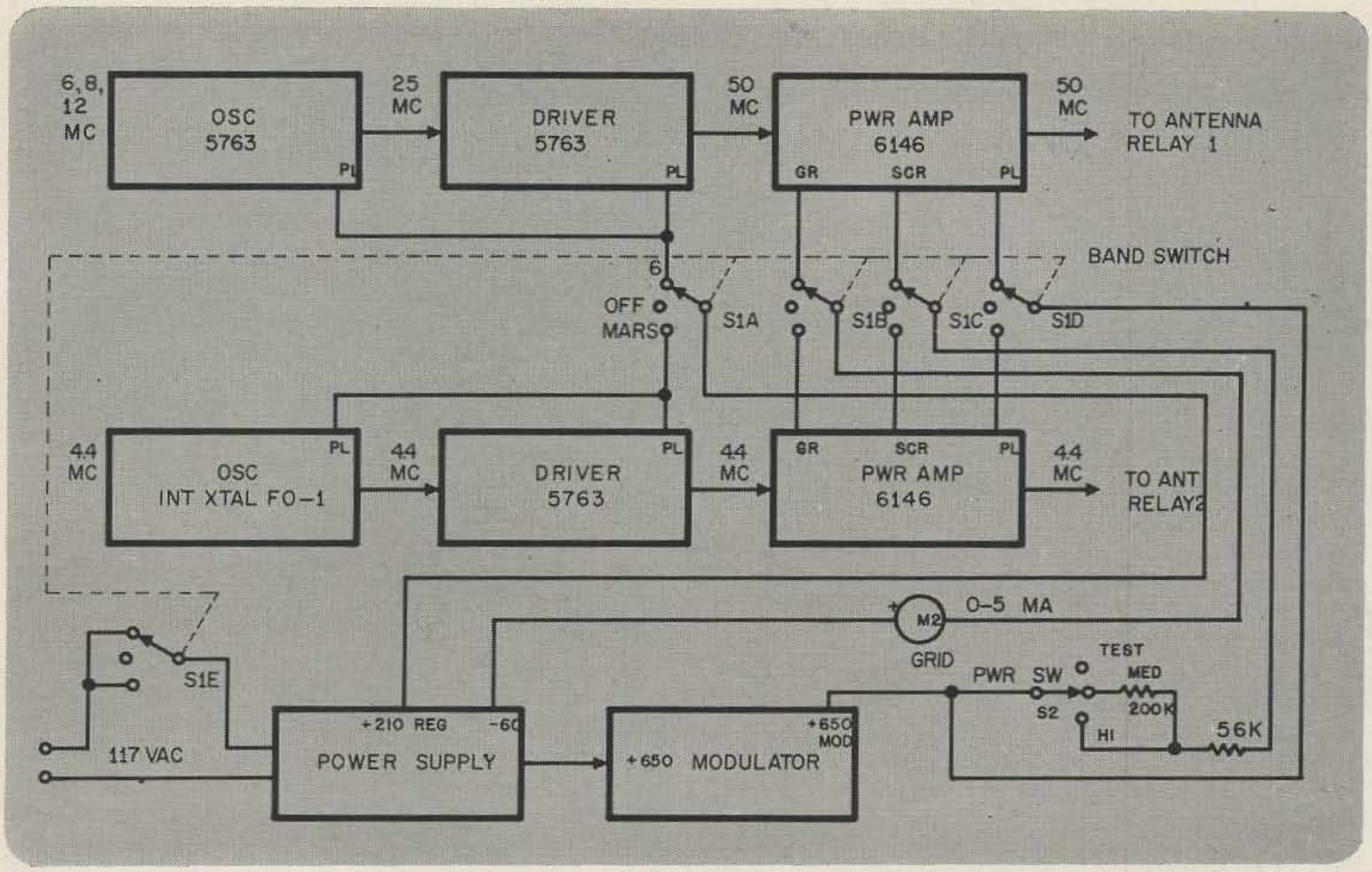


Fig. 3.

capacities in the VHF stage, and for lower cost due to the reduction in power supply requirements.

Another feature added was a trick bandswitching circuit, but we're getting ahead of ourselves. . . . . .

After you've thought over your specifications for a while, making whatever changes you want to (it's a lot easier now than it is when you get to the metal-working stage) it's time to start drawing diagrams.

Any of the recognized ham radio handbooks has enough material on basic circuits to get you started, so I won't repeat that here. A point I've found helpful in sectionalizing the design and making it easy in all respects is to draw a "box diagram" of the unit at this stage.

The box diagram is simply a drawing with a "box" for each stage of the unit, and each box labeled with what that stage is supposed to do.

In drawing the box, it's helpful to start back from the output stage to determine requirements as you go.

Here's where the tube charts come in handy. Pick your output tubes to fit your power requirements, then check to find out how much power they take to drive them properly. Most charts give this information directly in watts.

Remember, though, that these watts have to get to the grid. To allow for inevitable losses, it's a good idea to have at least five times that much power available from the driver stage at low frequencies, and at least 10 times as much at VHF.

This requirement tells you what tubes are suitable for drivers. You keep up the process for two or three stages until you're back to the oscillator, and that's a different problem.

Now, with your box diagram and your tube charts, is the right time to design the power supply. Be sure not to exceed tube ratings unless you're a millionaire and can afford to replace the bottles every five seconds. I once knew a fellow who got 500 watts out of a 6L6, he claimed, but the tube didn't last through the "C" of a short "CQ."

At this stage, you have a collection of boxes drawn with labels ranging from "oscillator" to "final", but no circuits for any of them.

Blending the handbook basic circuits is easy, now, much more so than the customary method of taking "this" from one published rig and "that" from another, then hoping they'll work together.

All you have to do is work from the antenna back, picking the circuit you want for each stage. Pi-network or link coupling; capacity coupled drivers or untuned links; all of these choices are up to you, based on the information in the handbooks and the purposes you have in mind.

The important thing is that with power requirements and tube ratings in mind, you've already guaranteed the thing has an even chance of working right the first time around. And, barring wiring mistakes, you know you're not going to blow anything up.

Getting back to my example, the box diagram of this rig is shown in Fig. 3. This shows the trick bandswitching I mentioned a while

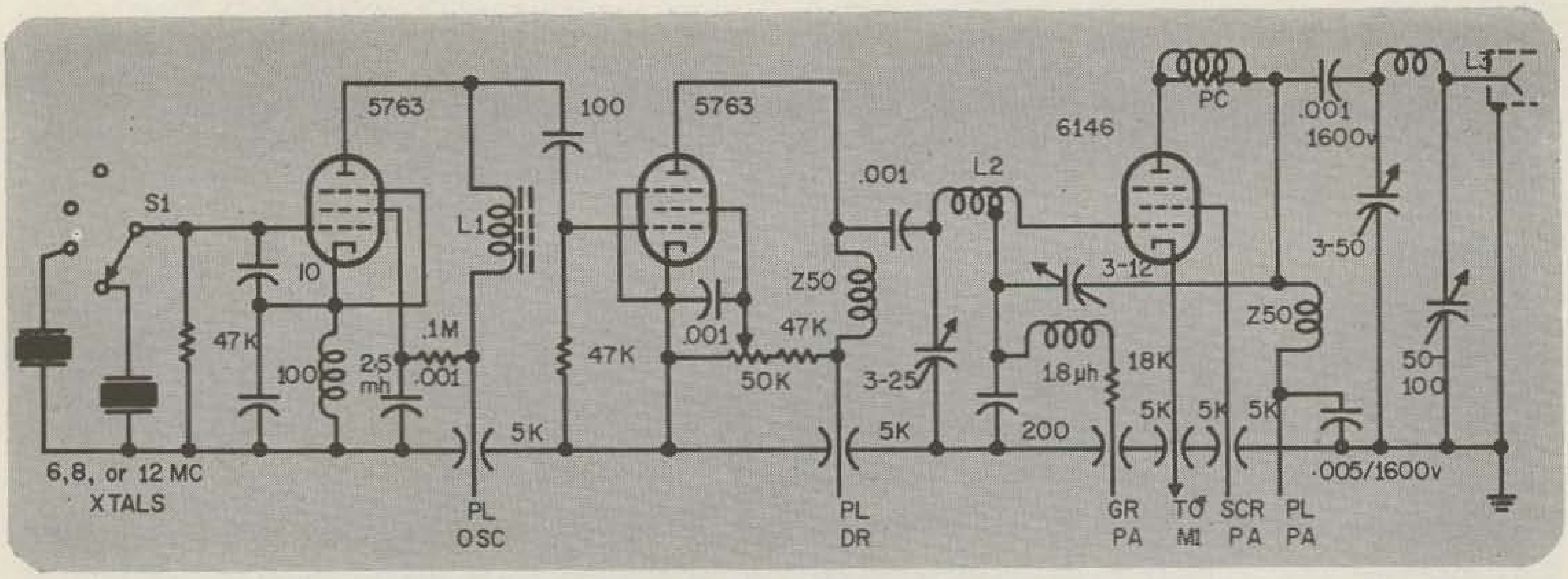


Fig. 4a.

back—using two separate rf sections with all switching being done in power leads, with only one power supply and modulator.

This box diagram led to the detailed schematic, Fig. 4. Actually, in the control circuit wiring the box is easier to follow.

With 6146's decided upon for the output stages, as determined earlier, tube choices boiled down to drivers. The tube books showed several would work, but 5763's were chosen since they had good characteristics throughout the frequency range and could provide a good safety factor of drive.

The modulator and power supply were left in box form, since a search of my library turned up already-published circuits for them which exactly fitted my needs.

The modulator is from the 1957 ARRL handbook, while the power supply is from Editors and Engineers Radio Handbook, 14th edition (later published in GE Ham News, vol. 12, no. 5.)

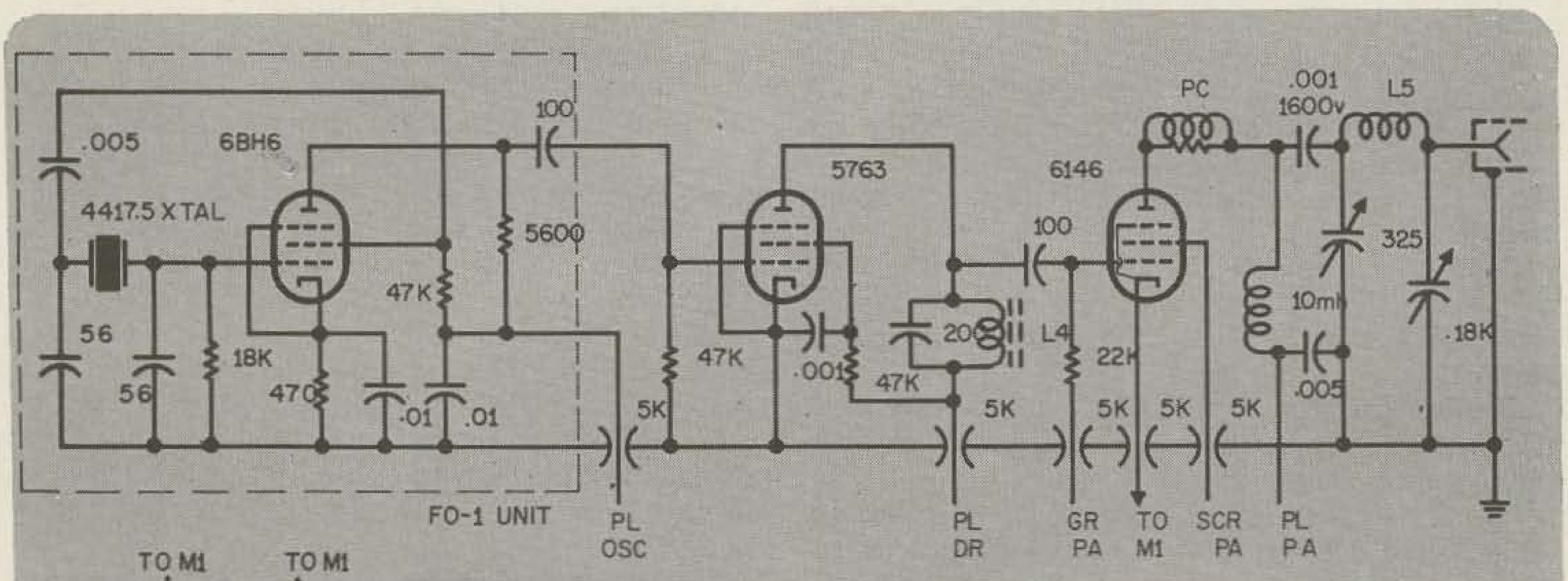
A couple of tips may help out in the business of putting all the component stages together on paper.

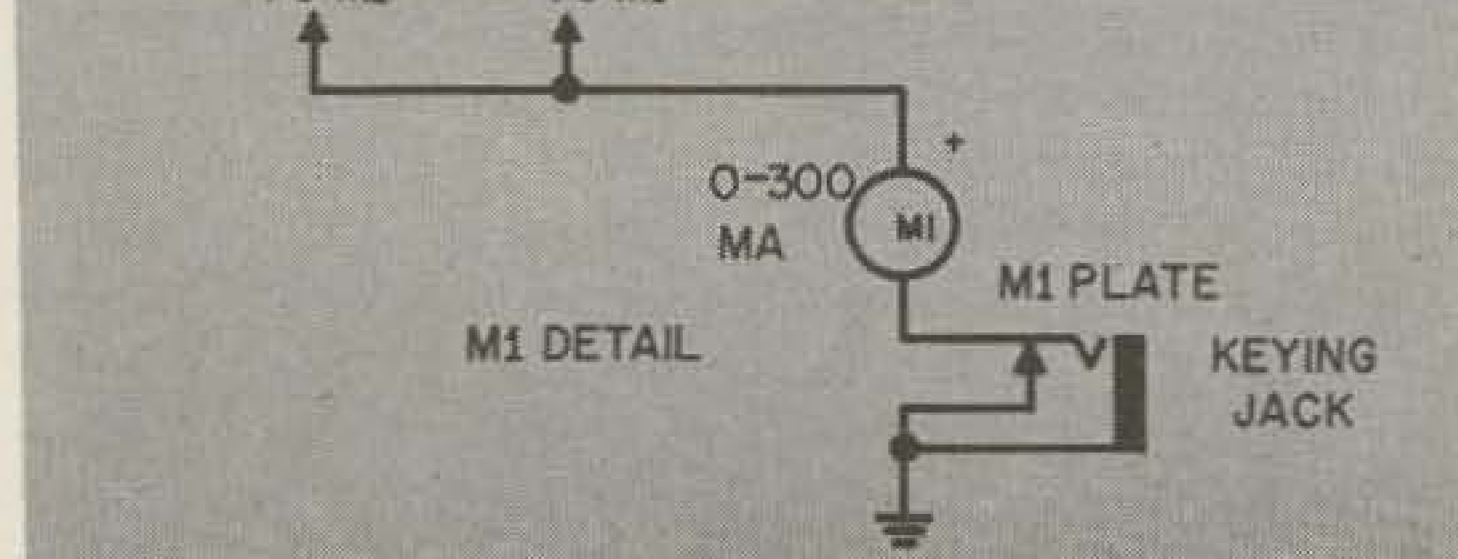
The first is the famous Fudge Factor, so ably dissected by another 73 author, John Campbell Jr., W2ZGU, in the pages of his own magazine. It basically consists of making allowances from theoretical data to fit the known situation, or in other words, make the closest thing you have available do to start with.

The second is this: mathematics formulas don't have to be difficult. Some of the handbooks fairly bristle with complicated-looking algebraic equations, apparently designed to scare away everyone except graduate engineers.

But if you take a close look, you can usually find a table somewhere nearby in which all the values have been worked out closely enough that the Fudge Factor can take over.

And as a last resort, you can always check published circuits until you find one similar,





S1—10 pos Single Pole Rotary Switch
PC—3 turns #20 tinned on 47Ω 1W. Resistor
L1—1 8turns #20 on National XR-50 form, wound to fill form
L2—10 turns #20, 16 T.P.I, 5/8" diameter (AIRDUX)
L3—6 turns #4 bare wound around 6F6, spaced wire diameter
L4—Slug-tuned coil from SCR-522 Receiver
L5—Airdux #2007A (18 μh)

and take the values shown there as starting points for cut and try work.

If you've been following directions closely to this point, the ream of paper you started with should be gone by now, and the dozen long, sharp pencils should now be worn and nubby stubs. All your acquaintances will be referring to you as "that fellow who's mumbling all the time," as well.

But cheer up. You're close to the culmination. Because you now have a semi-final schematic drawn for that rig you want.

One more step, and you're ready to dive for the junk box. That step is this. Take your schematic, study it carefully. You might even memorize it, if you haven't already done so. Make absolutely certain that it does what you want it to do—assuming it's going to work at all when you wire it up.

In all probability, you'll find several points you want to change. Make those changes, and draw a final working plan.

Now to the junk box. Everybody has a different approach to a building job, but I like to have every part, down to nuts, washers, and tie point lugs in hand before I start. I get them all together in a coffee can, then begins the real labor part of the operation.

You still don't need any fancy equipment at this stage, but of course, the more of it you have, the easier it can be.

The only absolutely necessary tools are a pair of wire-cutters, a hacksaw, a drill, and a soldering iron. The only piece of test equipment you can't get along without is a volt-ohm-milliameter of some sort, and this can be a jury-rigged affair.

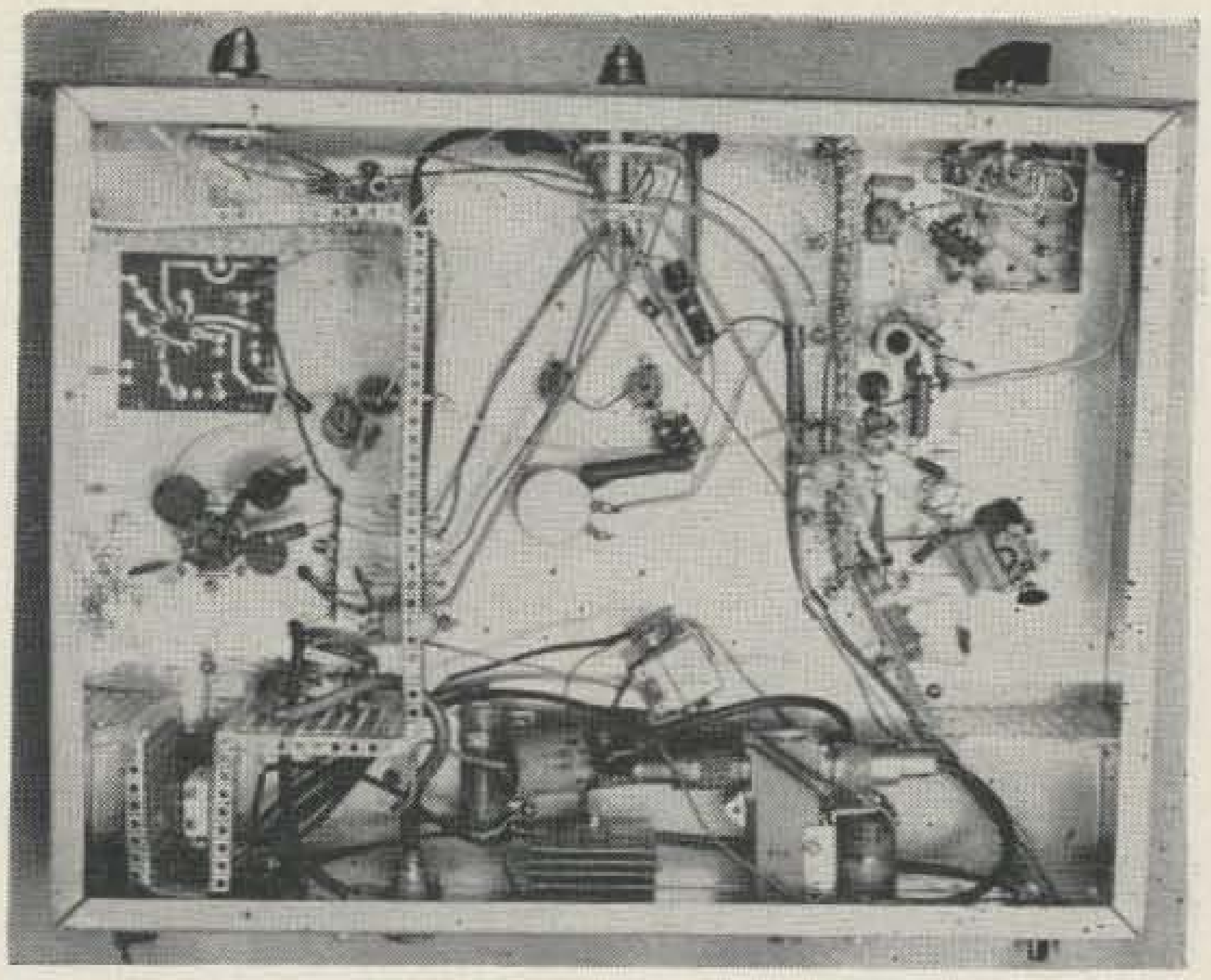
The ubiquitous grid-dipper comes in handy, sure, but you can build many a transmitter without one by careful calculation of coils.

At this point, parts layout comes into its own. If you're building a chasis from scratch, you can juggle the parts around until they're the way you want them and determine chassis size. If you're using a ready-made box, then shift the components on it until you're satisfied.

One point to remember, since it spells the difference between success and failure in many circuits, is to keep all signal-carrying leads short. Good looks of the panel may have to be sacrificed to attain this, but the object is to make the thing work.

Once satisfied with the parts arrangement, and with all parts on hand, you're ready to proceed with the wiring. Except, that is, for cutting the chassis. Drill all holes and mount all tube sockets and heavy items such as transformers. It helps if you turn tube sockets so that leads run naturally to the point they have to get to, rather than having to criss-cross above the socket.

Actual wiring is similar to wiring a kit, except that you have no instruction book telling you what to put where and when to solder.



Underside of chassis shows separation of RF sections. Clutter at rear of chassis is control circuity not shown on schematics. It includes antenna relays and receiver muting controls. Selenium rectifier provides DC for coax relay. Bandswitch assembly is at top center. Turned-over edges of shielding contact bottom plate firmly to button up rig against TVI. Also visible are ceramic feed-through capacitors used on all low-voltage power leads which pass through shielding.

I have found it most helpful to work from the first stage toward the rear of the equipment, completing each stage as I go and testing it. By this I mean start at the oscillator of a transmitter and work toward the antenna, and start at the antenna of a receiver.

In original designs there is going to be much cut-and-try fitting, and sometimes things which look on paper as if they should work fine simply refuse to operate when you wire them up. Doing one stage at a time, building block fashion, helps you avoid trouble since you can test as you go along. You know as each stage is tested that it works, and if it fails you have more room in which to work on it.

If you wire your design in this manner, you'll know that it works when the last stage checks out. Next thing to do is to put it in operation.

Live with it a while. You can be sure of one thing: Bugs will appear. I have never heard of any equipment being built from an untested design working perfectly the first time around. Give the bugs a good chance to make themselves known.

Then, obviously, apply bug eliminator. This translates as hard work, since what cures a symptom in one rig only makes it worse in another. The handbooks, however, have good coverage on these troubles, and many suggestions.

After the first period of testing and improvement comes another, much the same. The second time, though, the troubles will be much more minor, and when they are cured, you

Details of 6-meter side of transmitter. Tubes in shields are 5763s. Behind them are two OB2 in low-voltage supply. Control behind OB2s is to set bias on final stages. Only one section of split-stator capacitor is used—but it happened to be in the junk box when rig was built

will have a piece of gear you can be proud of.

The final word is this: When it does what you set out to do, leave it alone! More bad signals are emitted from transmitters which were touched up just once too often than for any other single reason. Of course, this applies to all gear, not only homebrew.

Since you designed and built it you're naturally the most competent person alive to make improvements. But be certain, before you do, that what you're about to do is improvement.

You'll find, also, that the first time is the hardest. After that, the whole thing comes much easier, and before long, you'll have the reputation of being a man who can design anything anytime, anywhere, and have it work.

Since I used the combo rig here as an example earlier, here's the finished product, pictured in Fig. 5. Running 60 watts input to the final, high-level plate modulated, it has accounted for some 22 states and two countries on six meters despite a sharp lack of activity on my part, on the air. It gets 40 watts into the antenna, for 67 percent efficiency.

Most heartening of all, though, is the comment on it which is still music to my ears although I hear it frequently, on both VHF and MARS frequencies: "You can't be running 60 watts, old man. Your signal is the loudest on the band."

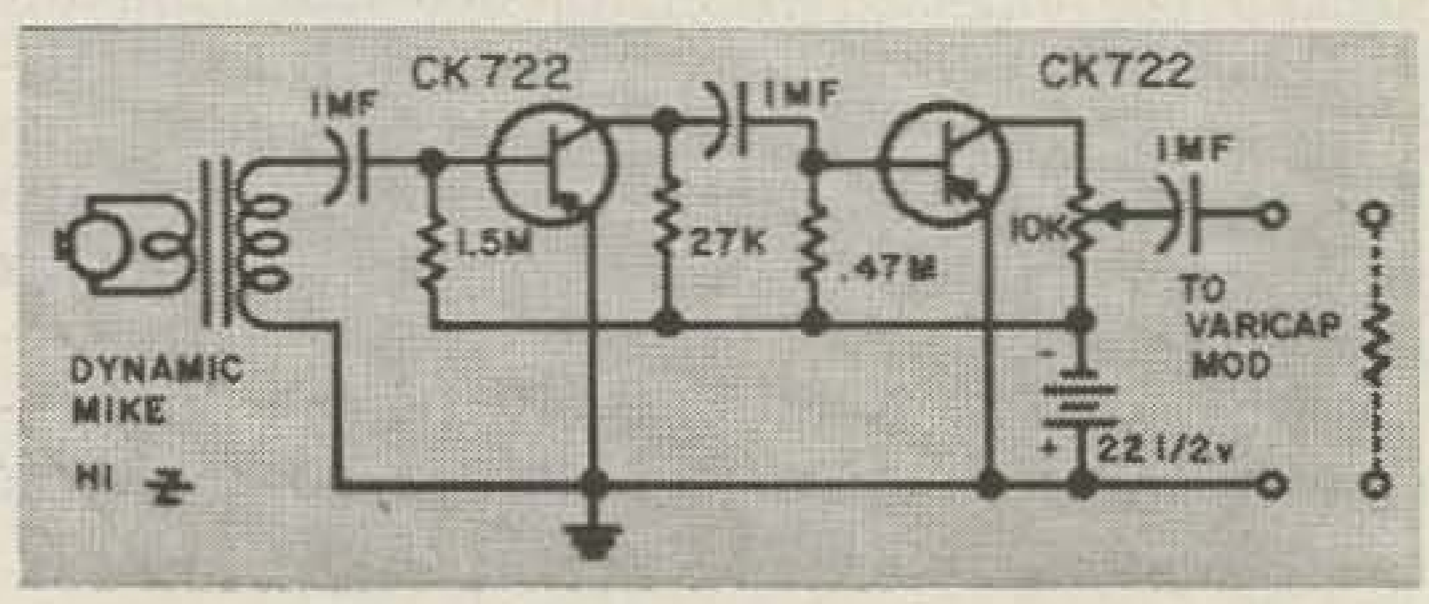
Excuse me now. I just had an idea. If you took a 4X-150A and a hetrodyne VFO. . . . . Gotta run for the slide rule. 73

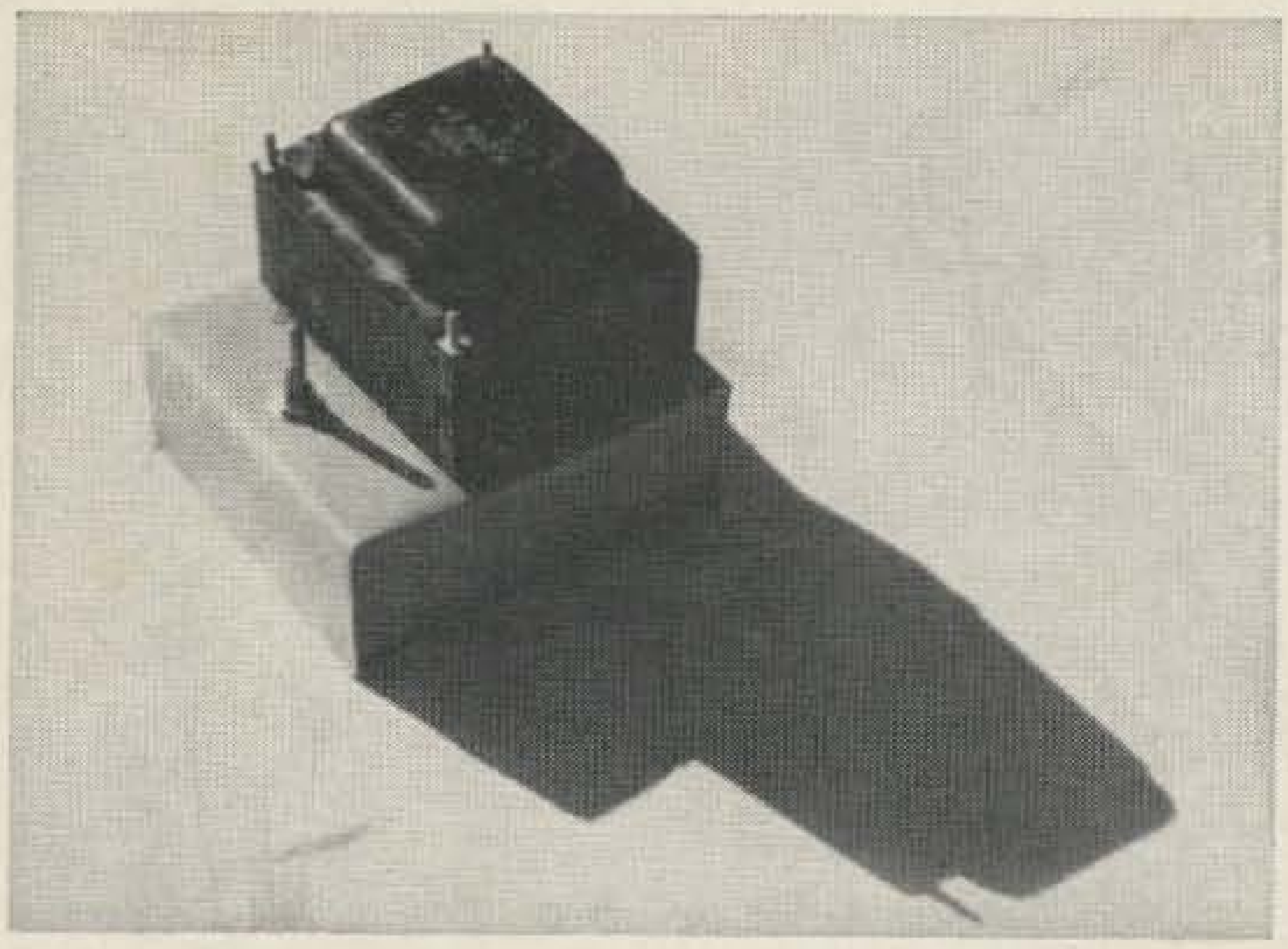
Pre-amp for Vaircap Modulator

THE writer has received several requests for the transistor pre-amp circuit used with the Varicap modulator. The original Varicap modulator was used in the VFO which multiplied from 10.5 mc to 21 mc and it was found that about 1 volt RMS was necessary to get a 3 kc band at the 21 mc transmitting frequency. A single transistor following a dynamic mike did this very well. Subsequently a 40 meter command transmitter has been modified by placing a Varicap modulator in the grid circuit of the oscillator. A VC-100 in series with a 25 mmfd ceramic were the only changes from the original circuit.

Using the above arrangement it was necessary to have over 2 volts of audio to get the necessary band width. So it was decided to build another pre-amp. After a little experimentation the circuit in Fig. 1. evolved. Battery and all is enclosed in an aluminum box. The mike has a standard phone plug screwed in the end and plugs into a standard jack on top of the pre-amp. This unit works equally well for 15 or 40 meters. The volume of course is decreased on 15. With NFM this will modulate 1 watt or 1 kilowatt equally well.

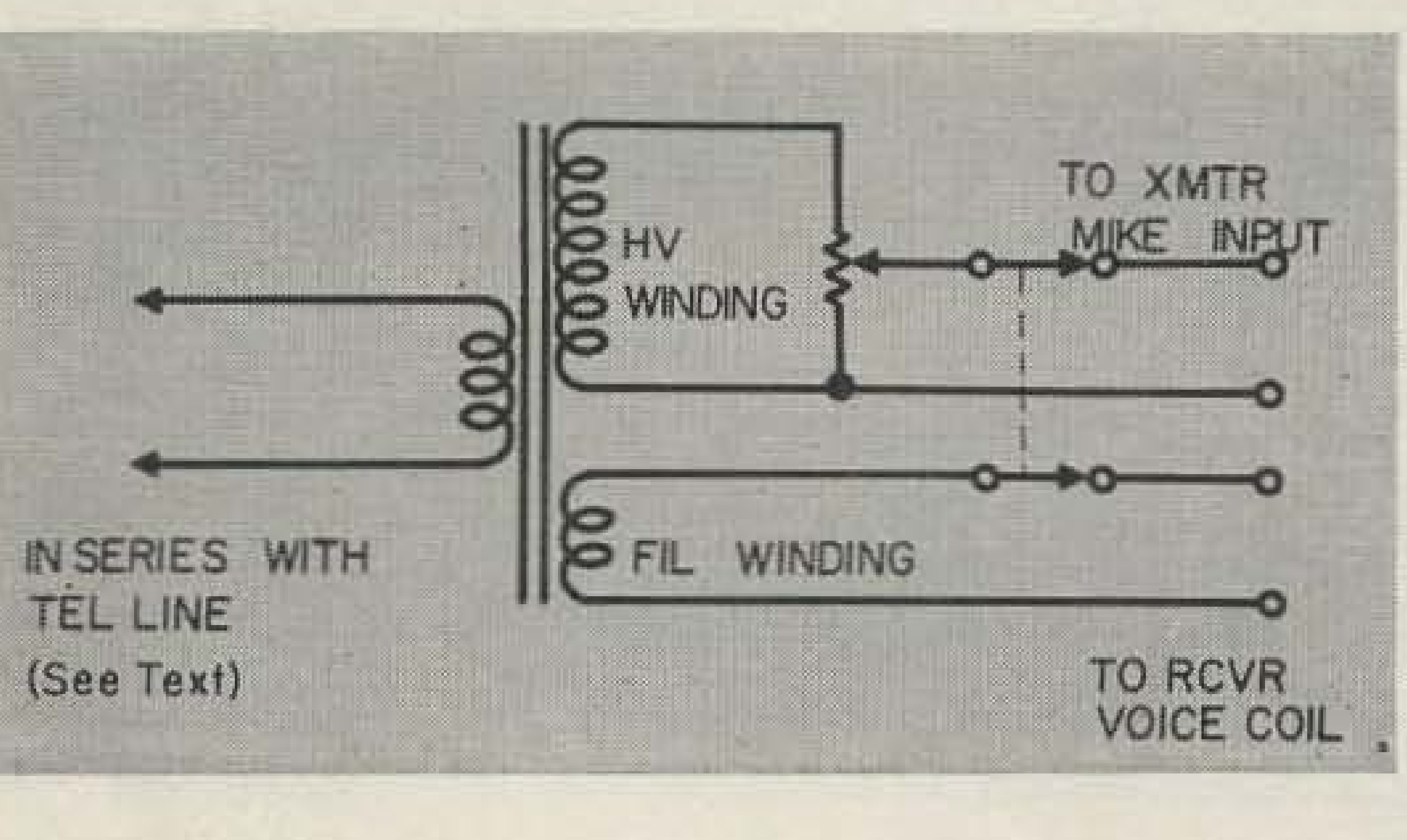
If 75 meter NFM is contemplated, perhaps a pair of 100 mmfd Varicaps in parallel, connected in series with a 40 or 50 mmfd mica or ceramic will do the job. . . . W7CSD





THE World's SIMPLEST PHONE PATCH

Jim Kyle, K5JKX/6
1851 Stamford Ave.
Santa Susana, Calif.



EVERY ham who aspires to perform any sort of public-service operating soon finds himself in need of a phone patch—and he then learns immediately that there are phone patches and more phone patches, all of them costing money.

The field of patches ranges from the fancy hybrid type (excellent for so many purposes, and the only kind which allows VOX operation on sideband) which bear an equally-fancy price tag, down to the well-known Macy Special which can be built for $2.98.

The subject of this article, though, outdoes them all in at least one respect—it will cost the average ham absolutely nothing! That's right, I said "Nothing!" Every component can be found in the junk box of anyone who's been in the business at least two months.

Required materials are these: one each discarded AC power transformer (the ancient 2.5-volt-filament-winding variety which can be salvaged from a discarded BC set is excellent), one each volume control (anything from 100 K upwards to 2 meg), a mounting board (the proverbial breadboard is fine), some wire, and a DPST switch. The switch is necessary only if you wish to be a mite fancier about it.

When you have these components gathered in your hot little hands, wire them together as shown in the schematic. None of the wiring is critical.

Operation of this patch divides into two phases—installation and use.

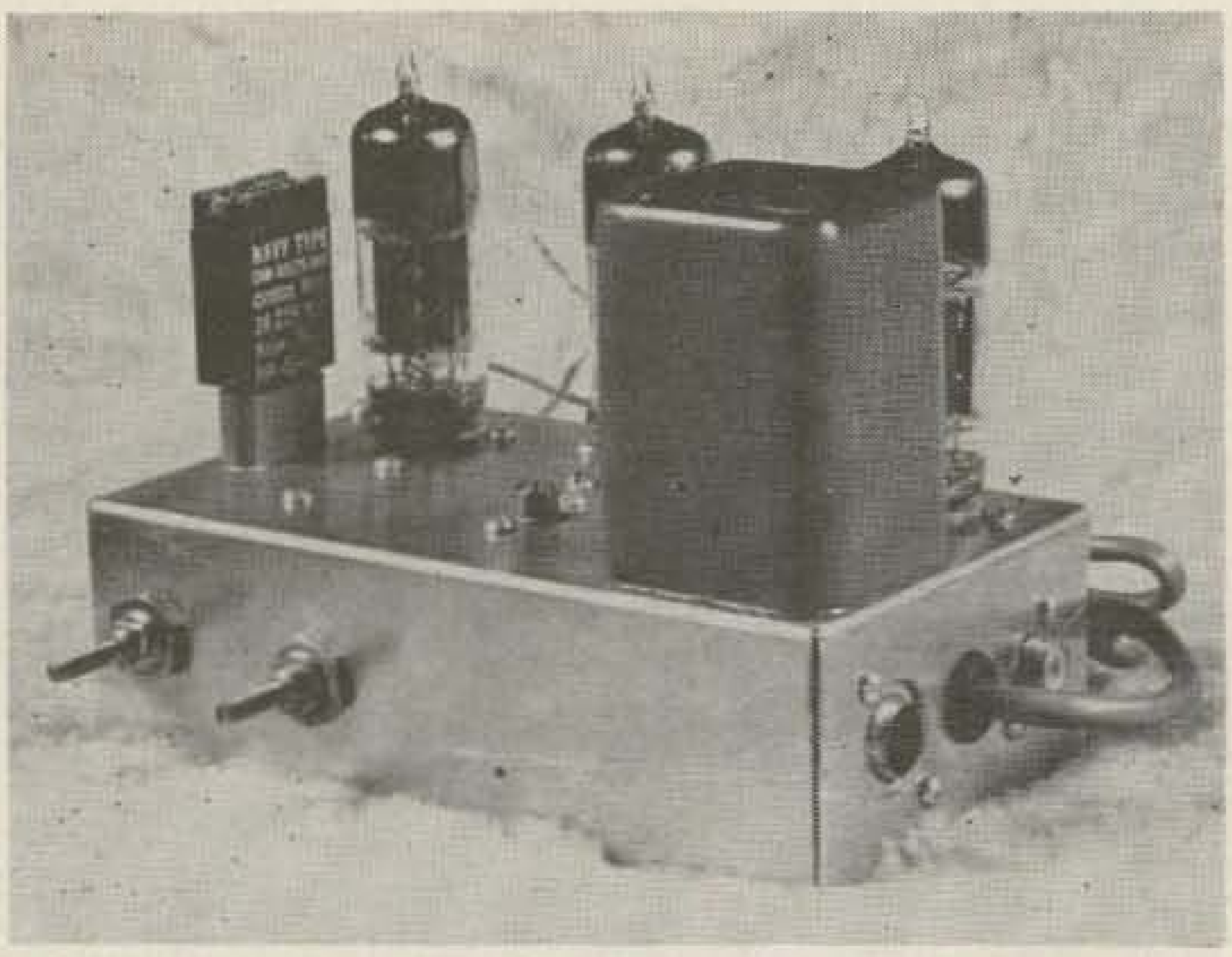
The patch is installed in what may appear to be an unconventional manner: Instead of being connected in parallel with the telephone line, it is connected in series with either the red or the green wire.

If the patch is inadvertently connected across the phone line, you'll hear from the telephone company, for it will create a continual busy signal on your circuit and make it impossible for anyone to call you. It will also hamper your placing of outgoing calls. Be certain to connect it in series to avoid this problem.

Once installed, the volume control may best be set by an on-the-air test with a couple of willing friends. Adjust this control so that the incoming telephone voice modulates your transmitter fully without splattering.

Volume of the sound fed into the phone line will be determined by the setting of your receiver's audio gain control. Try to keep it slightly below the volume of a normal telephone voice, to combat both the tendency of the telephone party to mumble and the tendency of the telephone line to create crosstalk.

That's it—the world's simplest phone patch. Have fun, and be certain you are ready to perform public service. 73



Ray Fulton K6BP
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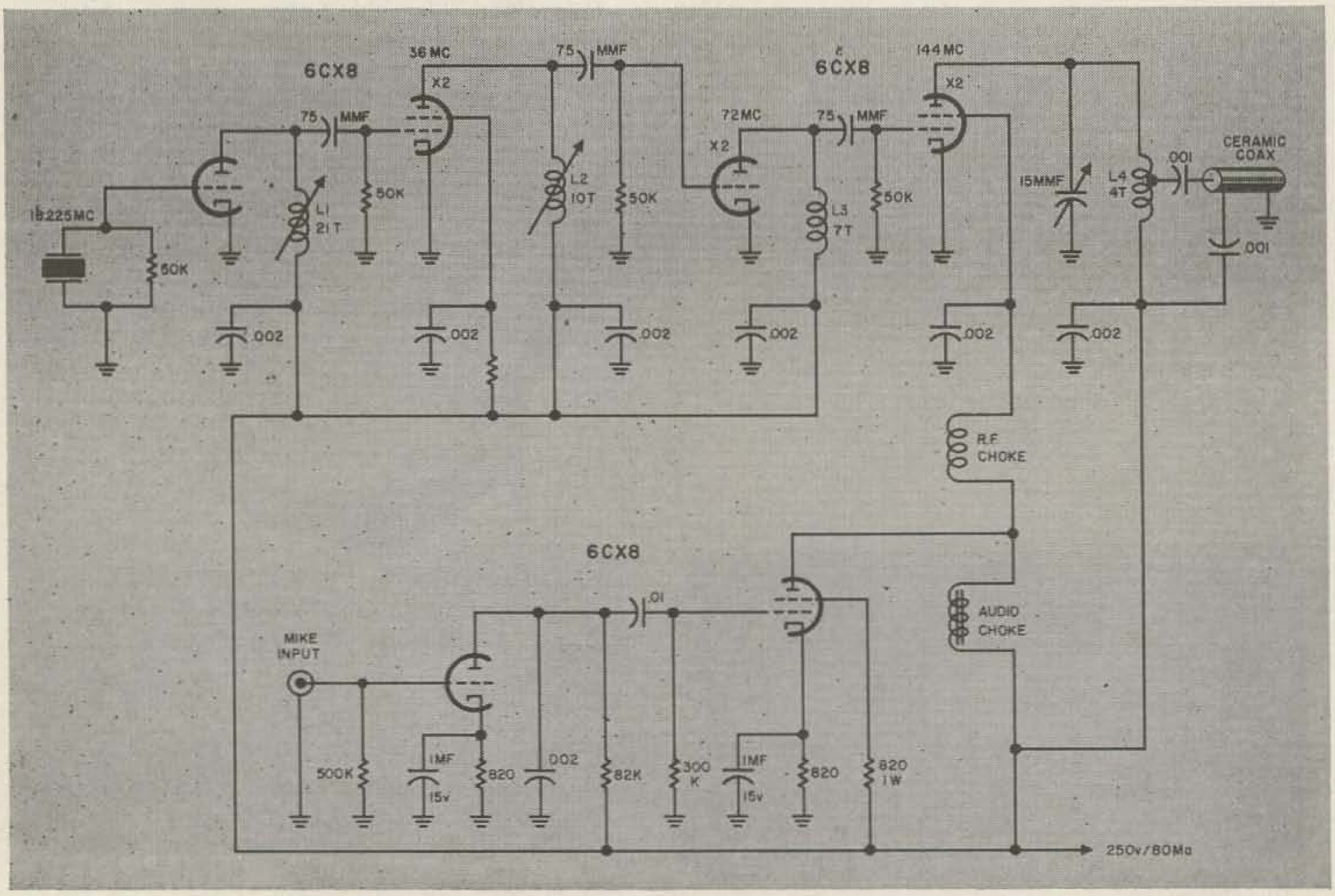
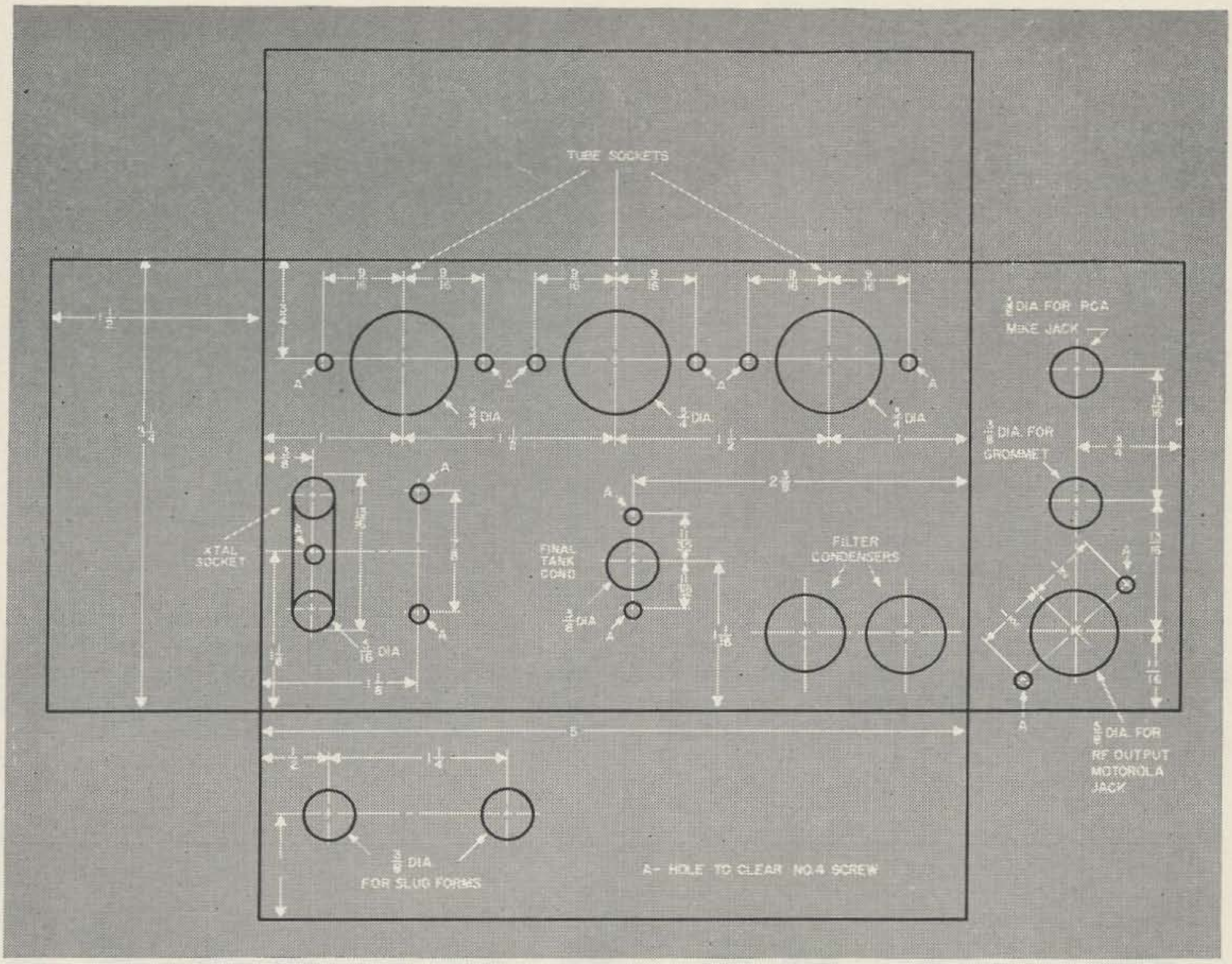
Lathrop, California

3 Tubes, 2 Watts, 2 Meters

If anyone is running a contest for the simplest two meter rig I figure I have it won, hands down. Of course I had to pull a couple of "deals" to boil the rig down to such basics, as you will see, but the end result may justify the means. The finished product is a two meter phone rig that you can build in a couple of hours. Two watts won't work DX, but it will put you in good touch with all of the locals and generally that is all you need for rag chewing.

Short-cut number one was the use of an 18 mc crystal, which saves us an extra multiplier stage that we would normally use with





the more popular 8 mc crystals. Fortunately 19 mc crystals are available from surplus, so this isn't quite the hurdle that it might have been. These crystals come eight-to-the-box for just under $2. Three of them hit the two meter band, four hit six meters and one is fine for 220 mc.

The second short-cut is the Heising screen modulation. This really saves a lot of building and extra tubes. Not only that but it works just fine. Signal reports are quite flattering.

Construction

Those of you who are taking the first plunge at 144 mc type construction would do well to follow the layout diagram and photos rather closely. It takes experience to successfully ad lib. Your leads and by-passes have to be as short as possible. This rig has been built and re-built many times, so why not take advantage of all that spent effort and do it my way? Or maybe you'd rather rediscover all of the mistakes I've stumbled through.

The chassis is 5" x 3½" (or thereabouts). There are so few parts that you should have them mounted in a jiffy.

Schematic Diagram. L1— 21T insulated wire on ½" poly slug tuned form. L2— 10T insulated wire on ½" poly slug tuned form. L3— 7T 5/16" (lead pencil size) air wound #20 bare wire. L4 4T 5/16" air wound #20 tapped 1T from B+ end, bare wire. RFC— over 25T on ¼" form or any small choke you have around. Audio Choke— primary of any small output transformer.

The Circuit

The triode section of the first 6CX8 is used as a crystal oscillator on 18 mc. This feeds into the pentode section where it is doubled to 36 mc. The triode section of the second 6CX8 again doubles, giving us 72 mc. We double again in the final to 144 mc, running about two watts input to the pentode section of the tube. Purists who are starting in with puttering fits at this point can calm themselves down somewhat . . . we recommend a small filter in the output to cut down the 72 mc output that might sneak through. Details on that later.

There is enough audio gain in this gadget to get all the sock you want with a crystal microphone.

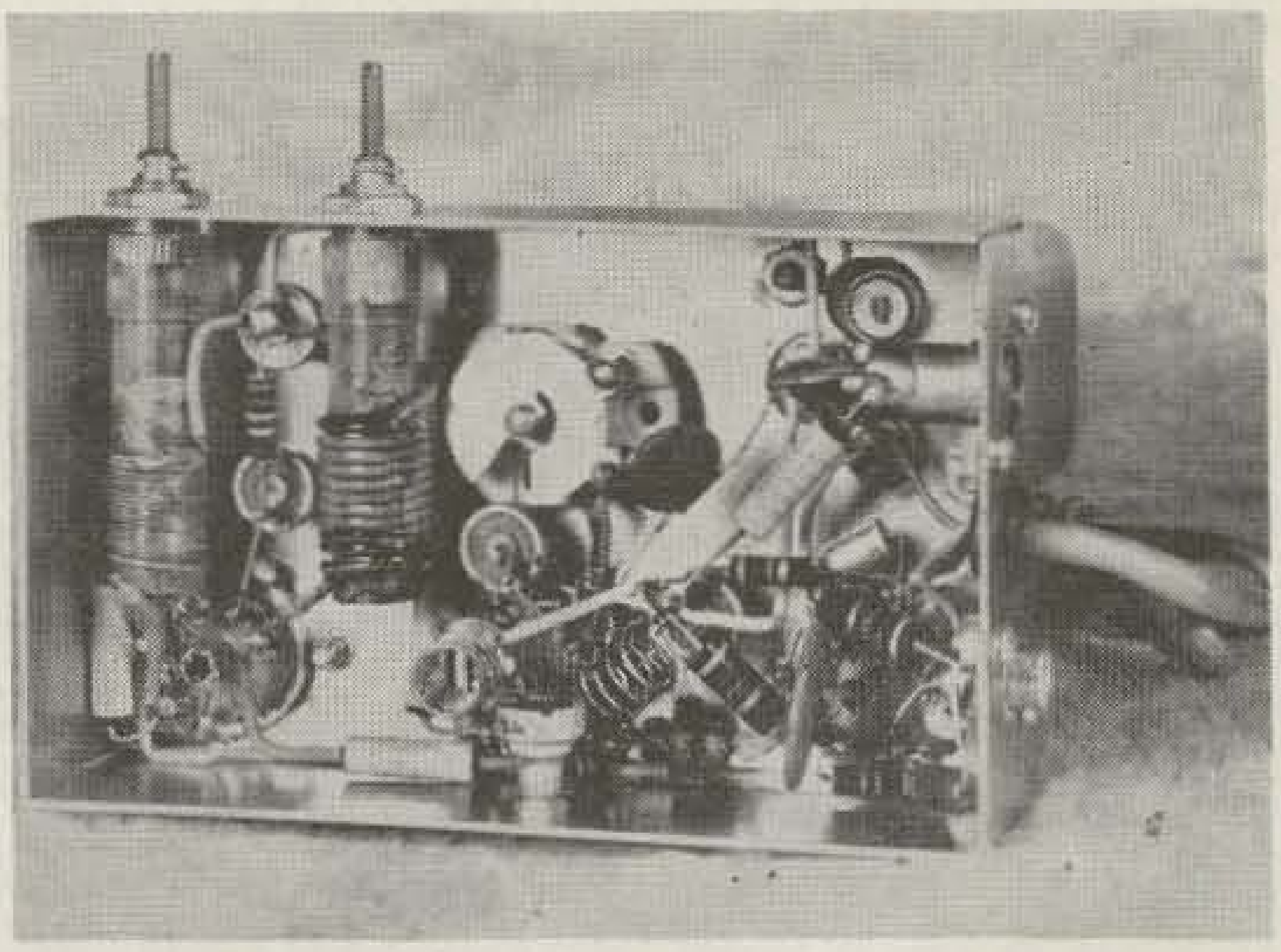
Details

Grid dip your coils to be sure they cover the range desired. You can save an awful lot of time and frustration this way. When you are ready to tune up the rig it is a good idea to limit the voltage to 150 v so the tubes can't be damaged. Tune the oscillator, then the 36 mc stage. The 72 mc stage has to be tuned by squeezing the coil. A field strength meter comes in handy about this time. A voltmeter will do a lot too. Ground the positive probe and connect the negative probe through an rf choke to the grid of the stage following the one you're tuning. This will measure the drive to the following stage.

If you are impatient with a fixed frequency rig you can grid dip yourself a slug tuned circuit for the 72 mc stage.

Now, about that trap to remove you from any 72 mc receivers in the immediate neighborhood. Ten turns of #20 (or so) on a half inch form with a small variable condenser (15 mmfd) in series with the coil should be connected from the antenna terminal to ground. This can be built into the rig. Dip it to frequency.

Oh, and about those extra crystals you got



back in paragraph two. This rig can be reworked for six meters quite simply, as you should suspect. It will also perk on 220 mc, which should come as a surprise. Try a three turn 3/16" diameter #20 bare wire coil for the "tank." Connect antenna one turn from B-plus. Use the dipper carefully on this as there are all sorts of frequencies you can be using with this arrangement. You will only get about a half watt, but you'll be on 220!

Have Fun

. . . K6BP

SQUAWK!

Edwin K. Cole W7IDF
P. O. Box 3,
Vashon, Wash.

Now that we are irrevocably into 1961 and our New Year resolutions have been thoughtfully filed away, let's turn from seasonal self-appraisal and consider the mischief perpetrated by other people.

It seems strange that fair-minded, tactful and unbiased criticism usually meets with resentment. It shouldn't—such criticism is mild, benign and useless. On the other hand, the effective critic is biased by personal experience, single-minded and happy to sacrifice the grace of tact for immediate results. He meets opposition head-on, wins or loses without wasting time on irrelevancies and moves on to another issue. But his blunt arguments shouldn't be resented either for there follow upon such efforts all the progress we make which cannot be laid to fortuitous chance. (What other ham magazine prints phrases like "fortuitous chance"?) (It's redundant, but sort of Churchillian.)

We have our marvels of transportation and communication because us here-now common folks weren't satisfied with running and shouting as transcendent activities. We were critics who wanted something better than we had.

In this economy the best inspiration of the inventor is the potential consumer standing behind him—waiting. So they tell us, and if it's true I'd like a second chance with some of those resourceful gentlemen. For example, I wouldn't waste much time if I could get into the right position behind the one who thought of marking miniature, G and GT tubes with vanishing ink, sea water or fairy tears. Whatever the stuff is I have come to suspect it begins fading on the date of sale.

It is true that if the internal structure is visible an experienced prospector for markings can often confidently hazard a guess as to the tube type, but hazard is unfortunately the right word and in this sporting spirit you can even try a tube tester to confirm or refute your insight. Also ingenious schemes for deciphering faint identification marks have been published in our magazines, but these experiments with oblique illumination, ammonia or polarized moonlight fail with me. They end as they begin—with my crossed, myopic eyes trying to focus on a tube pressed against my nose. Revolted by frustration, my brain, which is not very large or healthy anyway, slips out of gear into a neutral state which is manifested as daydreaming. This is hilarious to my children who promptly press tubes to their hot little noses and invent a typical "family fun" game combining apparent lunacy, aspects of hysteria and sly deflation of a grown-up.

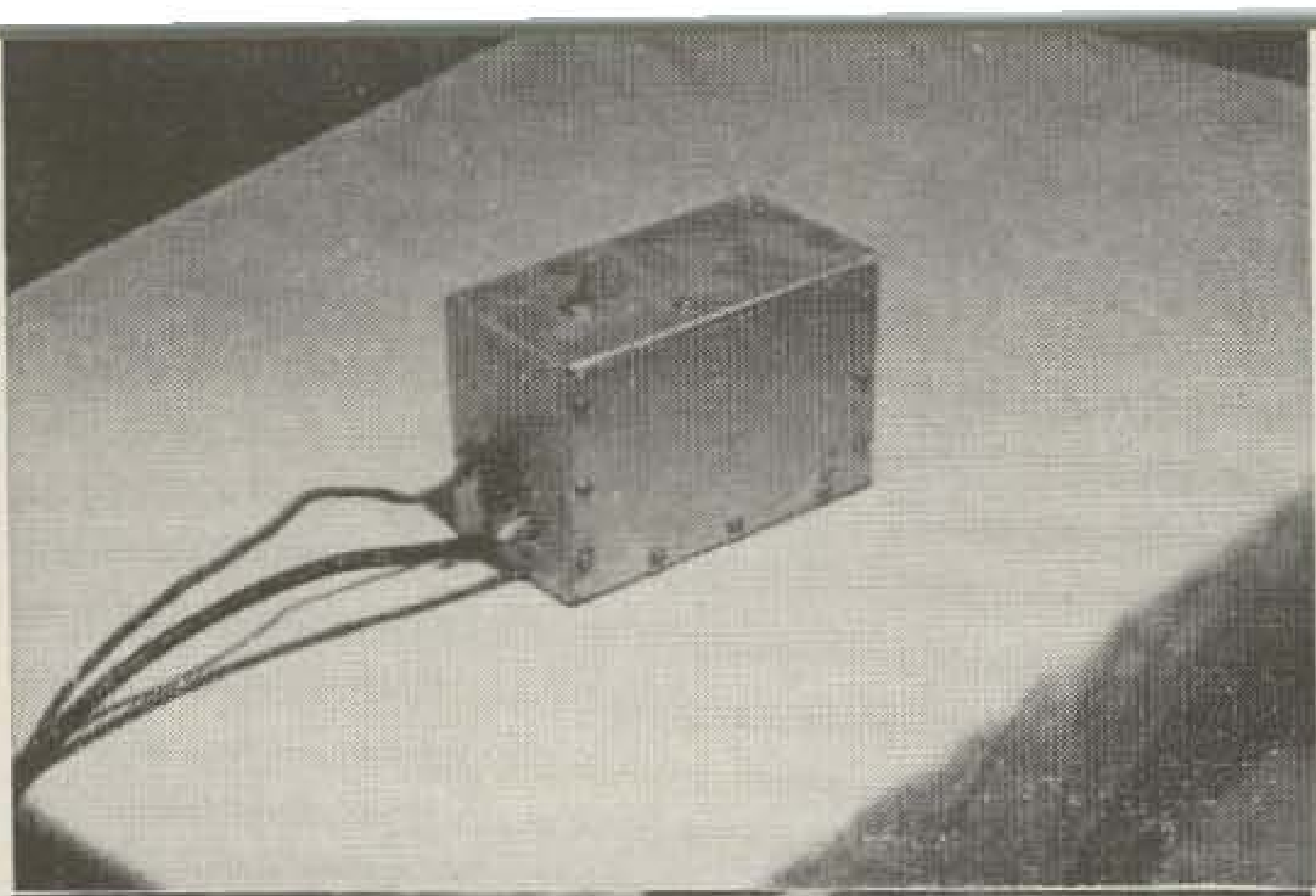
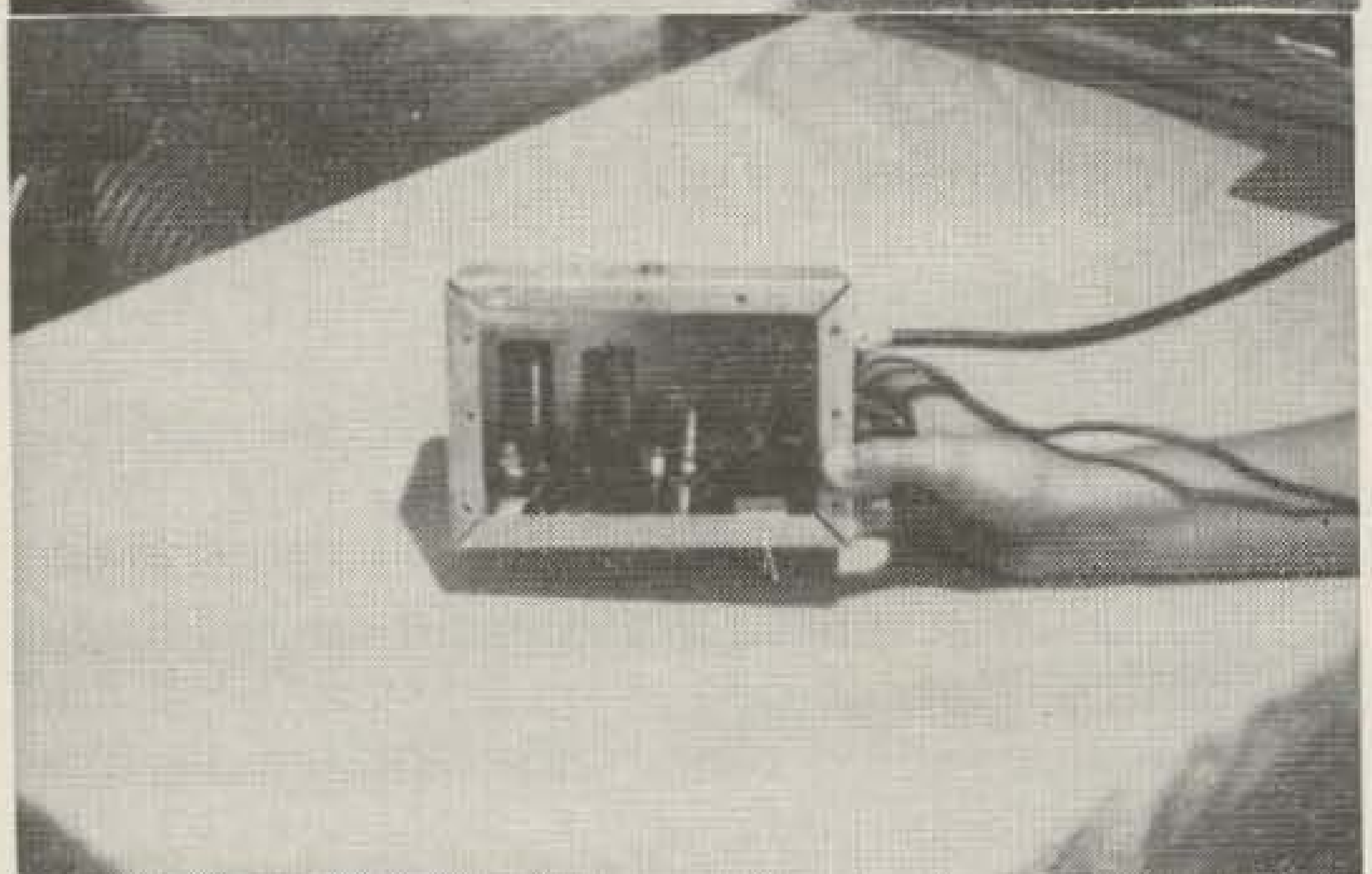
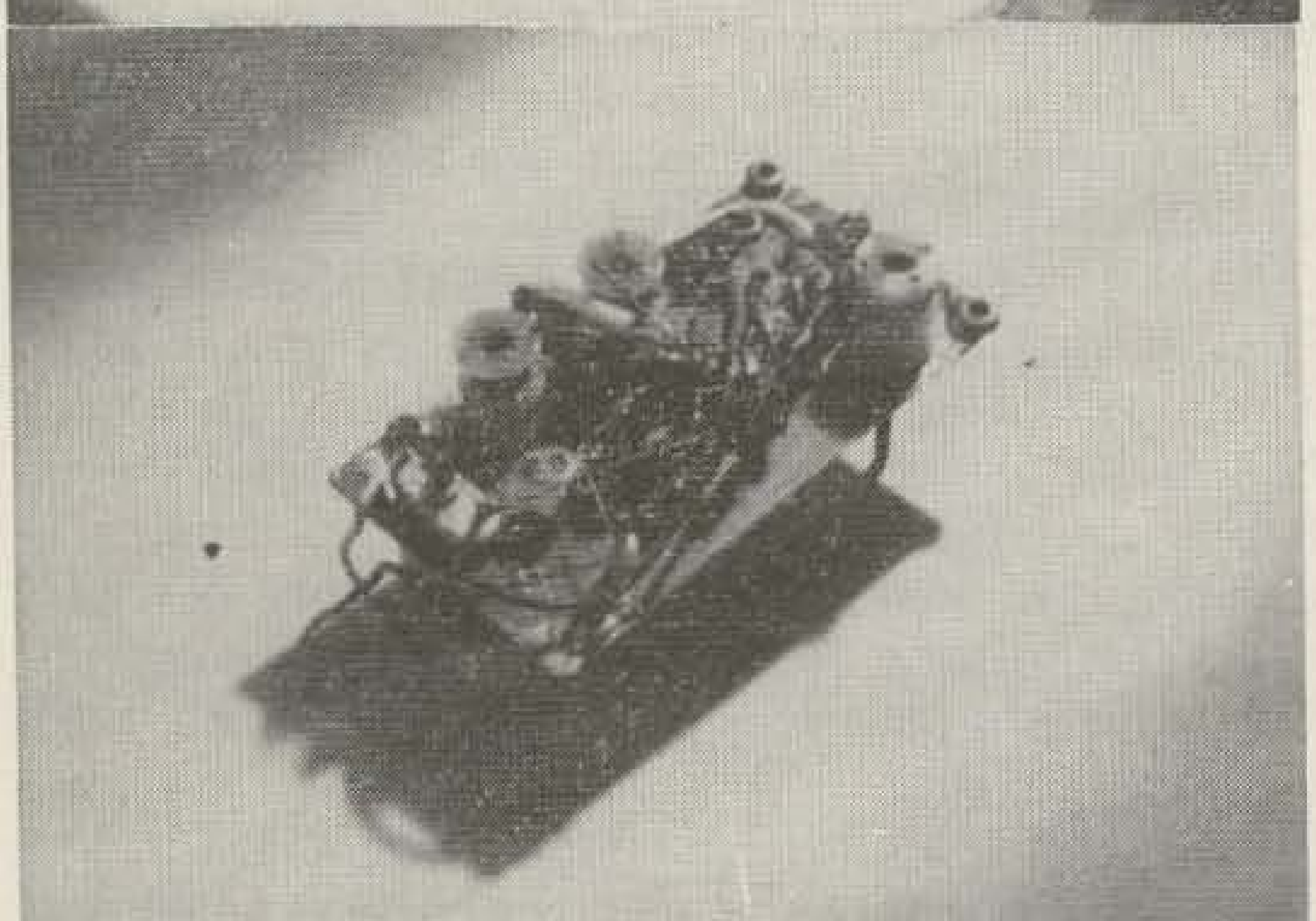
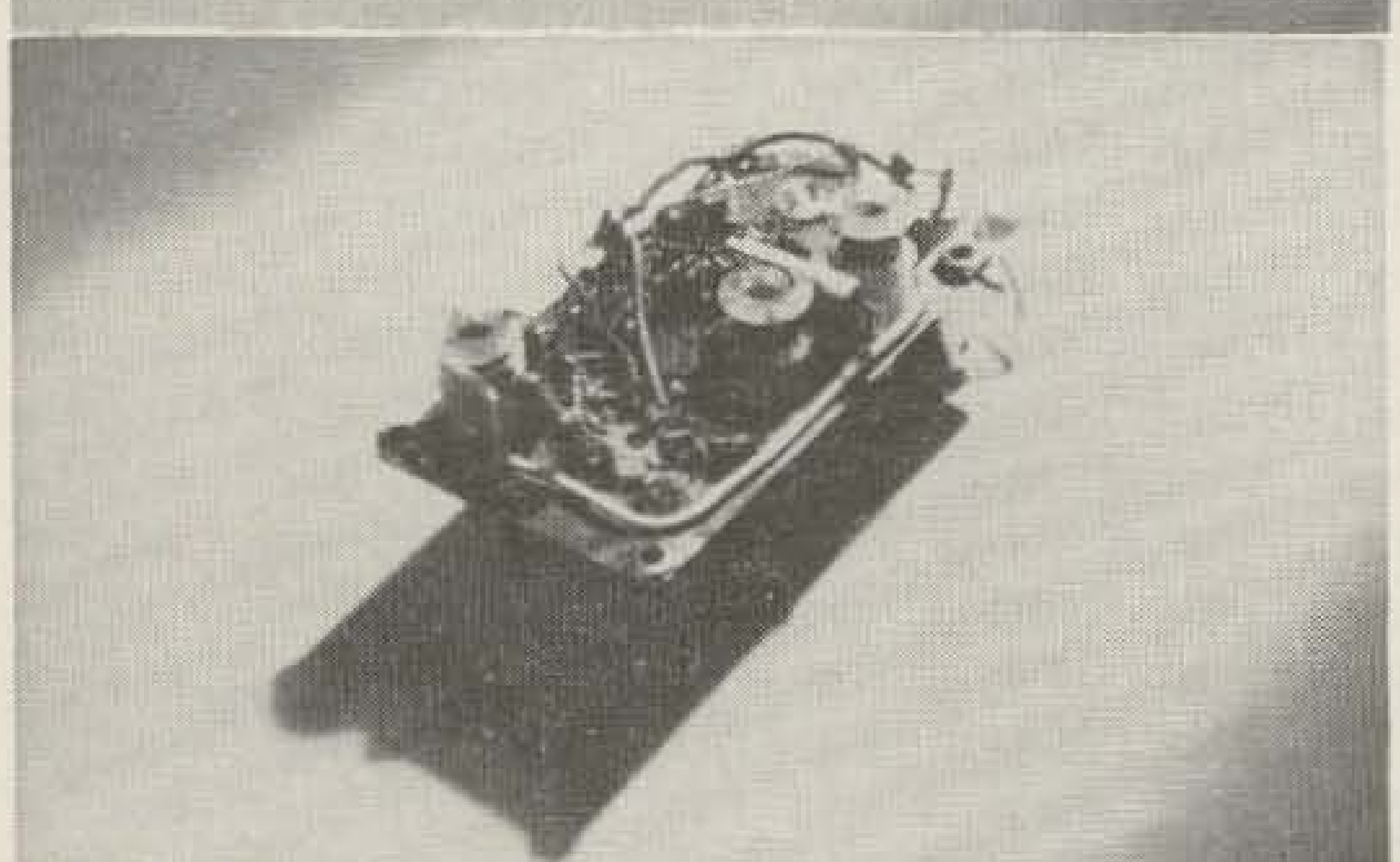
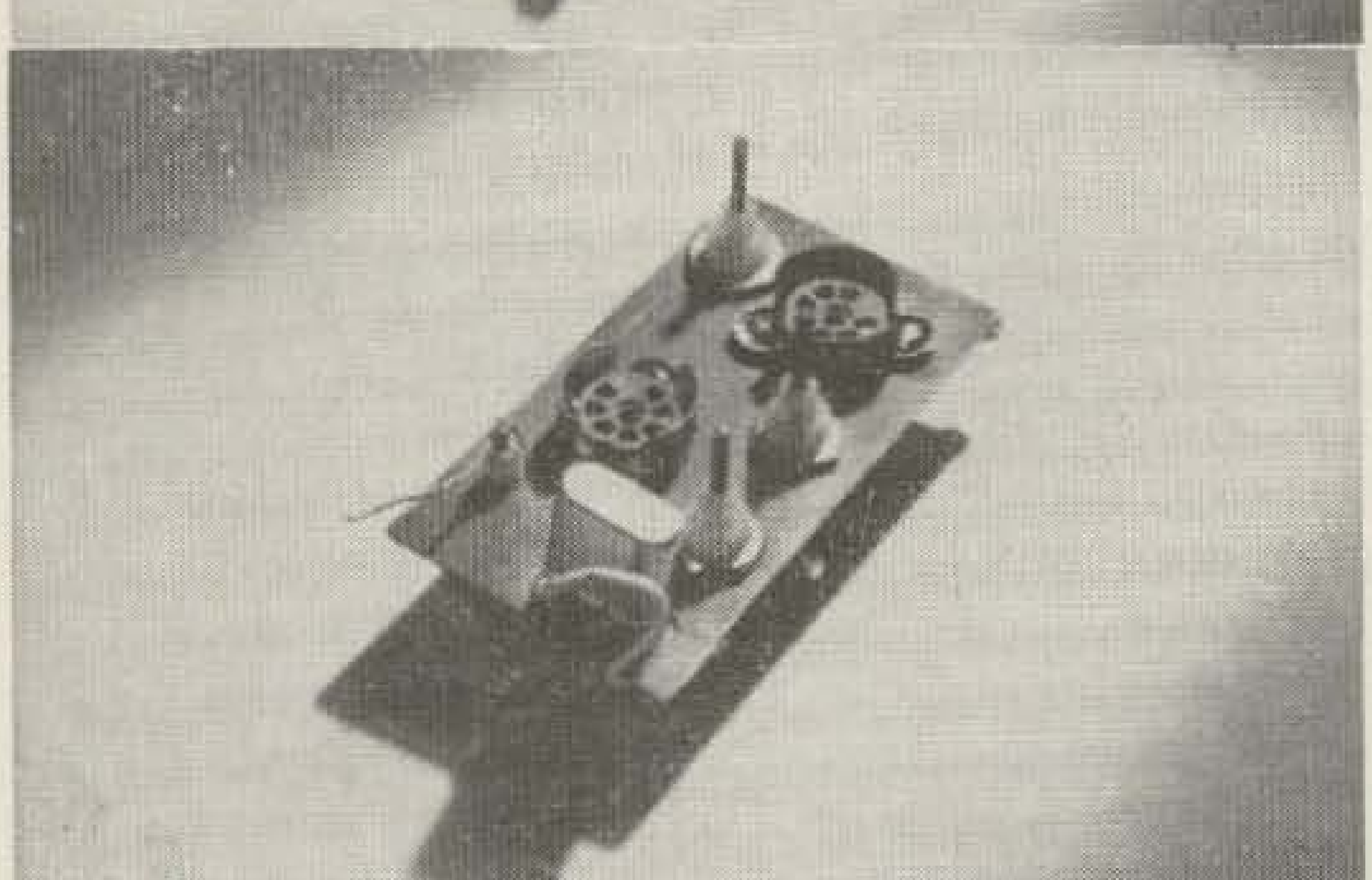
So many glass octal tubes had their identification stamped handsomely on the base as well as the bulb during the second World War that this security leak came to be taken for granted. Presumably that novel concession was made to facilitate turning the stubs in for replacement in the event a direct mortar hit broke the glass. Anyway the favor was soon withdrawn. Came peace, back to the modern evanescent message on the bulb, and on the base nothing but a fancy trademark and mysterious code numbers which are probably digital for "lots of luck," or something worse.

In the late forties I was living in a low-noise, high-DX area of western Alaska when one day a shipment of tubes furnished me with short-lived encouragement. These were standard types of octals but with king-size markings on the bases as well as on coated bulbs sized between G and GT. They looked very businesslike. I plugged one into my VFO and went out of business. This was the pre-war Millen ac-dc model and the difficulty was that the heater current requirements of the tubes bore no relation to any figures in the tube manual. Later someone told me that they had been manufactured to special order for the British forces, perhaps with the idea that if you shoot a private calibre the enemy can't use your ammunition. Maybe this was a blow to the Nazi table radio Gesellschaft, certainly it was a blow to me for tubes were hard for me to get and I suppose it contributed to my moodiness about their markings.

It would seem to be less than charitable to address this pipsqueak of a complaint to the industry that provided me with, among other blessings, a lively 6D6 I have had for nearly a quarter of a century, vintage 80's that would pro-rate at a nickel a year, 6C5's whose life span may exceed mine, and so on. Yet there are indications that a a few obstreperous growls from the market place would not be untimely just now. The increasing sheet-metal elegance in much new equipment, the airy references in copy to "dial excursions" meaning tuning, the endless abuse of "mode" and "configuration" and other annoyances lead me to suspect that some of our manufacturers whose products have deservedly been accepted on faith may be putting too little emphasis on the qualities that made them successful. Land sakes, I hope our tube and equipment producers aren't in danger of infection by the wrap-around tail-fin crowd.

We have been fortunate in that the major manufacturers of the gear we use profess and demonstrate a stringent honesty in their dealings with us, indeed to the point of crustiness if the quality of their effort is questioned. Some years back, to illustrate just for fun, I bought a small transmitter from McMurdo Silver and found occasion to write to them regarding the possibility of parasitics. A swift reply combining equal parts of courteous advice and snappishness somehow left me with the feeling that I was on probation as a customer and should cherish my good fortune carefully. I'm sorry to say that I can no longer find this letter, but I do have one from Barker and Williamsom which illustrates the same point. I wrote to them to order a variable condenser for a dip meter which has given fine service for ten years. They answered promptly, coolly advising me that it would be quite pointless to sell me a new condenser because the units do not become defective, and they added pointedly that they had never had any complaint about them. (Who's complaining?) If I cared to return the dip meter to the factory, however, they would restore it to new condition. I knew I could bet my bottom socket it would come back to me with the original tuning condenser in perfect condition, and as I'm as hardheaded as the next guy I didn't send it. I was careful to keep the letter, and I may have filed it under "Soreheads" but I like it. It spells pride to me.

Okay, fellas—shoot the works on high style cabinets, continue to print the values on some micas and color-code the ones I need, micro-engrave the ends of cartridge fuses, don't give in on standardization of transistor designations, but how about those markings on the GT's and miniatures? Use the good stuff you put in the trademarks. . . . W7IDF

50 Mc Converter Without B+

Jim Kyle, K5JKX/6

BY NOW it's no secret that mobile operation with the new hybrid and transistorized auto radios is possible. Either transistors or the 12-volt series of vacuum tubes can be used in a ham-band converter with these sets.

However, this trick has apparently been employed only on the lower ham bands. No circuits for VHF converters for use with high-voltage-less auto radios have been published to the author's knowledge.

Here's one for the 50 mc band which gives excellent results in local-range work. While its sensitivity won't measure up to your cascode-amplifier home-station converter, it will pull in any signal you can ever read under mobile conditions.

The tubes used were carefully selected from the entire 12-volt series for maximum transconductance. As a result, the receiver with this converter will give a clear, readable output with less than 1 microvolt input.

Basic operating principles of the circuit are similar to a conventional converter. Incoming signals are amplified by the pentode rf stage and mixed with the local-oscillator 49.4 mc signal in the converter. Output, in the 600-4600 kc range, is taken from the converter plate.

When used with a conventional auto receiver the converter tunes from 49.95 to 50.95 mc. Since the lower 100 kc of the band has been assigned for CW exclusively, you might want to change the crystal to a 49.55 mc unit and tune from 50.1 to 51.1 mc. Tuning is accomplished with the auto radio tuning knob.

Only two differences exist between circuitry of this converter and a conventional unit using high-voltage type tubes. The most obvious is in the grid circuits. Since cathode bias would rob you of a large portion of the plate supply voltage, contact bias is obtained through the

2.2 megohm resistors. Signal is coupled to the grid through low-value capacitors.

The other difference is the absence of any screen-dropping resistors. With 12-volt tubes the screens take full plate supply voltage.

Not shown on the schematic, since it may not be necessary in all cases, is a low-pass filter in the 12-volt supply line. The filter, which resembles a conventional power-supply filter in arrangement, removes all noise from the battery line and assures that only pure dc reaches the converter tubes. It was added to the prototype to eliminate vibrator noise from another unit.

The converter is built on a plate of flashing copper, 2¼ by 3½ inches in size. Brass 6-32 nuts soldered to the plate at the corners allow for mounting with 1½ inch spacers in a 3 by 4 by 5 chassis. The open side of the chassis is covered by a sheet of Reynolds do-it-yourself aluminum held down with self-tapping screws. These elaborate enclosure methods were employed to keep all noise possible out of the converter and to assure that any signal reaching it would enter through the antenna jack only.

The copper chassis is easily soldered with a 47-watt "super-hi-temp" tip in an Ungar soldering pencil. All tube sockets and tie points were soldered instead of bolted to the plate.

Coils L1, L2, and L3 were obtained in surplus. Their nomenclature and value are unknown, but any coil of proper inductance and Q will substitute. The coils were purchased ready-wound, and required only the removal of three turns from each to fit the converter's requirements.

The switch, visible in the photos and shown on the schematic, is another surplus item. A 4PDT bat-handle toggle, it provides single-control operation for the converter. Input and output connections are made through standard auto-radio connectors, and a 3-foot extension cable (NOT regular coax) is used to connect the converter to the auto radio.

Few parts values are critical in this converter. However, converter-plate-circuit components (the 1 mh rf choke and the 68 mmfd capacitor) should not be changed. With these values, and the 3-foot length of auto-radio antenna cable, the circuit is broadly resonant at approximately 1 mc and gives good output across the broadcast band while discriminating against higher-frequency noise in the neighborhood of 3 mc.

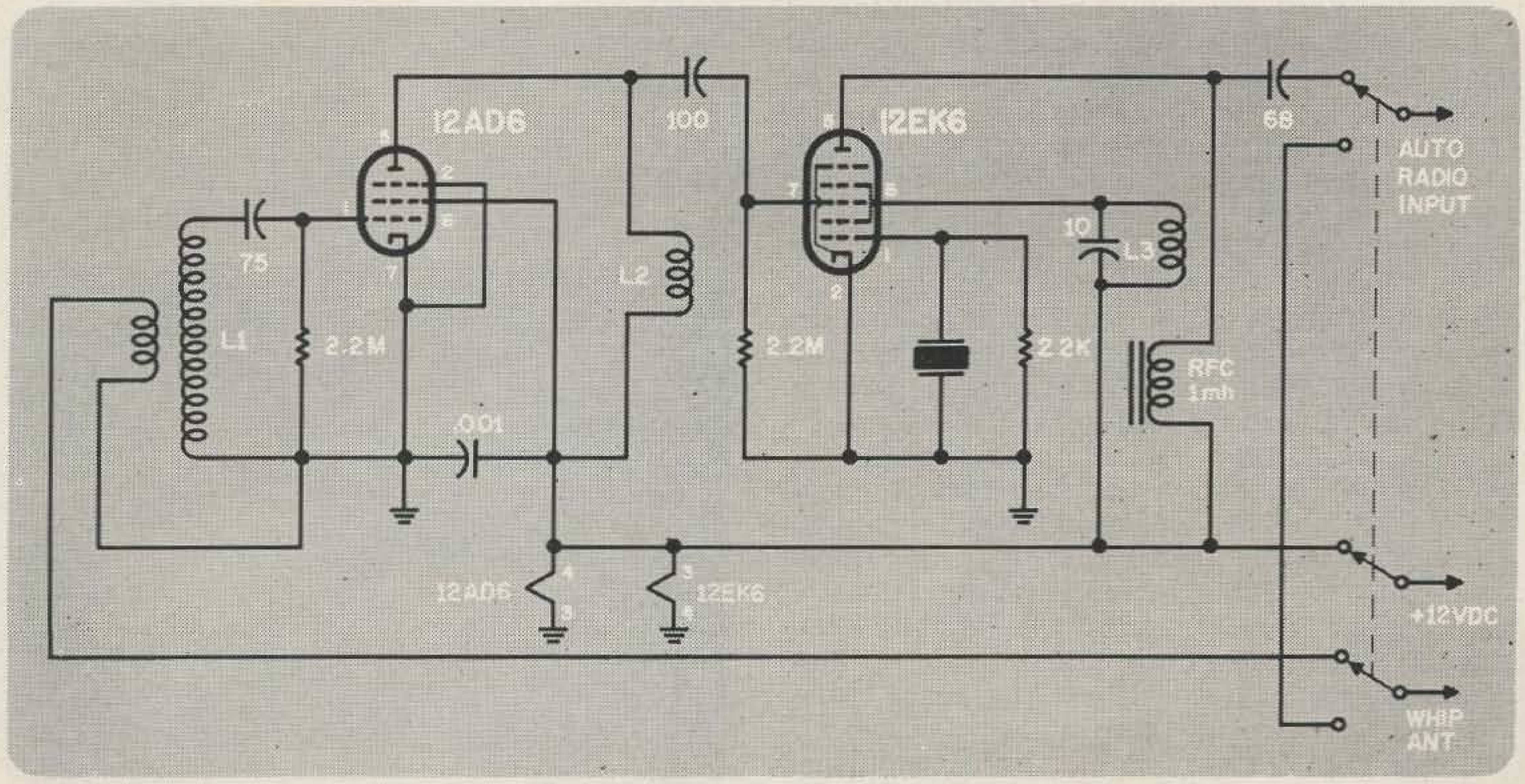
Another item which will have quite an effect on converter sensitivity is the 22,000-ohm crystal resistor. This may be varied from the value shown up to 470,000 ohms. However, local-oscillator amplitude will vary as this resistor is changed, and may reduce the converter's gain. The value shown was best for the prototype—other converters might require a different value.

Using the layout and components shown in the photos, the finished converter is a natural for hideaway mounting. One of the original design specifications was that the unit be mounted completely concealed behind the dash lip on a 1959 Ford, with the on-off switch readily accessible but not visible. With this added feature, you should have no XYL trouble with this converter. 73

L_1, L_2, L_3—8 turns No. 24 enam on ⅜" nylon iron-slug form (surplus item—dip to frequency)

L_1 link—3 turns hookup wire on top of L_1

Crystal—49.4 mc. overtone (International FA-5)



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The Heathkit Hybrid Phone Patch

. . . a review

FROM a fundamental viewpoint a phone patch unit has a formidable set of conditions to satisfy. It must match the nominal 600-ohm balanced landline to the unbalanced high impedance input of the transmitter, and it must match the very low impedance speaker line (3 to 8-ohms usually) to the same line. It must do this using one line for both transmitting and receiving *without switching*. And finally, is must maintain isolation between the speaker and microphone so that a feedback loop is not formed. In view of these considerations, a good phone patch is a pretty neat trick.

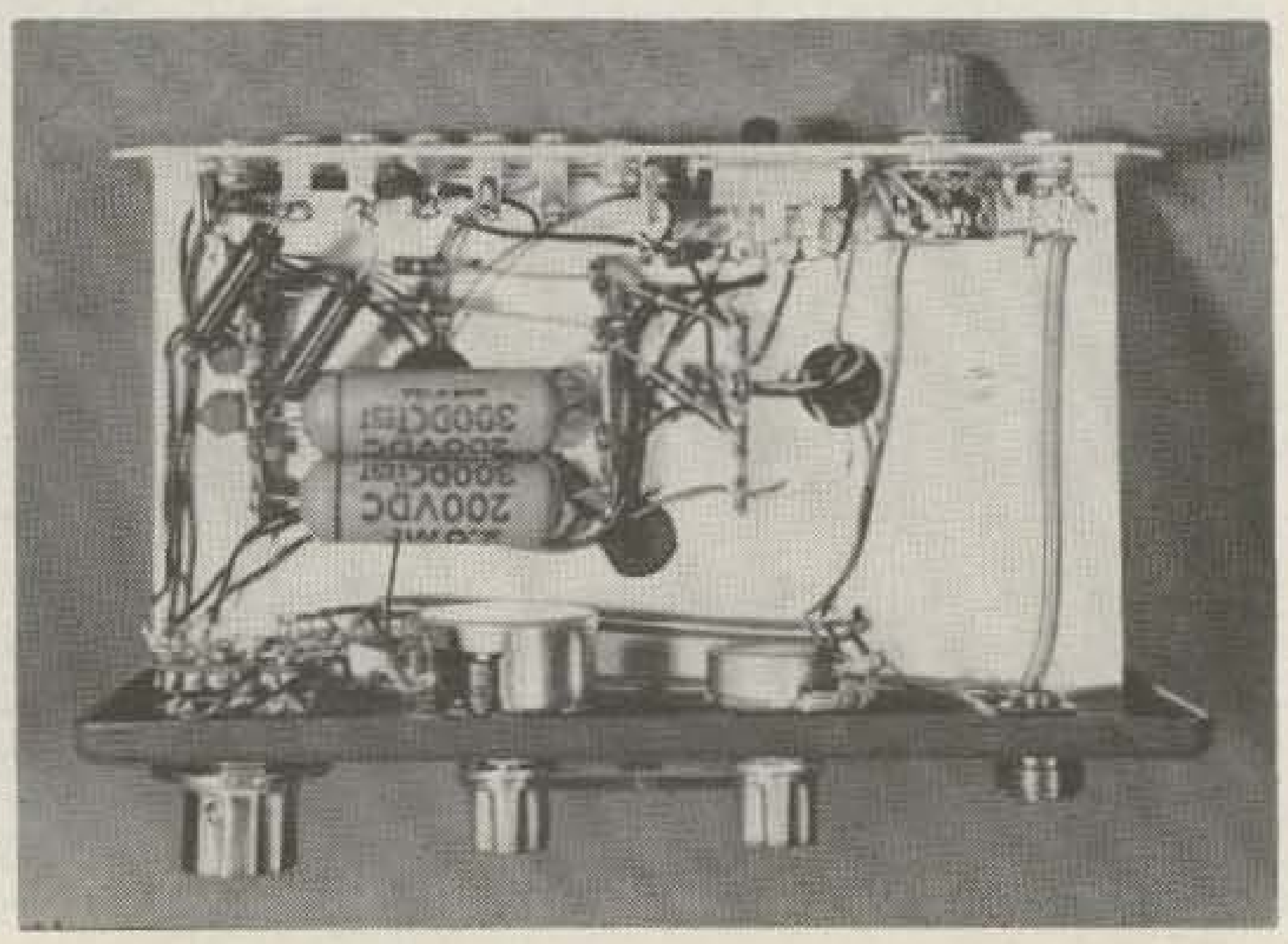
Fortunately, a traditional technique of the telephone industry is perfectly suitable to the problem. This is the hybrid matching method used in most phone patch designs. In essence, transformers are utilized with their windings wired into a bridge circuit in such a fashion that signals coming in on the phone line will appear at one set of transformer windings (connected to the transmitter input.) Signals coming into another set of windings from the receiver will appear across the land line terminals while cancelling out in the winding connected to the transmitter. And, since transformers are used as the coupling devices, impedance transformations can be accomplished at the same time.

There have been many phone patch circuits described in the literature around adaptations of transformers which were available in surplus or which were made for other purposes. Most of these have been compromises in that the transformers didn't always exactly fit the requirements. Many of the circuits did not provide for matching to land line which were somewhere between balanced and unbalanced electrically (as many phone lines are), and they did not provide for a method of monitoring and adjusting the level of the signals to and from the line.

Troubles with many such home-brew phone patches have generally taken the form of: high hum level making intelligibility poor and VOX operation difficult if not impossible; overdriven phone lines causing cross-talk in the telephone company's equipment; and generally poor audio quality as a result of the use of transformers not specifically designed for the purpose. The fundamental problems of adequate isolation between input and output and of prevention of rf energy from feeding into the telephone system have also been inadequately solved by some of the earlier designs.

Fortunately, the Heath Company with its usual competent engineering has solved all of these problems in the Heathkit Model HD-19 Phone Patch. Due to the size of their market, they could have good quality transformers made up to suit the application. Provision is made for balancing the bridge of the phone patch to imperfectly balanced land lines; and a VU meter is provided for monitoring the line at all times to assure that it is not overdriven. (The meter of the VU circuit also serves as a very sensitive and effective indicator for making the line match.)

Two potentiometers on the front panel allow adjustment of transmitted and received signals to comfortable levels while another potentiometer on the rear apron adjusts the balance of the patch to that of the line. Two switches complete the external controls available. A slide switch on the back apron places the VU meter across the line for monitoring purposes or the meter at full sensitivity across



the microphone output of the patch for balancing purposes.

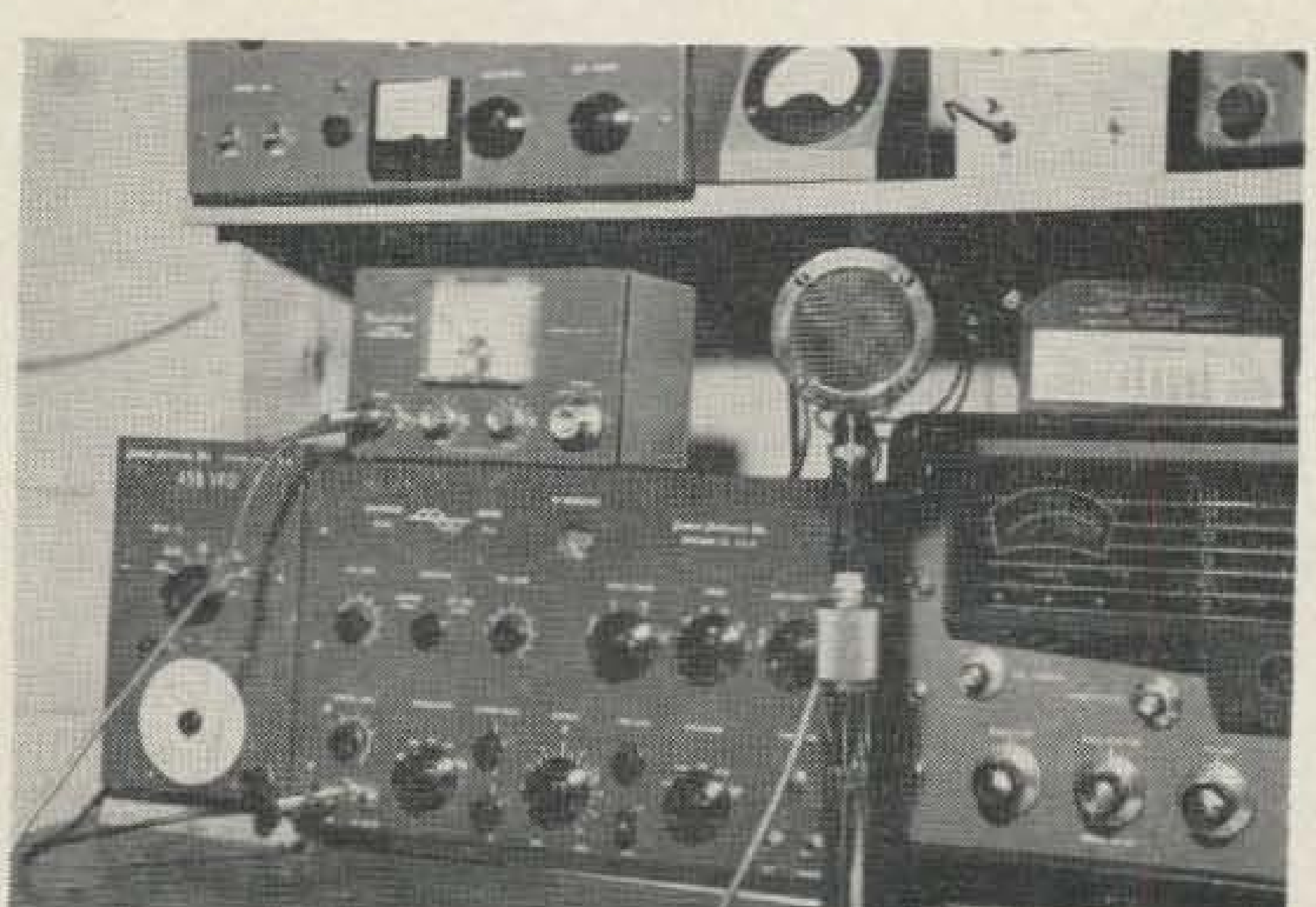
The front panel switch places the patch in or out of the circuit as desired. It provides for switching the microphone straight through to the transmitter and the receiver straight through to its speaker when the patch is off. In the "on" position of this switch, the speaker and microphone are both disconnected and local input and output of the station are through the telephone handset only. This switching arrangement allows the patch unit to remain connected at all times without affecting normal operation of the station.

A terminal strip, coaxial phono-type output connector, and a coaxial microphone connector complete the connectors supplied. Shielded cable and mating connectors are provided for making up the line from the patch to the transmitter microphone input.

Underneath the chassis are the components of the line filter which prevents rf from being fed into the telephone lines, and the two 2-mfd. capacitors which are paralleled to form the dc blocking, audio-pass filter between the patch and land line.

Construction time for the kit is about two hours at the most for a careful worker, and there is nothing tight or tricky about it.

All of the external connections are spelled out in good detail in the manual. However, there is one thing which must be watched here, and which is not mentioned in the manual. Many modern communications receivers have one side of the output transformer secondary grounded to the chassis of the receiver. This polarity must be observed in connection of the receiver to the patch, or it will be found that the speaker is "on" under all circumstances and cannot be switched by the patch. Since the dc resistance of the output transformer is quite low, it is not possible with the usual types of ohmmeters to determine which of the terminals is grounded in the receiver. You must either find this from the schematic in your receiver's manual, or as a last resort you will have to open your receiver and see which terminal is grounded. (Of course, you can try the connection one way and if it



doesn't work, reverse the lead connections at the patch. But this is a most unscientific way to proceed!)

Connection of the patch to the land line can be made with almost any kind of insulated wire—zip cord, twisted pair, etc. Since this is a low impedance balanced line, there *should* be no rf pickup. However, if you want to be sure, and especially if the line must run in close proximity to your transmitter, you can use two conductor shielded line (not coaxial) such as is sold for running shielded extension speaker leads. Ground the shield of this line to the patch and leave the other end floating.

There are only two criticisms which the writer has after a few months use of this patch. These are:

It might be better if the null adjustment potentiometer and the meter switch had been placed on the front panel. Admittedly, these need not be used often; but when it is necessary, it is a nuisance to have to pull the patch unit out to gain access to them. And, in those stations where each piece of gear is built into its own pigeon hole in a console, this could be a great annoyance.

The other criticism is a very petty one indeed, but one which could be easily corrected. The metal knobs are very neat in appearance and should be quite serviceable, but the index mark on the two small ones consists of a very small indented triangle filled with red paint on the narrow skirt of the knobs. This is quite difficult to see from the usual operating position distance. A dab of red paint on the side of the knobs has solved the problem for the writer, even though it doesn't look very professional.

In summary, the Heathkit Phone Patch is a very satisfactory piece of gear, and one which we can hope will attract many operators into providing themselves with patching facilities. This activity is one of the most rewarding in amateur radio, and one which certainly is good public relations for our hobby. The gratitude of some of the people who can hear the voices of their loved ones from overseas is heartwarming, and this is often their first personal contact with amateur radio. 73

Life Insurance for Your Transistors

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GENERAL purpose transistors of both low power and high power are becoming to be extremely inexpensive. RF transistors for Amateur frequencies through the VHF range are even quite reasonable. However, this does not necessarily mean that the transistor—or other semiconductor we are using—will have a readily available replacement. Many experimenters and technicians (and engineers) tend to grow a bit careless in the use and handling of transistors. The result is of course a rash of casualties which could be avoided by following a few common sense rules in the application and use of the semiconductors, which normally should have an extremely long life span.

Soldering

Practically all articles written on the construction of transistor circuits recommend the use of long nose pliers as a heat sink. Very few, unfortunately, tell how this can be done. There are two fairly easy and convenient methods. (1). Hold the pliers in one hand, the soldering iron in the other, and hold the solder between your teeth. This is not particularly recommended for people who are susceptible to lead poisoning. (2). The transistor lead and the lug or terminal are both pretinned, then a bit of solder on the iron is applied carefully and quickly. My preferred method of heat-sinking the lead is to use a small Mueller coil clip, (type 88), or a flattened copper Minigator clip. Effectiveness of the heat sink can be checked by measuring IcO while soldering.

The type and wattage of the iron itself makes a lot of difference. A big iron can actually radiate enough heat to ruin a diode or transistor even though the connection being worked on is not even electrically related to the semiconductor. A very low wattage or improperly tinned iron, on the other hand, may take so long to solder a connection that heat has time to travel up the leads and ruin a transistor in spite of the use of a heat sink. Some irons are not sufficiently isolated from the line to prevent a slight surge of current on contact with the transistor lead. For work with VHF transistors an isolation transformer of some kind on the iron is highly recommended.

Most germanium transistors have iron leads. This aids in slowing down heat conduction to the extent that a temperature of 240 degrees C is permitted for 10 seconds as close as 1/16 inch $\pm$ 1/32 inch from the base. Obviously there is no room here for a heat sink of the usual type. A little spacer is available from some manufacturers to lift the transistor off a printed circuit board to provide a slight safety factor when dip soldering. Inexpensive silicon diodes have copper leads. This should not be overlooked when soldering them into a circuit with very short leads. The higher temperature rating of silicon can be easily exceeded with a good hot iron. Fortunately perhaps, Zener diodes commonly are equipped with iron leads, and in addition the Zener breakdown point is not nearly as sensitive to temperature as is IcO in transistors. That is, Zener diodes may recover, but transistors seldom do.

To avoid soldering the transistors into the circuit, many wise experimenters use sockets, especially in their breadboard circuits. A curious note is that this too has it's pitfalls. A transistor can easily be spoiled if you solder to the socket while it is plugged in. In addition, one text says that the junction may be fractured unless precautions are taken when clipping the leads with a sharp pair of cutters. Ever consider how fast and far the clipped lead flies across the room? The old saying "for every action there is an equal and opposite reaction" may well be applied here. Of course some types of transistors have already been tested for shock resistance. One common test is 3 drops from a height of 30 inches to a maple block. Another is a vibrational test of 500 G's. After purchasing a transistor for a particular circuit it is wiser to avoid any similar tests.

Test It Before Use

While any new piece of gear or component thereof is generally considered to meet specifications, in semiconductor work these specifications are often quite liberal. For example, CK722's have been encountered with IcO of 10 microamperes and Beta of 20, and also with IcO of 1 microamp and Beta of 200. Both might be considered as good for some circuits, but not for others. The breakdown voltage rating is also very important in certain circuits. Fortunately again, most are rated far below what they can really take. In particular, the emitter-to-base breakdown voltage may be several times what the spec sheet indicates as a minimum value.

An example of where these ratings should be considered is in a free running multivibrator circuit. Here the low Beta units may perform better than higher gain transistors. Also, the base-to-collector junction is subjected to twice the power supply voltage when the base is reverse biased by the charge on the coupling capacitor. Hence, with a 22½ volt supply the junction is subjected to 45 volts. This is a mite high for popular experimental types, and the 22½ volts reverse bias on the base-to-emitter junction is too high for even more expensive industrial types. This, coupled with the increase of IcO at such voltages, leads to the necessity for selection of each one. While selection can be made easy if you build up a test circuit, the need for replacement at an inconvenient time (middle of DX QSO) should be considered.

Protection

Transistors and diodes can extinguish themselves much faster than any known fuse of similar ratings. This naturally leads to the obvious conclusion that it is useless to attempt to fuse your transistor circuits. Thanks to the happy circumstance that power transistors are becoming inexpensive, this is not too much of a problem. But a power transistor *can* be protected with a fuse, provided it has a high peak current rating and a series resistor is used to limit current to this peak rating. Here again this is a partial truth, in that a short circuit will blow the fuse, but a slight overload may catch an occasional transistor first. In any case, if the transistor is rated at 10 or 15 amps peak current, a Littlefuse type 8AG fuse of 1 or 2 amps rating is often very helpful.

Additional protection for power transistors can be provided by careful design of the circuit, avoiding possibilities of generating high transient peaks in case of overload signals or amplifier tests using square waves, etc. Sharp inverse spikes, such as the kickback voltage from a relay, may not immediately ruin the transistor since even if it breaks down the current is limited by the circuit resistance. Since these circuits generally reverse bias the base-emitter junction to cut off collector current and thus open the relay, the collector to emitter current during breakdown may be concentrated in a very small area of the junction. Eventual malfunction is almost a certainty, due to an accumulative effect of this.

In using power transistors to really handle lots of power, or where temperature derating is necessary, the manufacturers spec sheet should be examined very carefully. Rather than trying to economize on the size of the heat radiator used it is advisable to make it larger than recommended. This will help make up for the fact that you didn't have the right type of silicone coating for the assembly, and the slight errors in calculations that always seem to creep into experimental work. Many larger manufacturers have free bulletins on how to handle the problems with a minimum of risk of error and effort.

Don't Panic

When a transistor accidently pops two conflicting emotions occur. One is the feeling of dispair—what to do next. The other is the temptation to say "it was an accidental short," and plug in or try another one. That type of procedure invariably results in one or two more "popped" transistors. These are occasionally useful as diodes, but that doesn't help solve the problem. If a careful check of connections reveals nothing wrong it is possible to calculate the value of two or three resistors to temporarily replace the transistor and make voltage measurements, unless the transistor was expected to furnish self-bias as in some oscillators. The open circuit voltages with the transistor disconnected may also give some clue as to what went wrong.

Interpreting the Ratings

This is really a tough problem if you take them seriously. As a matter of fact many transistor ratings on the usual spec sheet do not really mean much to the radio amateur except to serve as a guide in selecting the type to use. Once you have definitely decided on a certain type for a particular circuit, it still is quite as important, to test this transistor to be sure it will work. Returning defective transistors to your local jobber may also prove to be more of a task than was the case with vacuum tubes.

The best solution is to test your own as you buy them. Several portable transistor and diode checkers are on the market, and many have been described in construction articles. The main point of this is of course to get the best your dealer has for the circuit you are planning to use. If he recommends another that he has on hand you should be able to test it and make your own decision. Naturally his friendship and cooperation are very important; both of which are more likely to be found on lax week days than on a busy Saturday morning.

Last But Not Least

While a common (and sometimes justified) comment of confirmed vacuum tube type personnel is that "transistors aren't here to stay," the fact remains that transistors will stay around a very long while if they are treated with the respect they deserve. They have innumerable advantages over tubes or other types of amplifiers in certain applications, and they can certainly give you your moneys worth of trouble free operation with a lower casuality rate than you may have learned to expect. 73

Staff

BEAT GENERATION

NOT too many years ago, CW reception was a simple affair. You either adjusted the one-lunger until it broke into oscillation, or turned on the BFO—and that was all there was to it (except the small matter of copying the code).

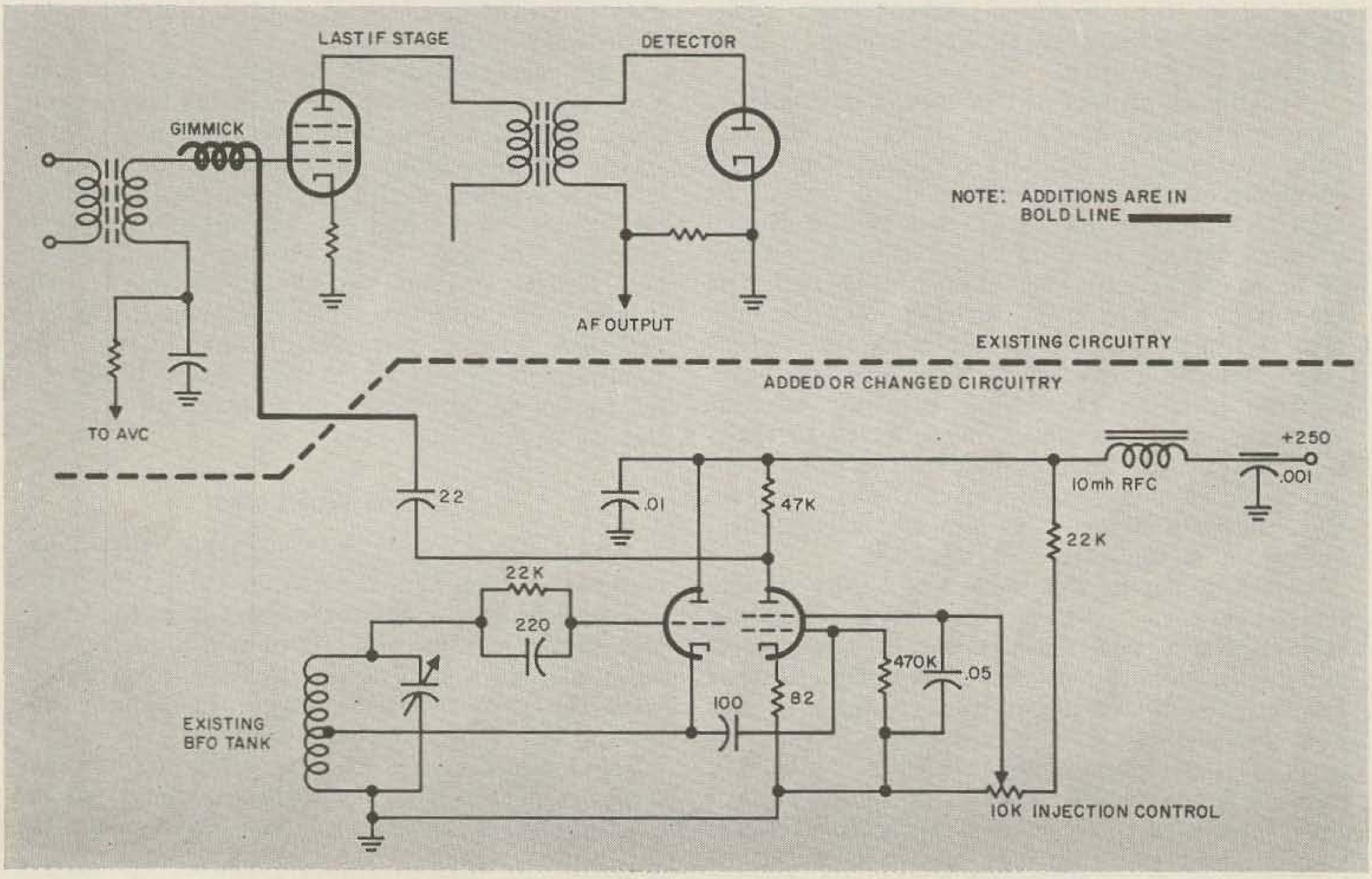
In those ancient days, sideband hadn't been heard of by most of the ham fraternity—and reinserted carrier detection was just a group of almost-meaningless words.

Not so any more. With the rise of SSB operation and the similarity between SSB and CW detection techniques, the business of demodulating a carrierless (or interrupted-carrier) signal has gotten complicated. A whole group of new detection circuits has been developed.

Interest in these circuits has gone through a sharp peak in the past few years, leaving a mass of misinformation in its wake. Pros and cons of each circuit have been aired quite thoroughly—leaving most of us slightly befuddled if we try to answer the question, "Which is the best technique?"

The purpose of this article is to gather in one convenient location most of these circuits, together with a listing of the advantages and disadvantages of each. With this information, you can easily determine which—if any—will do the most for beat generation in your own set.

Fig. 1—Conversion of the BFO to an adjustable-injection circuit allows foolproof SSB and CW reception. BFO components and all power leads must be rf-tight to prevent leakage of energy and subsequent birdies. The "gimmick" shown at if grid consists of two or three turns of insulated wire wrapped around the grid lead.



The major purpose of any SSB or CW detector is to mix locally produced signals with the incoming rf, thus generating beat notes in the audio-frequency range. In the case of CW, the beat note has a steady frequency. With SSB input, the beat varies in both pitch and amplitude, reproducing the original voice.

Of course, any non-linear device will cause a mixing together of input signals. In hi-fi, they call this intermodulation. In receiver front ends, it's called cross-modulation. In both locations, it's an evil byproduct of improper operation.

A better diode detector for reception of SSB is the "square-law" detector. With this one, output is proportional to the square of the input voltage. On AM, distortion is high, but the distortion is of such a nature that it tends to correct some of the diode's deficiencies for SSB use.

There's no particular trick to installing a square-law detector in your set, since the conventional diode action becomes square-law at extremely low signal levels. Just turn the AF gain up full and the RF gain down low. . . . Sound familiar?

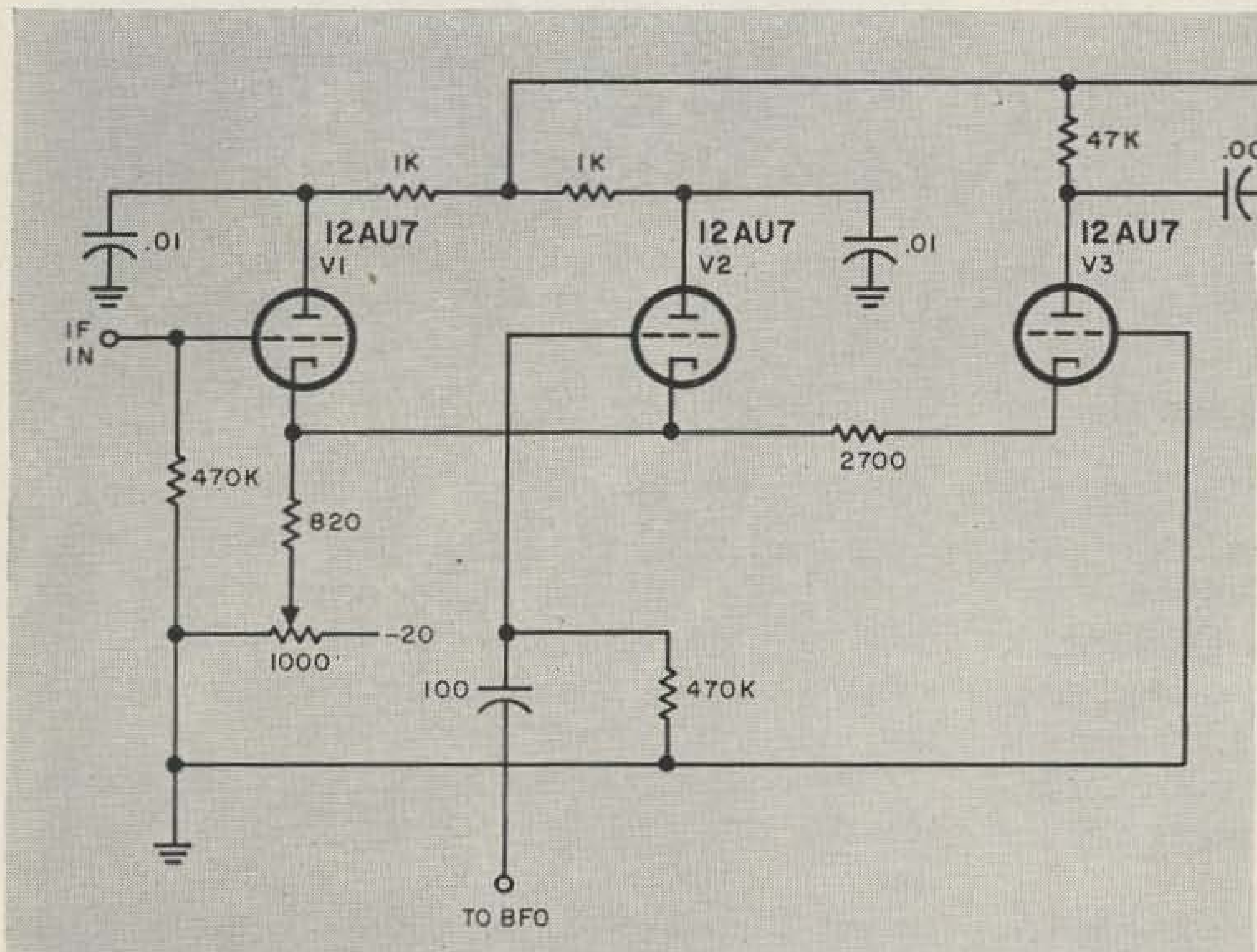


Fig. 2 — The Crosby three-triode "Product Detector" circuit. One triode can be eliminated by combining functions of V2 and V3. Eliminate plate circuit of V2, and grid and cathode circuit of V3. Connect plate circuit of V3 to V2 instead. The 1000-ohm pot in V1 cathode is the IM adjustment, a rear-panel control.

But in reception of SSB or CW signals, it's a necessity to produce results. That's rule one —the detector must be non-linear.

So what's all this we read about "linear SSB detectors" in advertising, product reports, and some theory articles? What the writers really mean is this: the detector isn't linear in its own operation, but it produces a signal which is related in a linear manner to the original modulation.

The same confusion is present in AM detectors. They, too, must be non-linear to give results—but the most common type is called the "peak linear" detector.

That's just the beginning of the confusion, though. The peak linear detector, which is inherently non-linear in itself, doesn't even give linear reproduction of SSB or CW signals in most cases. While the input frequencies are mixed properly, the output is of almost constant amplitude. This destroys all naturalness in the received signal, and in fact makes it undecipherable. You might say it's overmodulated—the sound is the same.

Of course, distortion is still present with this arrangement — although some extremely pleasant-sounding SSB can be received in this manner. The major cause of the distortion is our old friend the square-law characteristic. If we could operate the detector in peak-linear fashion but escape the automatic amplitude limiting, we might do better. . . .

The circuit of Fig. 1 is adapted from some of the oldest SSB circuitry in the books, but is still one of the least tricky arrangements around. The detector functions normally, and can be of any sort although a conventional diode is shown. The reason for this is that the detector thinks it's working with AM. . . .

Let's back off a couple of steps. Most receiver circuits combine the locally - inserted carrier with the incoming signal at the detector stage, to eliminate possible trouble with BFO harmonics which might get into the set's front end.

Since the BFO is limited in output, you're usually lucky to find 10 volts of local carrier at the second detector. In contrast, incoming signal may range as high as 20 to 25 volts.

This causes no particular problem in CW, since you're only interested in the pitch—amplitude makes little difference.

However, for true "mixing" action as opposed to simple beat-note production, the carrier must be at least four times the amplitude of the incoming signal. Distortion will decrease as carrier increases, so the more, the merrier.

When you cut back the rf gain, you not only forced the detector into the square-law region but you also cut the level of the incoming signal down to less than a fourth that of the local carrier.

But to keep the detector operating in the "linear" region, it's far better to boost the level of the local carrier. If the local carrier is at proper frequency, the detector stage then cannot tell the difference between SSB and AM—and your ears won't notice the difference either.

By using a low-impedance potentiometer and shielded interconnecting leads, you can control the BFO voltage injected into the last *if* stage. The less voltage injected, the lower the carrier level at the detector will be.

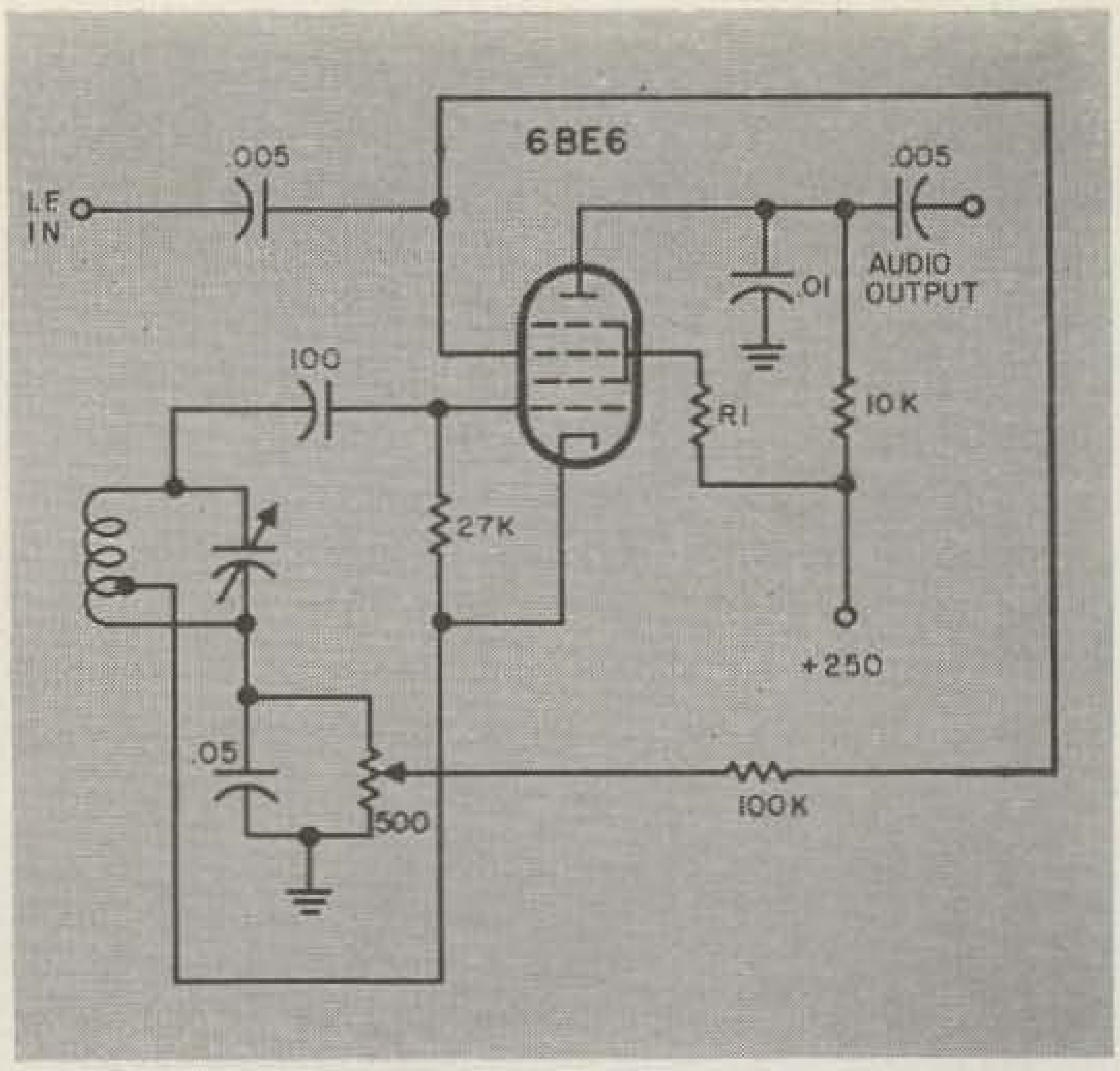
If the BFO is tightly enough shielded, it can be left in operation at all times for better frequency stability. With INJECTION controls set to zero, AM reception will be possible. Injection can then be increased as necessary for SSB and CW.

To use this trick, first tune to the SSB or CW signal with INJECTION set to zero. Tune for maximum wiggle of the S-meter needle. Then slowly increase the injection until the S-meter just stops wiggling. Adjust frequency of the BFO as necessary for a natural sound. If distortion is noticed, increase injection slowly until it disappears. You can now give an honest S-meter reading, because when the meter steadied you had injected just enough carrier to produce equivalent 100 percent modulation at the detector of your receiver. AVC will not be active, but you'll hardly notice its loss.

The only two disadvantages of this circuit, aside from the added front-panel control, are its susceptibility to BFO leakage and the nuisance of having to adjust another knob.

With these points in mind, amateur designers continued the search for a better inserted-carrier detector. One of the most successful was Murray Crosby, W2CSY. His three-triode circuit has been widely discussed in print, and a number of variations have appeared. One is shown in Fig. 2.

This circuit, originally known as the product detector (a term later applied to other SSB



detector circuits as well), requires only a small amount of BFO injection voltage and features especially-low intermodulation distortion, due to the adjustment provided.

Its operation can be explained only by resorting to columns of algebraic equations. Approximately, though, the first two triodes act as cathode followers, one driven by the *if* strip and the other by the BFO. Since they share a common load resistor, the two incoming signals are mixed in the load.

This common load resistor is also the source for the third triode, a grounded-grid amplifier. It isolates the mixing portion of the circuit from the audio output elements (and in one variation popularized by one W2NSD, was combined with the BFO cathode follower with no loss in performance). The potentiometer adjusts operating bias of the tubes, and is set for minimum distortion.

Advantages of the Crosby circuit and modifications of it have already been listed. Its disadvantages are these: 1. Audio output is much lower than from other detectors, usually requiring an extra stage of audio. 2. The detector is easily overloaded. 3. Adjustment of the IM pot is critical. 4. The circuit is comlex, requiring at least two tubes and a number of extra components, not to mention a separate BFO. When used, it is best built as an outboard unit for this reason alone.

One of the next circuits announced after the Crosby detector gained popularity was the pentagrid-mixer detector. It's almost impossible to give proper credit for this one, since a number of amateurs published circuits of similar nature at almost the same time. At any rate, it was a logical development, once the point was firmly made that detection is mainly a mixing process.

Fig. 3—This pentagrid mixer circuit gives approximately the same results as the Crosby detector, with a slight increase in audio output. IM distortion is reduced by adjustment of the 500-ohm potentiometer. Value of R1 must be determined by experiment. Start with 33,-000 ohms; reduce as necessary (in 5 percent steps) until no trace of distortion is heard on strong signals.

The pentagrid detector, shown in Figure 3, is almost identical to a standard mixer circuit as used in the receiver front end. The major difference is that output is taken through an audio network instead of through an *if* transformer. Another difference is the IM adjustment pot, which allows this much-simpler circuit to compete with the Crosby array on equal terms so far as distortion is concerned.

Advantages of the pentagrid detector include simplicity, low distortion, ample audio output, and the ability to substitute on a tube-for-tube basis for an existing BFO since the pentagrid detector requires only a single tube for all functions.

On the disadvantage side of the ledger are two points. The pentagrid detector, like the Crosby circuit, is extremely sensitive to overload. In addition, adjustment of the IM pot is especially critical and can only be made properly with the aid of an oscilloscope. Full adjustment details can be found in the references.

Possibly the newest entry in the field is the sheet-beam detector, which makes use of a special tube originally developed for color-television use and later announced as a SSB special by RCA.

Several detector circuits can be built around the sheet-beam tube. One of the simplest is shown in Fig. 4. It was apparently originated by ZL1AAX and later developed by RCA engineers.

The secret of this circuit lies in the tube itself. It's a cross between an rf pentode and a cathode-ray tube, having deflection electrodes where most pentodes have suppressors. With one cathode, one control grid, one screen, two deflectors, and two plates, the tube's output can be switched from one plate to the other by signals impressed on the deflectors. At the same time, the output can be modulated by a signal on the control grid.

When the *if* strip output is fed to the control grid and the BFO signal is fed to the deflectors, the average current to *one* plate (either can be used) will be a replica of the original audio. This means that output can be taken from the plate circuit.

If the *if* output is fed to the deflectors, however, and the BFO signal goes to the control grid, the audio will appear (in push-pull fashion) at *both* plates. Using a push-pull transformer will allow the BFO signal to be cancelled out, eliminating possible overload of later stages.

Audio output of this detector is extremely high—in the neighborhood of 30 volts. This is sufficient to drive the output tube directly, and in new-equipment design both the push-pull transformer and the driving stage can be eliminated by R-C coupling to push-pull audio output tubes. In adapting older gear, it's best

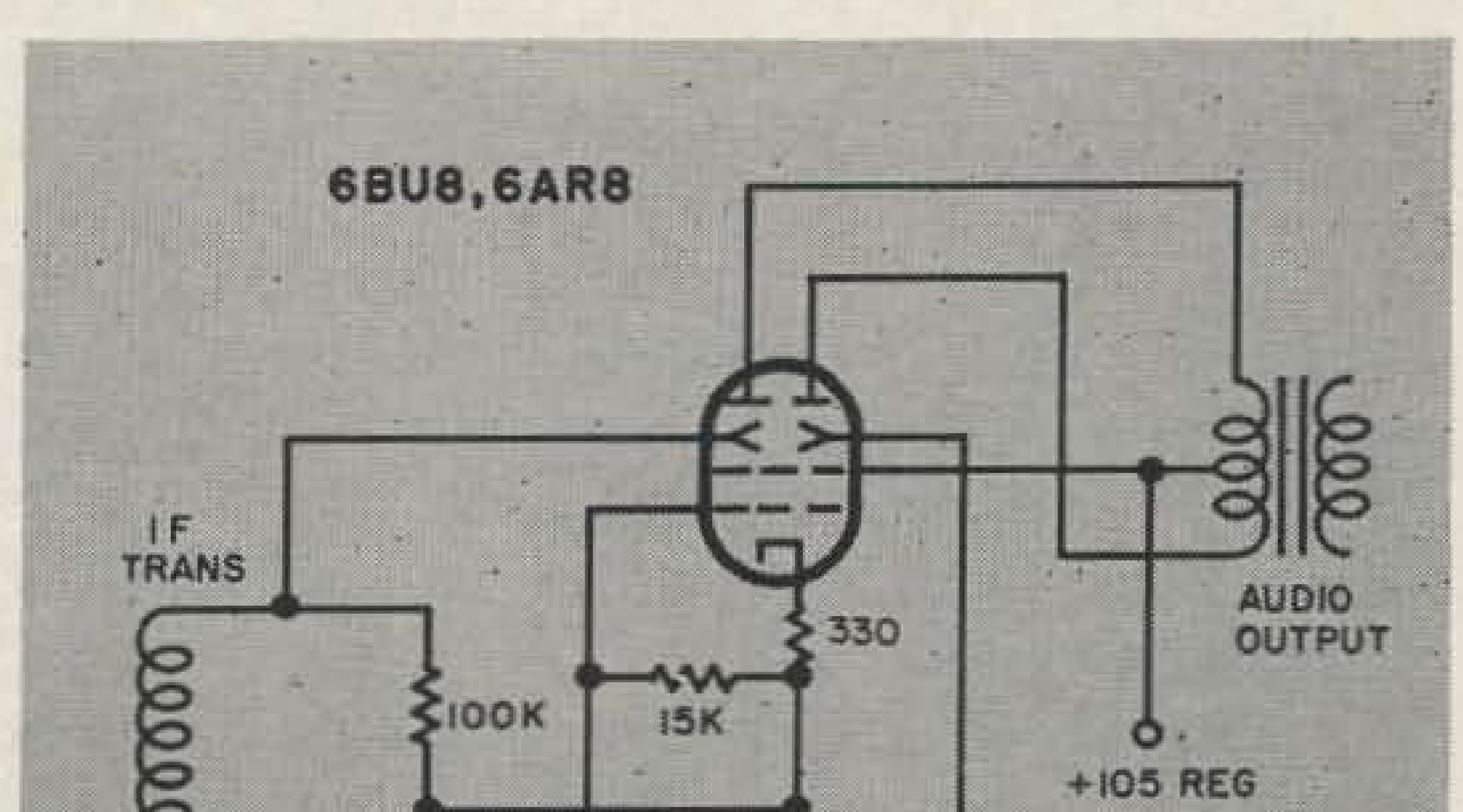


Fig. 4—The sheet-beam detector originated by ZL1AAX features minimum distortion and maximum audio output. Although a separate BFO is shown, it should be possible to use the control and screen grids as BFO elements in an electron-coupled circuit. Major disadvantage is the specia ltube required.

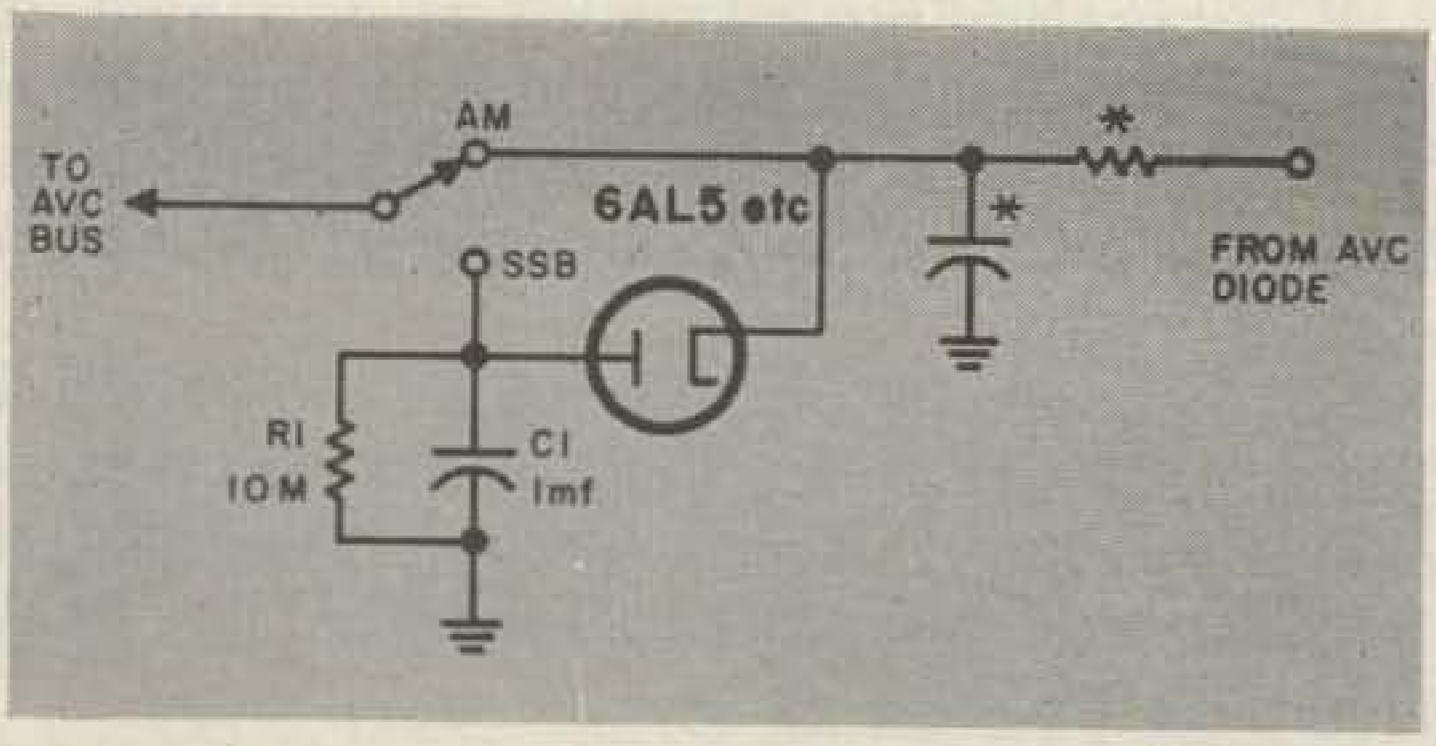


Fig. 5—This four-component circuit switches time constants in the AVC line to make it suitable for either AM or SSB-CW reception. See text for discussion of R1-C1 values and adjustment of attack and release times.

to pad the output back down to the nominal 1-volt level to eliminate readjustment of the audio gain control when switching from AM to SSB and back again.

Advantages of the sheet-beam detector include its high output, its resistance to overload, its circuit simplicity, and its low intermodulation distortion (where it's even better than the Crosby or the pentagrid, and is far superior to simple diode detectors).

Disadvantages are the requirement for push-pull circuitry, need for a separate BFO, and, most important, possible difficulties in obtaining the special tube used.

Before leaving SSB detectors and moving into AVC circuitry for use with them, one more circuit deserves mention: Webb's "synchronous detector" adapter which allows reception of not only SSB and CW signals, but DSB transmissions as well. While its advantages are numerous, so are its disadvantages: it is complex, expensive, bulky, and somewhat tricky in adjustment. Full details are found in the references; it's a full article in itself.

All the SSB and CW detectors described here (with the exception of that shown in Fig. 1) share a common disadvantage—they make no provisions for AVC.

While AVC is no necessity for reception, no one will deny that it makes listening easier —especially in a roundtable sort of operation where some stations have strong signals and others are weaker. A good AVC which brings them all to common level eliminates blasting of the eardrums.

If your receiver is a Super-Pro or a similar design, using separate channels for signal and for AVC, there's little problem. In fact, such a receiver *can* be used with no change at all, especially if separate switches control the AVC and the BFO functions. However, the attack and release time constants best suited for AM use lead to a distinct "thump" on each syllable of a SSB signal, and put a chirp on every CW station.

The circuit of Fig. 5 puts an end to such problems. The diode (which must be a vacuum-tube type) presents very small resistance in one direction but almost infinite resistance in the other. Connected as shown, it provides an AVC attack time measured in microseconds, but release time stretches out to be almost in seconds. Thus, the AVC can cut back instantly when a strong signal arrives, but gain won't be restored between syllables (or between dits of CW). Between words, normally, the gain will return.

Both the attack and the release times can be controlled independently by adjustment of values of C1 and R1. C1 controls attack time; increasing its value makes the AVC take longer to respond to a signal. With C1 set at the proper value, R1 determines release time. Increasing its value increases recovery time between signals. Values shown in the figure have been proved in practice, though they may seem unduly large.

Since SSB and CW AVC aren't suited to AM reception, the switch shown in the schematic is used to restore normal AM action. It is ganged to the FUNCTION selector on the front panel, or may be an added control.

This system of AVC won't work unless your set has separate *if* channels for signal and AVC lines. To install AVC for sideband or CW on a single-channel set, you have three choices: you can build up a complete separate *if* channel (which is bulky, expensive and

Fig. 6—This channel-splitter (two cathode followers with paralleled inputs) allows the same *if* strip to be used independently for signal and for AVC. It is connected between the last *if* transformer and the detector inputs. Interaction between the detectors is minimized by its isolating action.

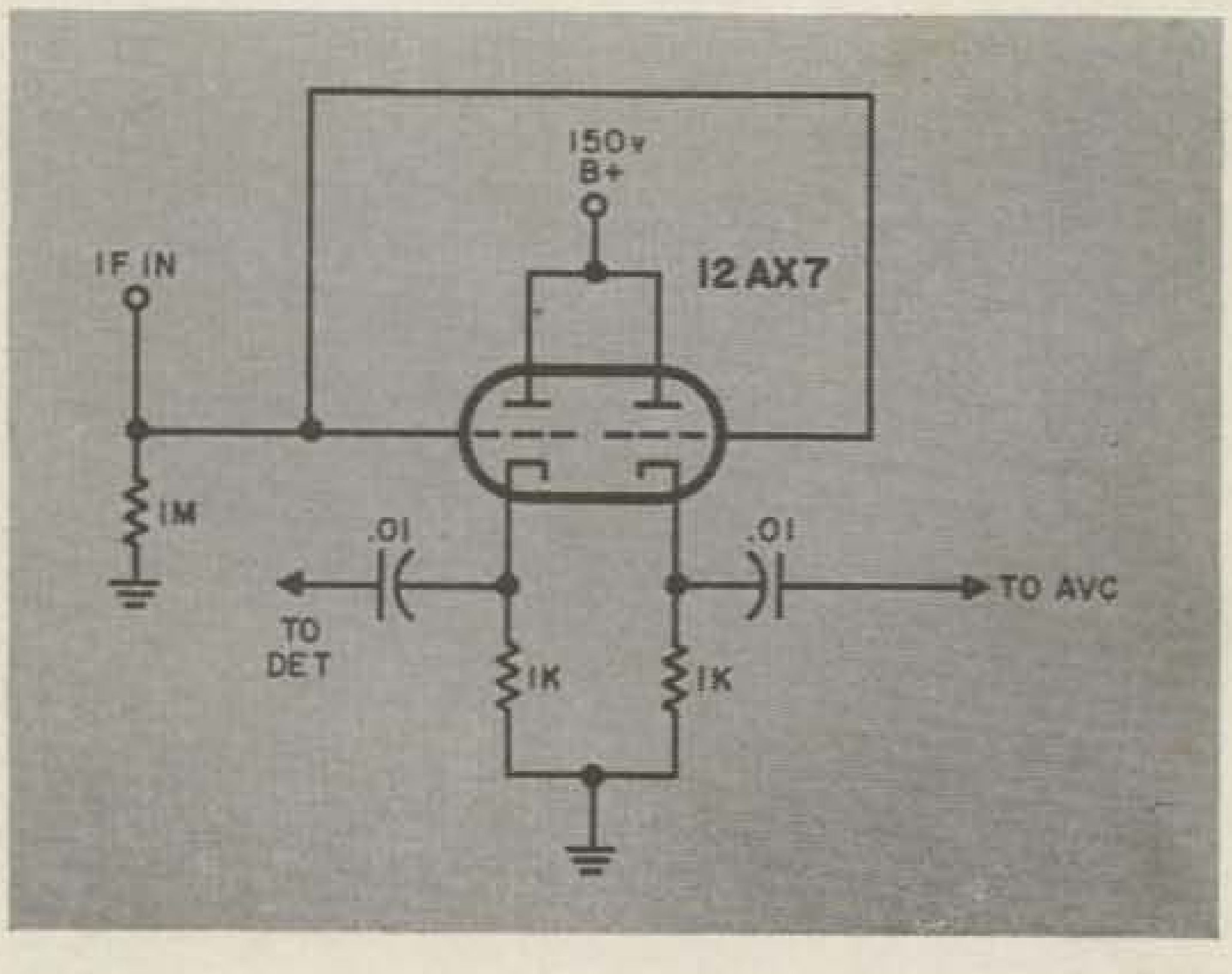
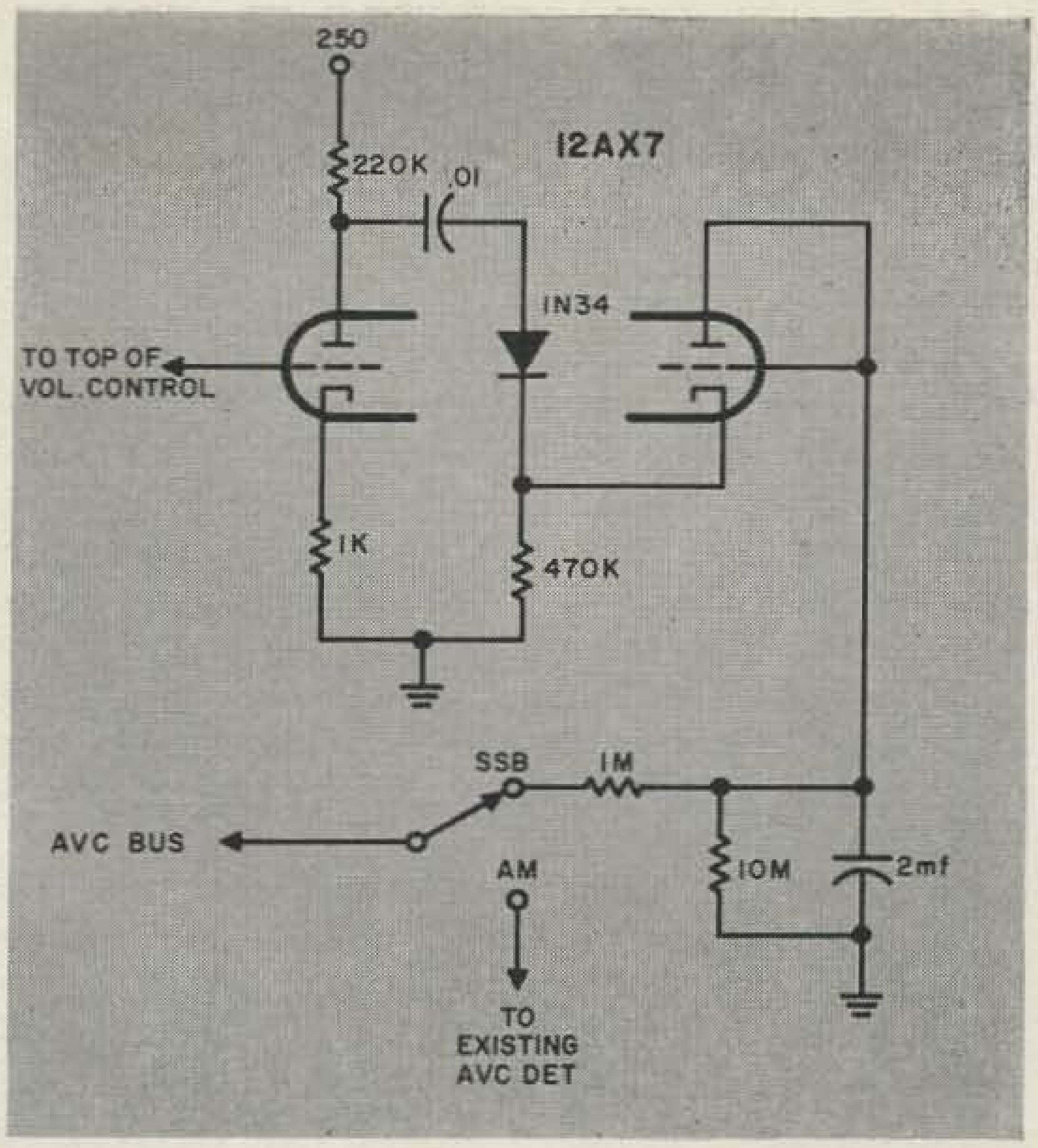


Fig. 7—Audio hanging AVC gives flattest possible characteristic for SSB and CW use. Audio is amplified in half of 12AX7, rectified to produce AVC voltage by 1N34, and AVC is gated to control bus by other half of 12AX7, diode-connected. The switch allows use of normal AVC circuitry on AM signals.



complex); you can install a twin-triode splitting amplifier (see Fig. 6) at the end of the *if* strip, ahead of the detectors; or you can install audio AVC.

Of the three, audio AVC offers more advantages and fewer disadvantages. The separate channel system has no advantages, and its disadvantages have just been listed. The splitter of Fig. 6 has the advantage of comparative simplicity (and the AM detector can be combined with the AVC channel) but is still more complex than audio AVC.

Audio AVC offers the advantage of a flatter gain-control characteristic, greatest simplicity in construction, fewest number of parts, and reliability. Its only major disadvantage, which can be overcome by careful design, is that it makes it possible to overload the detector before AVC cuts gain back. However, this effect is normally present only with AM signals of very low modulation percentage.

The circuit for an audio AVC circuit is shown in Fig. 7. Included in this circuit are the time-shaping networks of Fig. 5, in slightly different form. This circuit is adapted from one described by WØBFL three years ago. The original circuit used five tubes (in two envelopes) to accomplish its purposes. The modified circuit uses a single 12AU7 and one 1N34, allowing it to be added to almost any receiver.

That about wraps it up for now. There are countless other SSB or CW detector circuits, but virtually all are modifications of one or another of these basic arrangements. If you need additional details on any of the circuits, they can be found in the references listed below; if you can't find them there, the author below. 73

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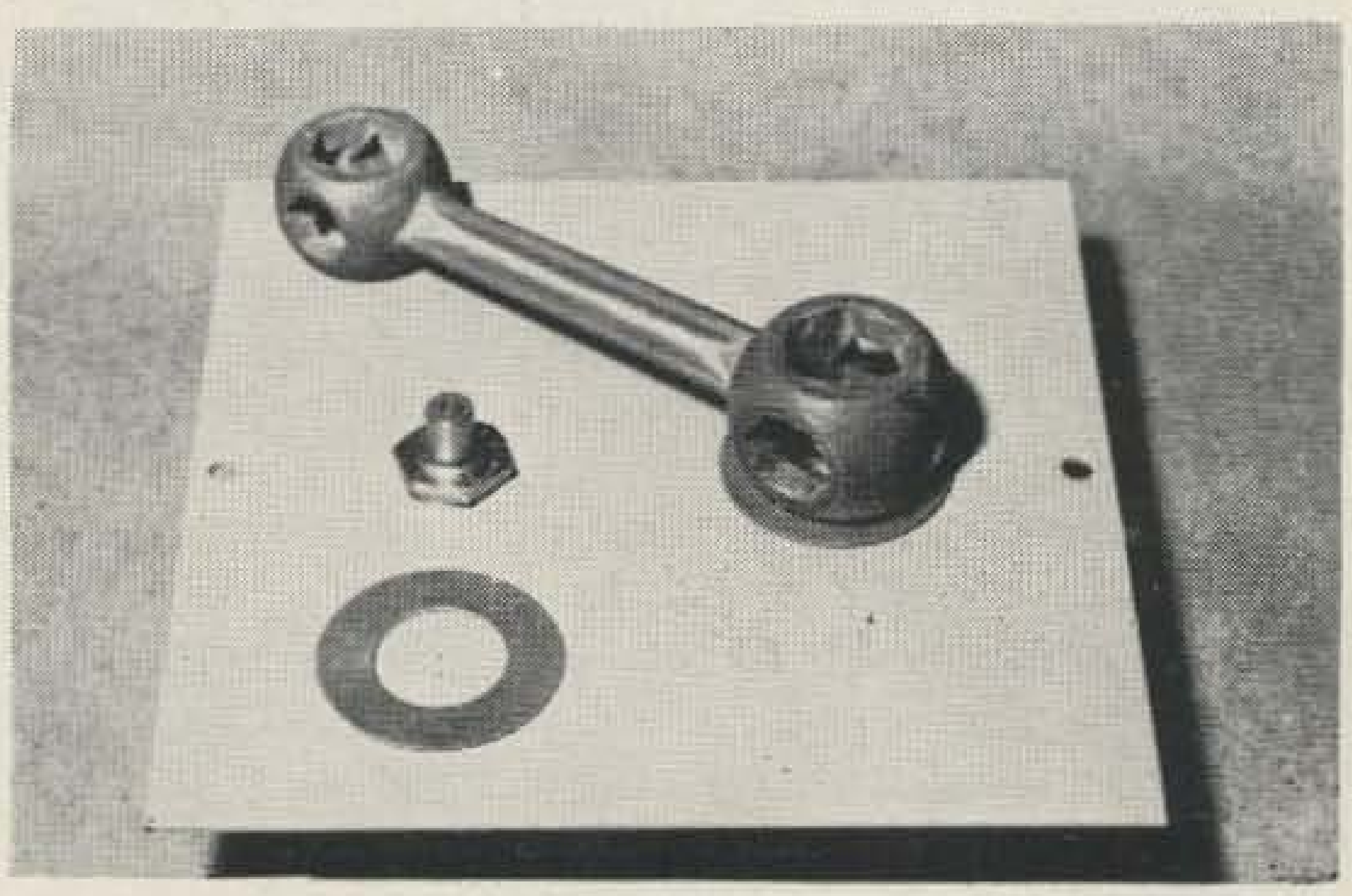
Protect the Panel

Probably the most exasperating accident that can happen in a construction project is to reach the final assembly stage and have the wrench slip as the control nuts are being tightened. A deep scratch through the decals and paint is the usual result.

A metal washer, with a center hole just large enough to clear the control mounting nut, will serve to protect the finish of the panel against tool marks. The photograph shows the method used.

. . . . Pafenberg



Up-Dating the Absorption Wavemeter

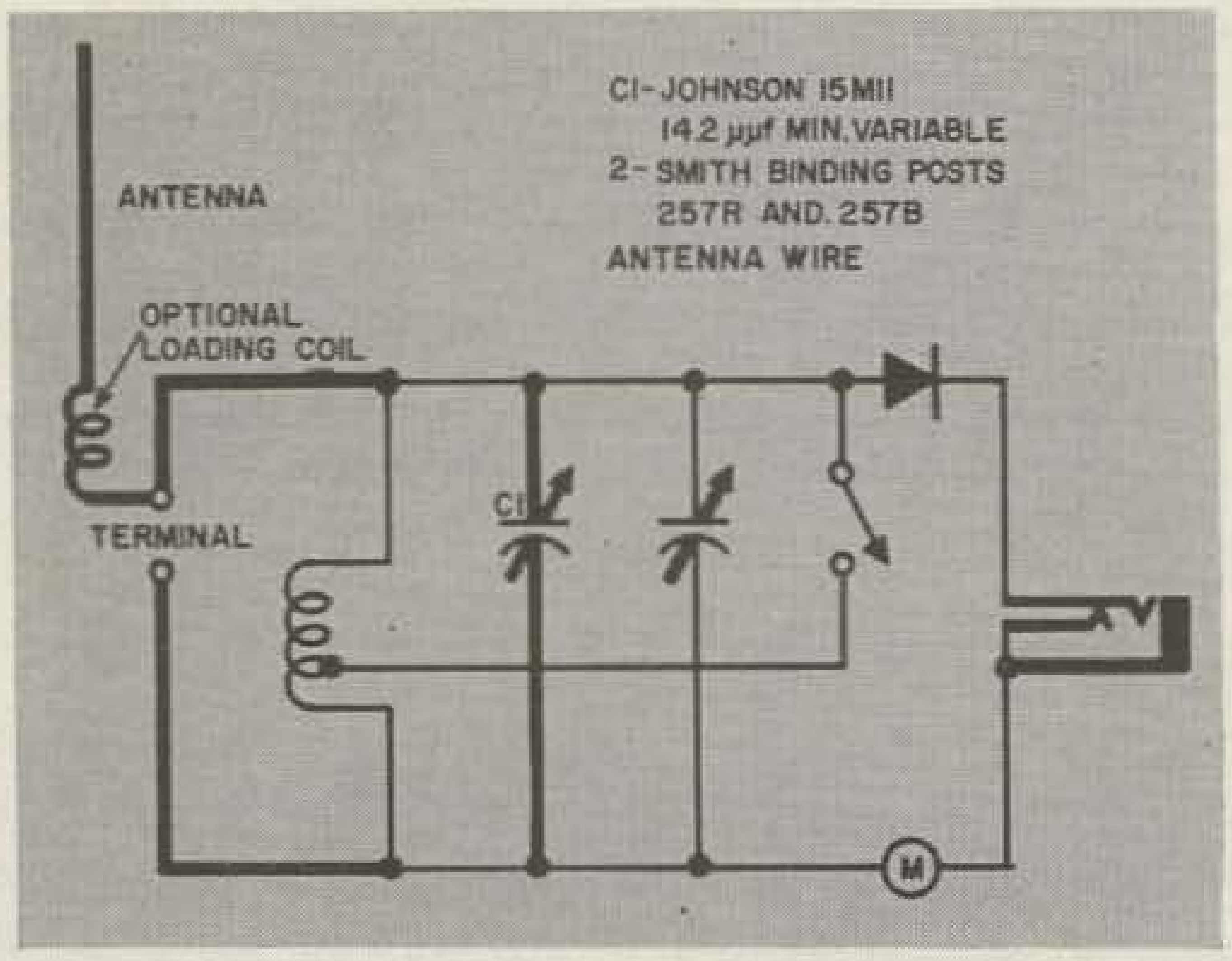
by Edward M. Noll W3FQJ

THE absorption wavemeter has had numerous applications around the station. Its resonant circuit makes rather efficient use of radiated rf energy. An absorption wavemeter can be calibrated rather closely frequency-wise and is not troubled with beats and harmonics like the more sensitive frequency meters. It is a fine device for checking-in the correct harmonic and for chasing down parasitics.

The average absorption wavemeter can be made even more versatile with some minor revisions. Many hams now have an oscilloscope at their disposal. Why not set up the absorption wavemeter to permit a convenient display of mulation envelope? Give the absorption wavemeter a little more pick up and it does well as a field strength meter. Some band-spread tuning helps out when you are concerned with a specific section of a band.

Our Triplett Model 3256 Absorption Wavemeter was the object of our modernization plan. As shown in Fig. 1A it uses a tapped coil arrangement and, therefore a single coil to cover the bands from 10 to 80 meters inclusive. A single-pole single-throw switch permits high and low band change-over. Three components were added to permit more versatile operation.

A small trimmer capacitor was added across the regular tank capacitor to act as a band-spreader. We selected a small 15 mmfd job



with a very low minimum. With the low minimum value, the main dial calibration holds up whenever the bandspread capacitor is set to minimum capacity.

Two multi-purpose binding posts were connected across the resonant tank of the wavemeter. These permit convenience in removing rf energy for oscilloscopic displays. They also provide a facility for connecting a stiff wire antenna and an associated loading coil for even better pick up. Just a three or four foot length of stiff wire has a pronounced effect on pick up. Therefore the wavemeter need not be coupled nearly so close to sources of rf energy.

If you bring the pick-up antenna into resonance by loading it works out rather well as a field strength meter. At least you can set it up outside and waltz it around the directional antenna to see what is or isn't happening.

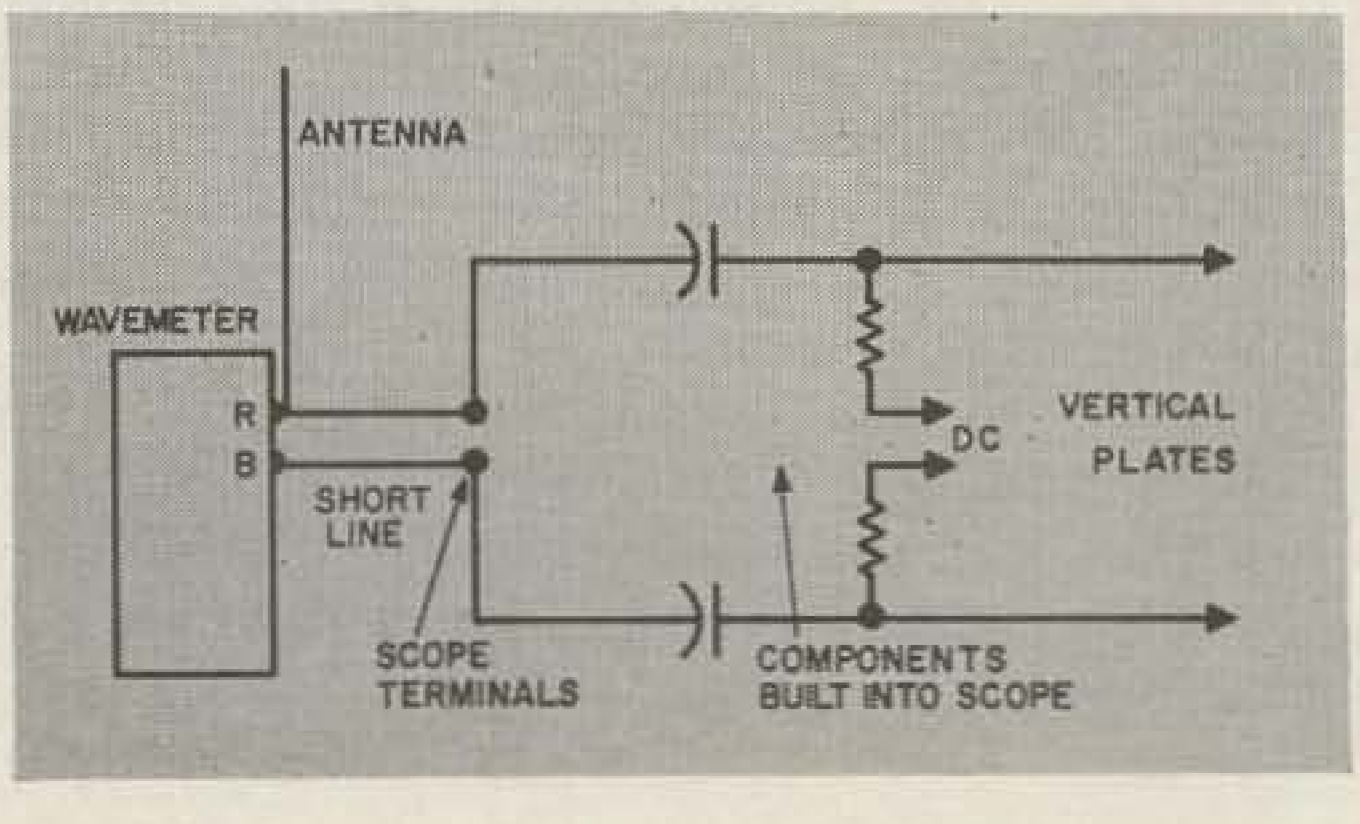
We use the arrangement to check out class D CB transmitters in the shack. It does a much better job than the untuned jobs used widely for CB testing. These are really flea-power transmitters and an improved pick-up is of great benefit.

Modulation Checks

Most service and ham-shack oscilloscopes provide easy access to deflection plate terminals. Usually a back or side plate must be removed to expose the direct-connection terminals. The connections are made via an R-C coupling network (most always built into the scope) to isolate the oscilloscope high voltages from the terminals. Thus direct lines can be run from the two added terminals of the absorption wavemeter to the direct-connection terminals of the oscilloscope. The rf energy in the wavemeter tank circuit is applied directly to the vertical deflection plates as per Fig. 2.

The use of the absorption wavemeter and oscilloscope represents an easy method of displaying a modulated envelope on the scope screen. No circuit need be broken into because no insertions have to be made into the transmitter or its transmission line. The wavemeter and a stiff antenna wire of four foot length when spaced several feet from a five watt CB transmitter picks up sufficient energy to display a two to three inch modulation envelope on the scope screen. Is there a more convenient method to check out modulation characteristics for any type of an AM or SSB transmitter?

In checking modulation on the oscilloscope an unconnected phone plug was inserted into the phone jack to take the rectifier and meter out of the wavemeter circuit. This precaution prevents high current flow in the meter circuit and clipping of the envelope. 73



The Interference Chaser

One of the most annoying forms of interference—TV, BC, HA (hearing aid), or any other kind—is that caused by audio rectification. It annoys not only the listener, who hears unwanted sounds in his set, but the ham—since the irate TV fan can easily learn his call letters and bombard him with complaints!

Of course, curing audio interference is simple. The handbooks have carried complete details for years. All you have to do is connect a low-pass audio filter ahead of the first audio stage of the affected set (see ARRL Handbook, Editors and Engineers Radio Handbook, etc.) and the interference disappears.

The trouble with this approach is equally simple—few of us like to dive beneath the chassis of a commercially-built receiver. And explaining to an unhappy neighbor, in terms he can relay to his repairman, usually proves to be a task beyond the capability of the most literate hams.

Here's a little gadget which you'll be able to whip together in half an hour or less which does all the work for you. Total cost will be less than $1.50—and most TV fans will be willing to pay for the parts when the gimmick proves its ability to chase your voice from their sets.

The Interference Chaser is a plug-in device which goes into the first audio tube socket of the affected set. The tube then plugs into the Chaser, and presto, interference is gone.

It's effective only against audio rectification. If you're having trouble with sound bars, blackout, negative images, etc., the Chaser won't help much. But against rectification, it's murder.

To build the Chaser, first determine which tube type is affected in the set. Usually, the tube location chart pasted to the back of most TV sets will give you this information. Although there's no standardized tube for the first audio position, many sets use a type 6AV6 (or similar series-string 'AV6 type) here, and the wiring diagram shown in Fig. 1 is for the 'AV6 series.

Next, gather the parts. For a 7-pin Chaser, get a Vector type TX-7-M-S "Experimenter's Tube Socket Adapter," a 47K ½-watt resistor, and the smallest 47 mmf. ceramic capacitor you can locate.

If the set you're working on has a 9-pin tube in the first audio slot, get a Vector TX-9-N-S adapter. For octal-based tubes, get the Vector TX-8-O-S. Other parts requirements do not change.

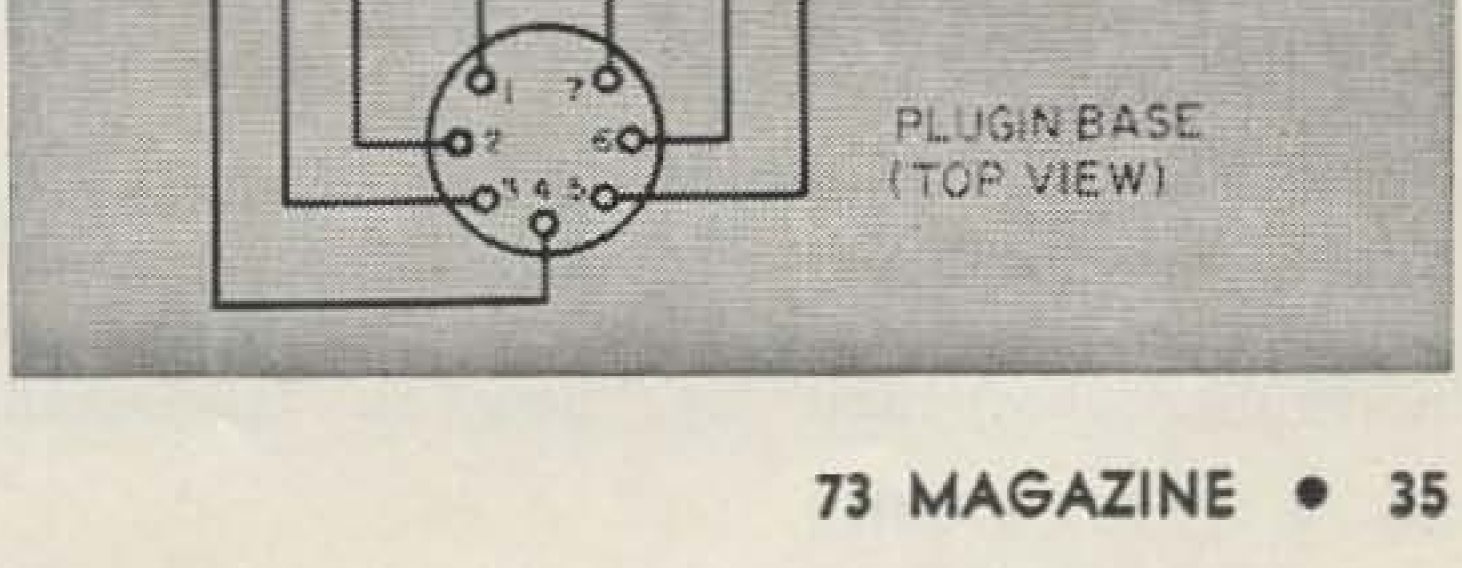
Now to the bench and soldering iron. Strap the plug and socket connections, with exception of the grid pin. By "strap," we mean connect pin 2 of the plug to pin 2 of the socket, etc., so that all connections go straight through the adapter—except the grid connection.

At the grid pin (pin 1 on the 6AV6, 6AT6, 6AU6, 6AQ5, and many but not all other 7-pin tubes), connect the 47K resistor in the circuit. One end goes to the plug, the other to the socket. Then connect the 47 mmfd capacitor from the grid pin of the socket to the cathode with the shortest possible leads.

Finally, put the shell on the adapter and you're all done with the gadget.

In operation, audio signals are unaffected by the Chaser's built-in filter since it has a cutoff frequency of approximately 150 kc. However, rf signals are greatly attenuated (more than 60 db at 50 mc) and cannot reach the tube's grid with enough strength to cause rectification.

Usually, a single Chaser clears up the interference. Stubborn cases, such as a sensitive tape-recorder amplifier operated within 50 feet of the transmitter, might require two. In this case, put one in the first stage and the other in the second. K5JKX/6



Getting the Most from Your Mobile Whip

Charles E. Spitz
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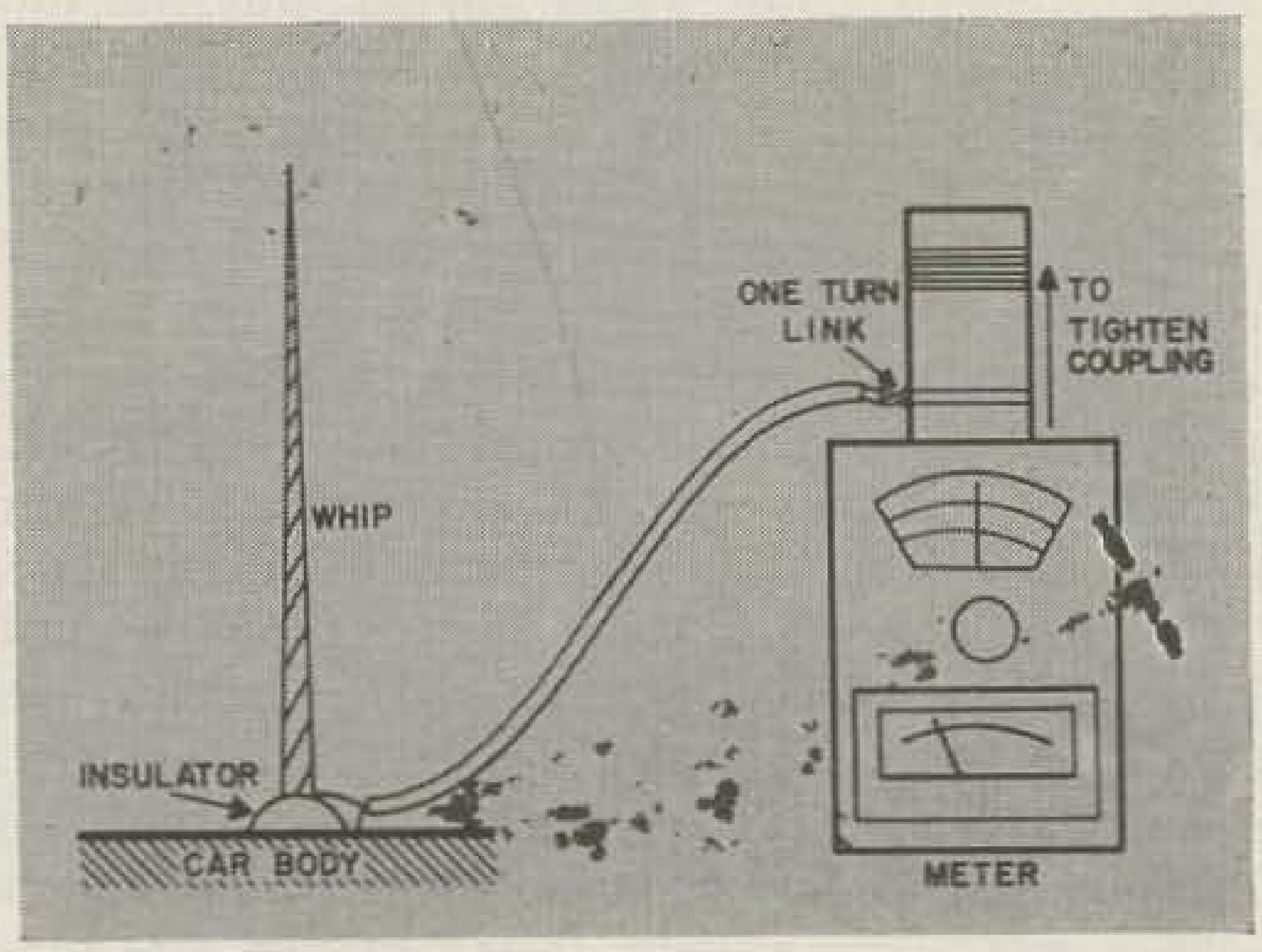
If you are one of the many who test out your new mobile rig on the big rotary beam and get those flattering reports that make you wonder if you should chuck the big juice eater out, then with unbounded enthusiasm go through the gymnastics of installing it in the family chariot .... and call and call without breaking that round table, this may be for you.

Did you ever reverse the situation and see how the big rig would work on that pretty miniature mobile whip? Well, of course no one in their right mind would mount the whip on an ash can and pump a kilowatt through it. Ah, but it should work way up on top of that fifty foot crank-up tower! In fact, I think, let's put the 40 meter whip on top of the trusty tri-bander and add forty meters to our antenna repertoire. After all, that's why we insisted upon *all-band* receivers and transmitters. One glance at the wintry breezes out of doors convinced me to share this secret thought, and after a brief discussion and with the vision of doing away with masts and long wires, my good friend Les Williams, W4ERZ ex-F7EM, volunteered.

From the comfort of my arm chair where I perused visions of new electronics devices, alarming scattered reports came in over the radio. Now alert to the situation, I found the full story deep under the heterodynes of forty meters. Les put a shiney new fiber glass whip with a spirally wound element on top of his tower. He gradually cranked in carrier and it became evident that the VSWR was good and that the thing might work. Up came the full power, then the on-the-air trials. There is an oit repeated amateur legend that says "a vertical antenna is equally poor in all directions." Even with a full kilowatt, the reports weren't just poor, what there were of them were horrible.

The tower was cranked back down, dutifully tilted over, and the antenna and all connections were examined. This type of whip has a rubber compound tip, now all blackened, splattered and charred. Even the resonant frequency of the antenna had shifted. Obviously we discovered a new type of electronic heater that did not have a good industrial application on top of an antenna mast. In fact, it certainly did not appear to have the makings of a good antenna in this application.

I am sure that by now you may be wondering just what all this has to do with mobile work. Well, *the effects are similar but the lower power normally used in mobile work does not show up some of the invisible forces at play so easily.* Come summer the KWM-2 was going to be mobile and these were the antennas to be used. The lessons learned should, of course, be applied.



A basic problem is to get the most from a whip. There are all kinds of whip antennas, and while there was no attempt to try them all, the experiments we made led us to think all would be similarly affected to some degree. By outlining the parameters of the situation, we find:

1. Unless there is some basic change in the art, the abbreviated whip is not very efficient; you must live with it and old man Heaviside (layer) as your chief aide.

2. The impedance should be matched to your feedline. After all, radiation *inside* your car isn't of much value!

Photograph, W4ERZ and W4API with whip and grid-dip meter.

3. The antenna should be resonant at your operating frequency. (Ha! sez you, *I know that!* Yes, but did you ever do anything about it?)

Problem One is beyond our control. Problem Two can and usually is taken care of with the trusty Micromatch. Most people come afoul of Problem Three and do nothing about it. With the spirally wound glass whips this is tricky. One of the purposes of this article is to give you the courage to use a hacksaw on that pretty whip yet retain it's trade-in value.

In order to tune up the antenna mounted on your car, you must simulate operating conditions in all respects. This mean you do this away from buildings, people, and car doors and trunks must be closed. Your chief tool is the grid dip meter and receiver. You may have to drill a hole in the body of the car (out of sight, of course!), so you may run a twisted pair to a grid dip meter link and yet close the trunk. You may elect to do your measuring on the car seat (hoping you have foam rubber seats, and not nasty inductive coil springs), using the car rig low impedance antenna feedline. The tricky part of this operation is to keep the antenna very loosely coupled to the grid dip meter by a link so you can be sure of the resonant frequency. Note your basic resonant frequency and write it down. You must be sure of it, because this is where the hacksaw comes in and your rate of change is noted. You saw off the end of your antenna, one inch or one-half inch at a time as illustrated in the chart.

The photo shows the proper attire for the experiment—in midsummer. The picture actually shows how not to do it, as the whip should be mounted on the car and people as far away as possible.

The purpose of Fig. 1 is to insure familiarity with the proper hookup to any grid dip meter. Twisted pair or light co-axial cable may be used to couple the meter to a one turn link on the appropriate coil for the band used. The coupling may be "tight," that is near the coil, for initial location of the resonant frequency of the antenna. The "big dip" is what you are looking for. The link is then backed away from the coil, however in doing so you will note that the grid dip meter frequency has changed. The process may have to be repeated until you are sure you have the correct frequency, which will be the only appreciable big dip. Grid dip meters are notoriously poor in calibration, therefore when you have the correct spot, tune it in on a frequency meter or good receiver in order to get the exact frequency.

Our aim was to cut a 40 meter Shakespeare Wonderod Model 62-6 whip to 7210 kc and a Model 62-7 to 3975 kc, for SSB operations. The chart illustrates the cautious inch-by-inch measurements as the whips were pruned with a hacksaw. You will note that as the frequency goes up, the effect of the winding pitch of the spiral antenna and inductive effect increases the frequency change per inch. This will become more critical on higher frequency band antennas.

What happens if you cut too much off? Remember our rubber compound tip? Placing the tip back on the 80 meter whip *lowered* the frequency from 3975 kc to 3955.5 kc! This opens up the possibility of frequency recovery by the use of the capacitive effect of a lossy dielectric such as the rubber compound. Various types of tape should do this also, and there should be no difficulty just as long as you don't feed a kilowatt in to the antenna! 73

Frequencies Shown are Without Rubber Tip

80 Meters One Inch Steps, Sawed Off Tapered End	40 Meters One-half Inch Steps, Sawed Off Tapered End
Basic Frequency—3855 kc	Basic Frequency—7046 kc
	—7073 kc
—3900 kc	—7109 kc
	—7134 kc
—3933 kc	—7168 kc
	—7192 kc
—3975 kc	—7210 kc

How Modern is the VFO?

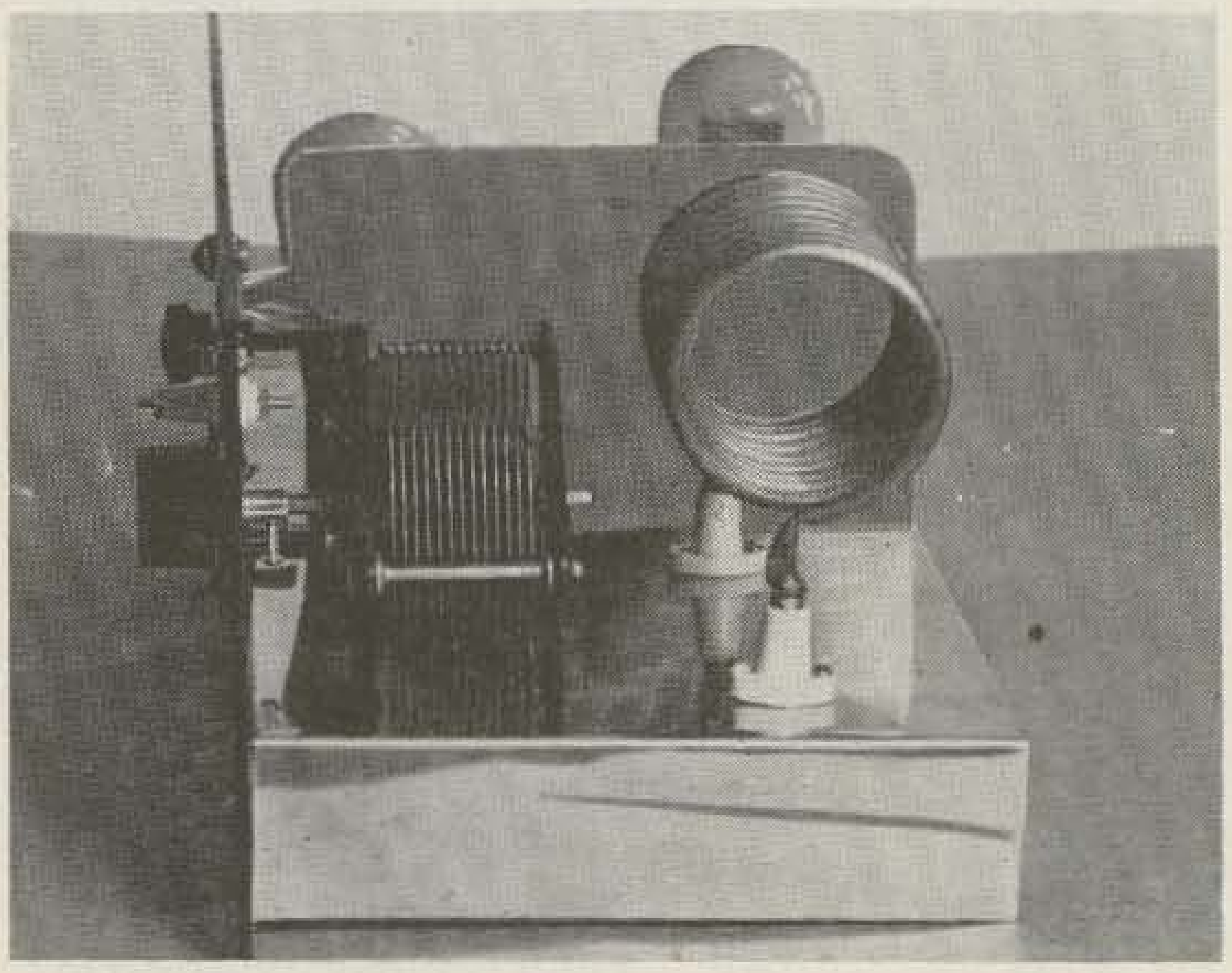
Howard S. Pyle "YB"W7OE
3434 74th Avenue, S.E.
Mercer Island, Washington

Tuned-plate, tuned-grid transmitter of the 30's. Grid coil on left, plate coil on right.

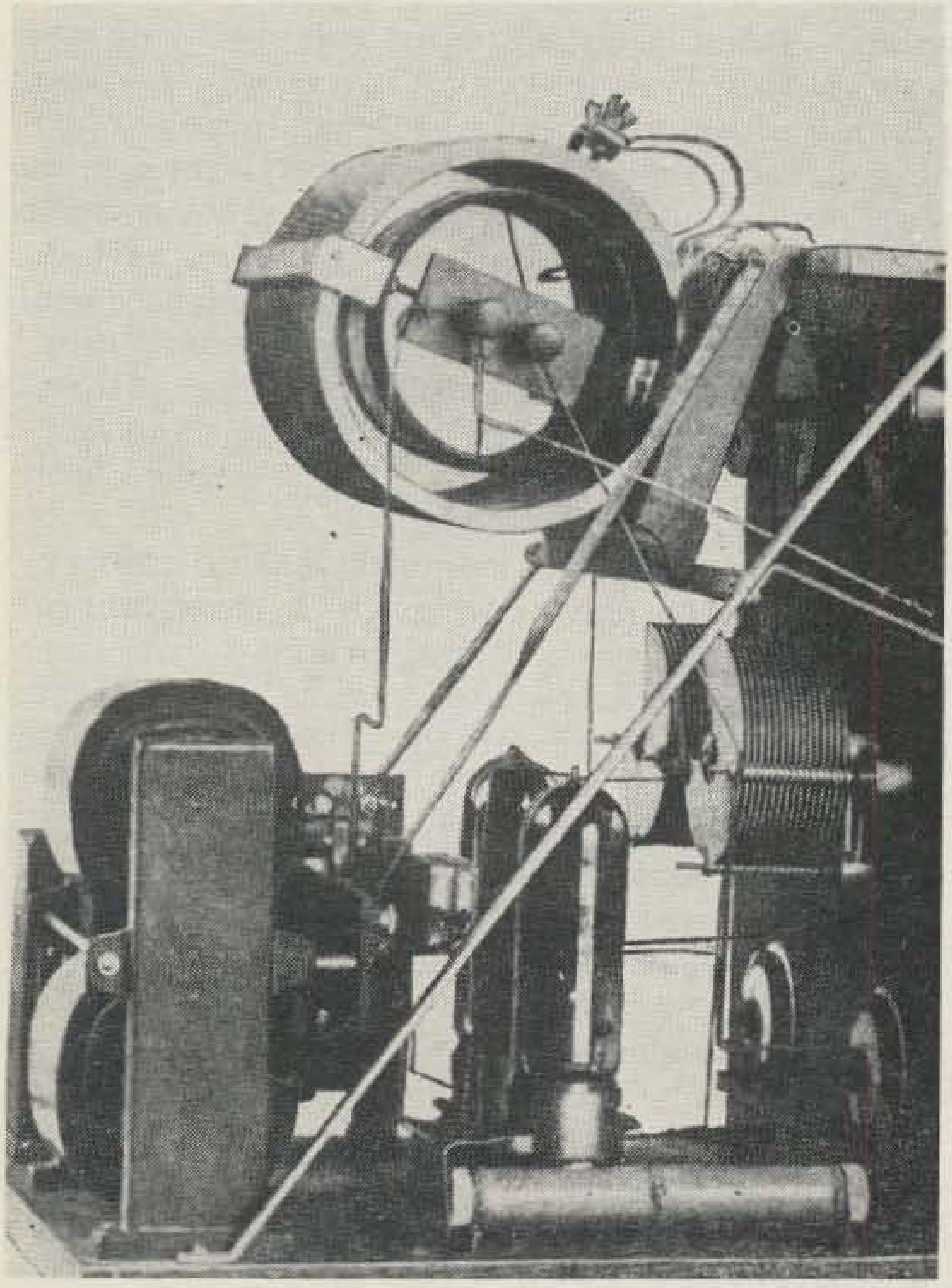
NEWCOMERS to the ham ranks take the "variable frequency oscillator" or "VFO" as it is popularly termed, for granted. If they have entered the field via the Novice route, a VFO is of course, 'forbidden fruit' until such time as they qualify for a higher class of license. Surprisingly enough, a large number of relatively "old timers" among the General class licensees accept the VFO as a development of fairly recent years. Let's see *how* recent!

Right after World War I, when the ban was lifted from amateur operation (October 1919), great interest was exhibited in the vacuum tube as a generator of radio frequency oscillations not only by hams but by commercial companies and the military services as well. Experimental work in various laboratories during the period of hostilities had rather conclusively demonstrated that great possibilities were evident here. While vacuum tubes had previously been used to a limited extent, chiefly by Dr. Lee deForest, their inventor, as radio frequency generators, they were not popularly accepted either in amateur circles or by commercial operating interests; "spark transmitters predominated in the wireless/radio communication field. How could you possibly work any DX with 5 or 10 watts of power from a little lamp when you had trouble covering three to five hundred miles with a quarter or half kilowatt "rock-crusher"?

A tunable oscillator of the late 20's.



Probably the greatest single incentive which brought the turn to vacuum tubes for transmission was the development and production for the U. S. Navy by the Western Electric Company working in conjunction with the Bell Telephone Laboratories, of the CW-936 RADIO TELEGRAPH AND TELEPHONE TRANSMITTER / RECEIVER. Nominally rated at ten watts, it employed a VT-2 oxide-coated filament type of vacuum tube as the radio frequency oscillator. A similar tube acted as a power amplifier. Oxide filament tubes of smaller physical size and rating, designated as the VT-1, were employed in the receiver portion of this compact unit. The CW-936, initially designed for the small WW-I subchasers, performed so surprisingly well that they soon found their way aboard destroyers and not long thereafter were included in the radio equipment complement of more major war vessels. Hundreds of hams among the thousands who had enlisted in naval service, found opportunity to use and evaluate these little rigs. Much thoughtful pondering resulted: "H-m-m; ten watts? Only 350 volts of direct current at a few milliamperes and yet we work hundreds, even *thousands* of miles? Maybe it's because we are at sea on an unbroken expanse



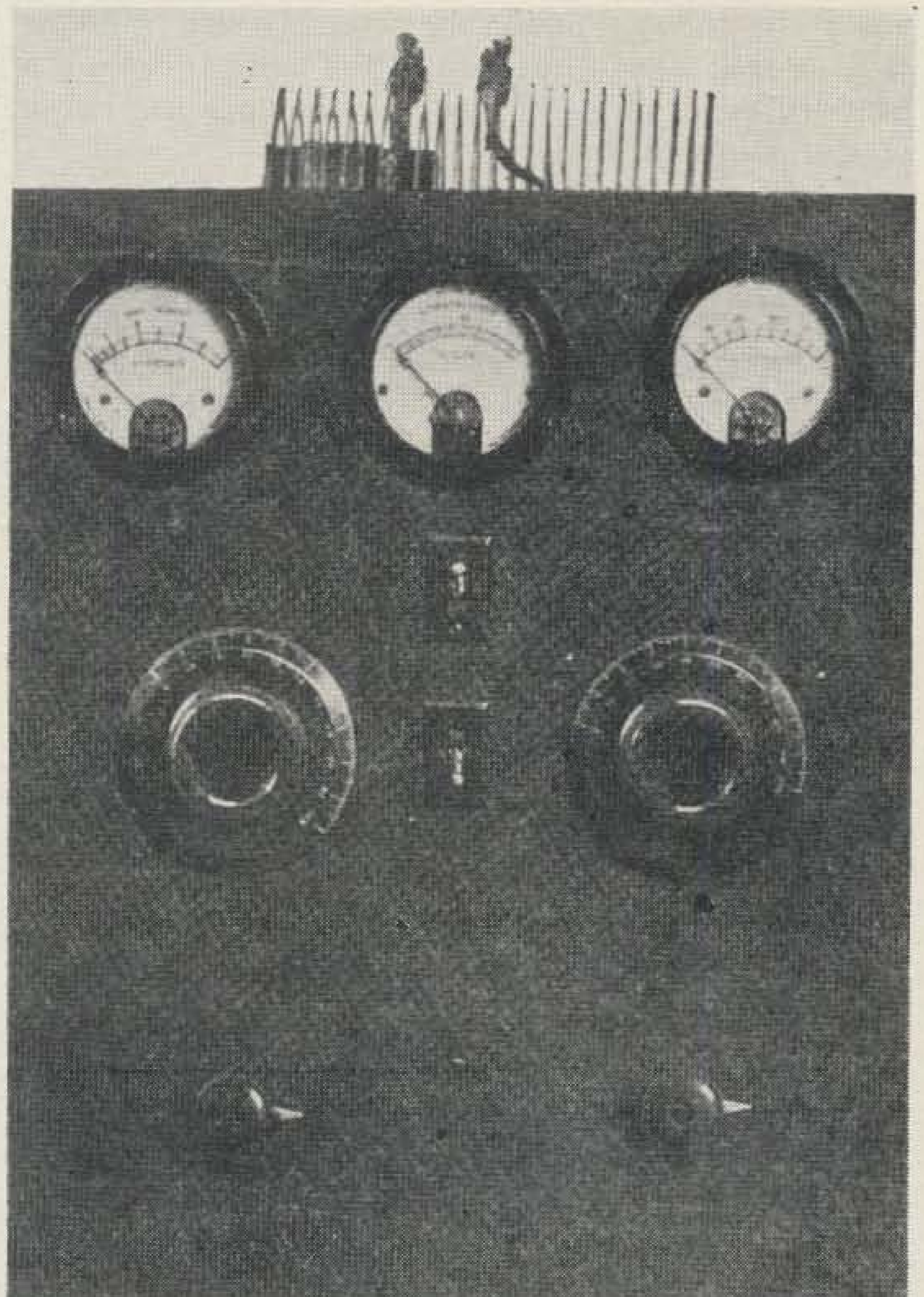
Side view of the 200 meter transmitter. The grid coil is mounted inside the edge-wound plate inductance.

of salt water but too, maybe they've got something there! If we ever get out of this navy and back on the air, let's try it!"

And they *did!* The transition period was relatively slow; many "die-hards" who had only *heard* of the marvelous performance of the tiny vacuum tube . . . they had not been assigned where they could actually observe this . . . still swore by 'spark' and stuck to their guns. Just the same, more and more of the peculiar, high-pitched whistles began to appear in the regenerative receivers of that day. The remarkable thing was that such stations, many a thousand or more miles distant, were consistently heard stating that they were using only 5, 7½, 10 . . . only a very few were reporting as much as *fifty* watts of power! Remember too, that the frequency or 'wavelengths' as it was then referred to, was in the neighborhood of 200 meters or 1500 kilocycles, admittedly far less effective than the much higher frequencies which we use today. And, the use of vacuum tubes seemed to offer a solution to a whale of a lot of problems which had been plaguing the development of the radio *telephone!* It began to look like it wouldn't be *too* long before the hams could converse by means of the human voice, as well as the more conventional keyed characters of the radio telegraph code!

That did it! Somewhat of a landslide started. Hams by the score were investing in transmitting vacuum tubes and appropriate power supply components, both of which were beginning to appear on the open market. Tubes were available in several wattage ratings; most popular at the outset was the UV-202 which was, if my memory isn't faulty, rated at 7½ watts. In most cases, the ham woefully overloaded them and they ran closer to 15 or 20 watts in many rigs even if their metal plates did turn a cherry red or better! But they worked! It was not long before the UV-203 tube, with a rating of *fifty* watts appeared.

100 watt 200 meter transmitter circa 1924. The wavelength was adjusted by the two variable condensers.



They were costly . . . initially $30.00 each and some ambitious rig builders required *two;* they were just as subject to burn-out and breakage as the relatively less expensive smaller tubes, but a number of hams gobbled them up, perhaps paralleled two of them as a 'high power oscillator' or used one as an oscillator, the other as an 'amplifier' with higher voltage and current input.

And what did the ham use for an oscillator circuit? Current magazines were literally saturated with construction articles and schematics covering vacuum tube transmitters. Circuits were devised, altered and 'improved' practically overnight. It made your head swim; what to use? Invariably an 'oscillator' tube was employed; it was the actual radio frequency generator and the real heart of the rig. Hartley and Colpitts oscillator circuits were the most popular among the early experimenters. Basic equipment was the tube, an inductance coil, variable condenser and a small handful of fixed condensers and resistors; maybe an rf choke or two. Often the inductance for even a five watt rig was wound of ¼" copper tubing or even larger! It just didn't seem reasonable that a transmitter would work with smaller diameter conducting material when we remembered that our spark rigs invariably called for such copper "pipe" or heavy copper ribbon for the "oscillation transformer"! Look at the oscillator coil in your rig today; probably wound with #20 or #22 wire; the final amplifier coil in even a half kilowatt modern rig, seldom uses anything larger than #10 copper wire!

Many of these initial tube transmitters consisted merely of an oscillator feeding directly into an antenna; no buffer, no intermediate or final amplifiers; strictly a one tube job (ignoring the rectifier tube or the 'slop-jar' rectifier, of course!). And, by simply moving clips on the oscillator coil and adjusting the variable condenser, any frequency within the L/C limits of the circuit components, could be rapidly tuned! What was *that* other than a 'variable frequency oscillator' . . . a VFO?

Many, many more circuits were tried, accepted or discarded. For a long time, what was known as the "tuned-plate tuned-grid" circuit was highly in favor. In effect, it was merely the conventional oscillator circuit of the time with a tuned plate circuit, to which had been added additional L/C components in the *grid* circuit, making that also tuneable. Whether this was any gain over the simpler oscillator circuit alone or not, is somewhat of a moot question today; at any rate they worked good . . . I used one for a couple of years.

The commercial companies as well as the military communication branches were not asleep either. The amateur was pointing the way with his impressive increase in signal exchange distance and the exceptional sharpness of the emission permitting dozens more stations to operate within the frequency sector formerly dominated by one spark signal! As with the amateur, newly designed commercial equipment incorporated a "tuneable oscillator" to which the power amplifier and the antenna could be resonated throughout the frequency range of the equipment. What were *these* other than 'VFO's' basically?

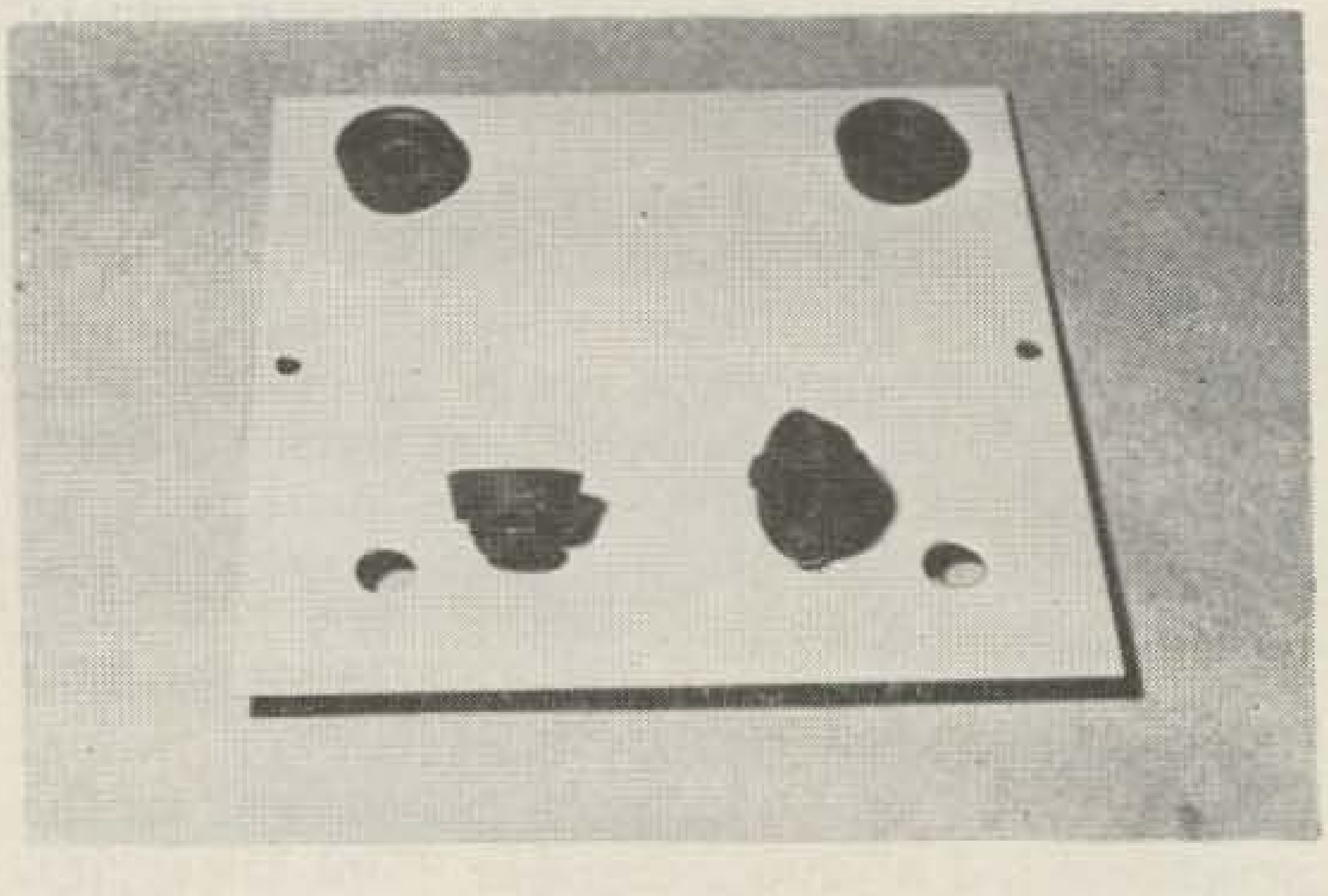
Amateur as well as commercial and military equipment has been through a program of continued progress and improvement ever since Marconi startled the world with his reception of the letter "S" across the Atlantic Ocean in late 1901. Prior to World War I, development of 'spark' equipment from the simple spark coil of Marconi, to 500 cycle, quenched spark gap equipment, took place. Subsequent to WW-I, with the impetus which it gave to vacuum tube transmission, developments have continued at even greater . . . almost fantastic . . . speed. The use of vacuum tubes are even now threatened to a considerable extent by a relatively newcomer . . . the transistor. Remember though, that just like the progress of spark transmission which, right up to the last, required high voltage, large components and a spark discharge gap to create rf oscillations, the vacuum tube *first* required an oscillator to create rf generation, just as it does today. The earliest vacuum tube oscillators of record were capable of frequency variation . . . the forerunner of our present VFO! Do you still think a VFO is something "new"? 73

Improved Mounting Feet

Although commercial rubber "bumpers" or protective mounting feet are manufactured for installation on electronic equipment, they are often difficult to locate and the proper size may not be immediately available.

Automotive supply stores stock replacement rubber hydraulic brake cups in a variety of sizes and prices on these items are reasonable. The photograph shows the original unit and its installation in a metal plate. The groove at the top securely holds the foot in the mounting hole. The rubber tip which projects into the cup is cut off with a pair of diagonal pliers.

These mounting feet are a distinct improvement over those commercially available. The suction cup action will hold the equipment securely in place on any reasonably smooth surface.



. . . . Pafenberg

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LPA-1 Kit—(less tubes, cabinet and blower)	$269.50
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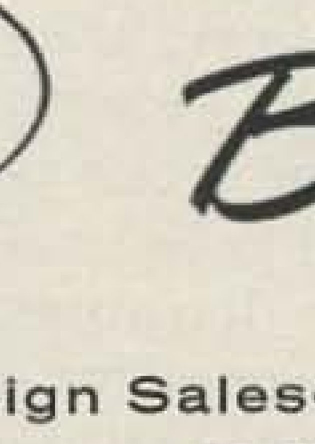
LPS-1 Kit—(complete with cabinet but less tubes)	$169.50
Adapter panel for rack mounting	9.95
LPS-1 Power Supply—Factory wired and tested Complete with cabinet and tubes	205.00

(See Nov. QST, page 115 and Nov. CQ, page 21, for outstanding features)



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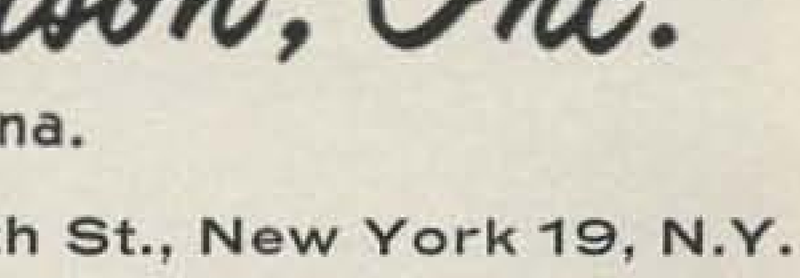
LPA-MU Matching Unit Price $36.00
LPA-MU-2 Matching Unit Price $36.50
Factory wired and tested



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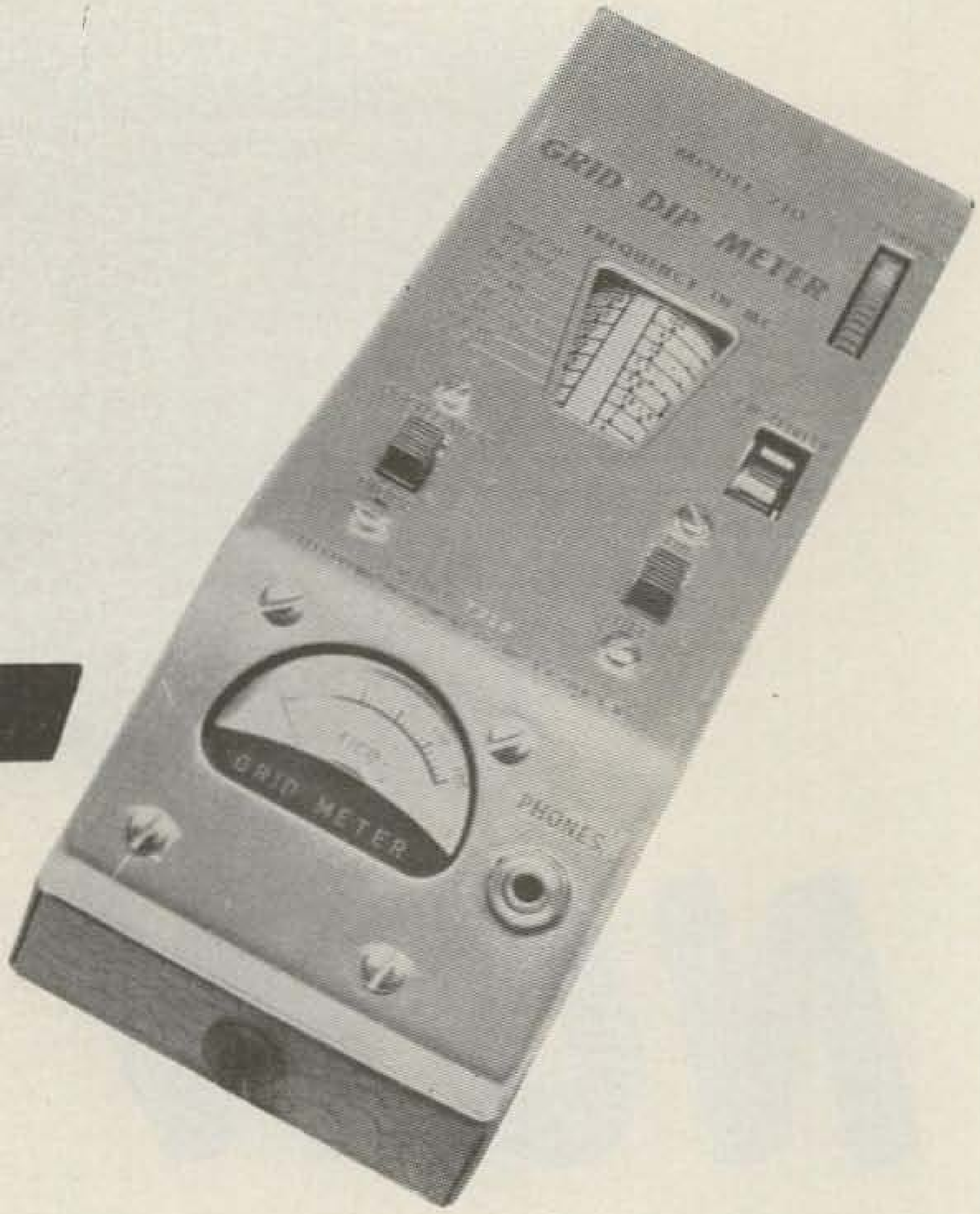
73 Tests the EICO 710 G. D. O.



Donald A. Smith—W3UZN
Associate Editor

Price: $29.95
Time for construction: 3 hours
Range: 400 kc—250 mc

- A. 400-700 kc
- B. 700-1380 kc
- C. 1380-2900 kc
- D. 2900-7500 kc
- E. 7.5-18 mc
- F. 18-42 mc
- G. 42-100 mc
- H. 100-250 mc

Input power: 117 vac at 10 watts (little enough to be used with a small inverter in your car)
Warm up time: 90 seconds for use
3 minutes for stability
Uses: Checking frequency of a tuned circuit
Modulation monitor
Crystal checker
Marker generator
Signal generator
Oscillation detector
Neutralization detector
Finding capacity of unknown condenser
Finding inductance of unknown coil

Note that tuning and sensitivity controls are on right, making for simple one-hand operation.

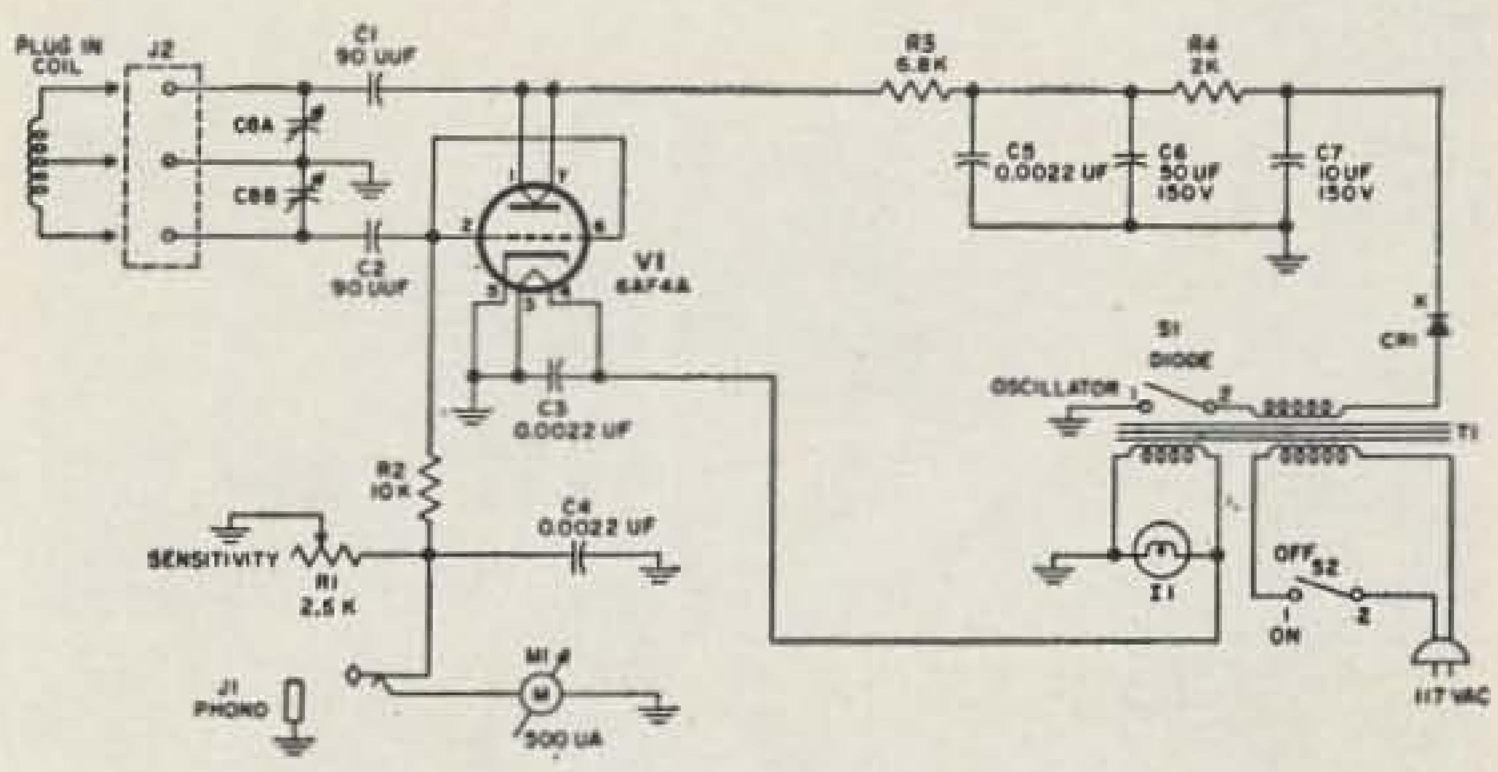
A GRID dip meter is one of those *must* pieces of equipment for the ham shack. By building one you can save money and become completely familiar with the unit at the same time. The Eico Model 710 comes in kit form and sells for $29.95. It has a band coverage of 400 kc to 250 mc, with all coils pre-wound and calibrated.

The unit is very small (2¼" high, 2 9/16" wide and 6⅞" long), permitting easy, one hand operation. It has its own built-in ac power supply, as well as a 500 microampere meter for reading oscillator current. The frequency scales are on a cylindrical drum which is rotated through 340°, all scales having the same length. The front panel is brushed satin aluminum, with markings etched into the panel. The cabinet is a grey finished steel, for ruggedness and good shielding characteristics.

The circuit used in the Eico G.D.O., is a Colpitts oscillator, using the excellent 6AF4A high frequency triode. Eight different ranges between 400 kc and 250 mc are provided by eight pre-wound plug-in coils. All scales are 3¾" long. A sensitivity control is placed in parallel with the 500 μa meter to adjust the oscillator current to a mid-scale reading. A switch is provided to cut off the B+ to the oscillator, thus permitting the circuit to work as a tuned diode detector. A headphone jack is mounted on the front panel for CW or phone monotoring, and zero beat purposes. The meter is automatically disconnected when phones are used and the sensitivity control is used to control the volume at the headphones. A pilot lamp is included to provide light for the dial scales.

Building the unit requires some care, though it is not difficult. It is necessary to keep the leads short in the oscillator circuit. Also, the unit was designed to be compact, which is a real advantage when using it in tight places. The oscillator tube is mounted at an angle, as can be seen in the photos, reducing lead length and lowering stray capacities. The oscillator circuit is wired first with the power supply and other parts following. The drum (dial scales) and gearing between the drum and variable capacitor are mounted after the wiring is almost complete. The gearing system almost completely eliminates backlash in the dial system. The meter and phone jack are the last to be wired before the unit is mounted in its cabinet.

Eico has done a very complete job on its instructions for the *use* of the unit. The manual explains over one dozen uses, including the



finding of "Q" in a circuit, unknown inductance, checking neutralization, etc. Drawings are provided in the manual, showing various methods of coupling the g.d.o. to tuned circuits, crystals, etc. This feature of the instruction manual will be of great help to the amateur who has not used a grid dip meter before.

Shacks

No matter how elaborate the equipment or ornate the setting, the room where Johnny ham sets up business is called "the shack." This is not because a good many such installations do actually deserve such a name, it's just a part of the old ham tradition. In the early days of amateur radio, communication of sorts was accomplished with the aid of motor-driven spark gaps, chemical rectifiers in fruit jars, extremely high voltages and huge antennas. No mother or XYL would tolerate the accompanying odors, din and acute danger of fire and explosion anywhere in the house. The only solution was a 'shack' in the backyard. Long after spark was replaced by CW, shacks remained popular for the privacy they afforded and were frequently seen right up to WWII. Now, years later, the shacks are gone but the term continues on.

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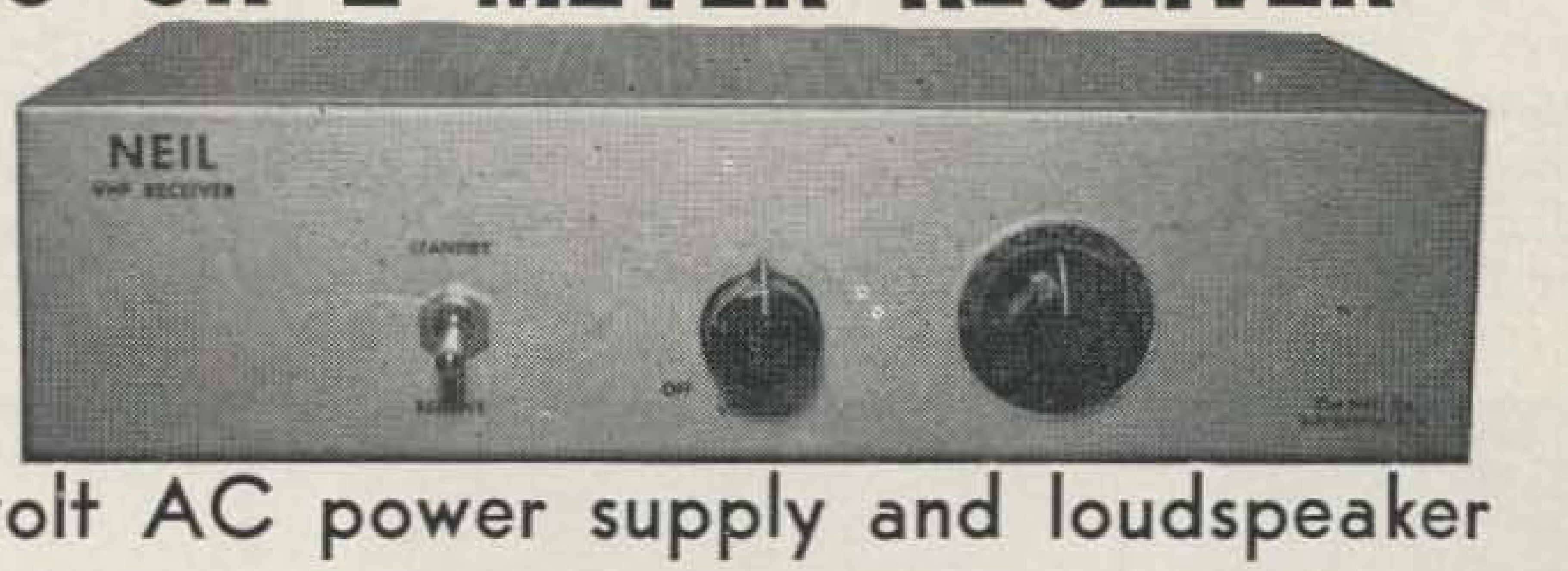

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- kit includes pre-tuned coils for ease of construction
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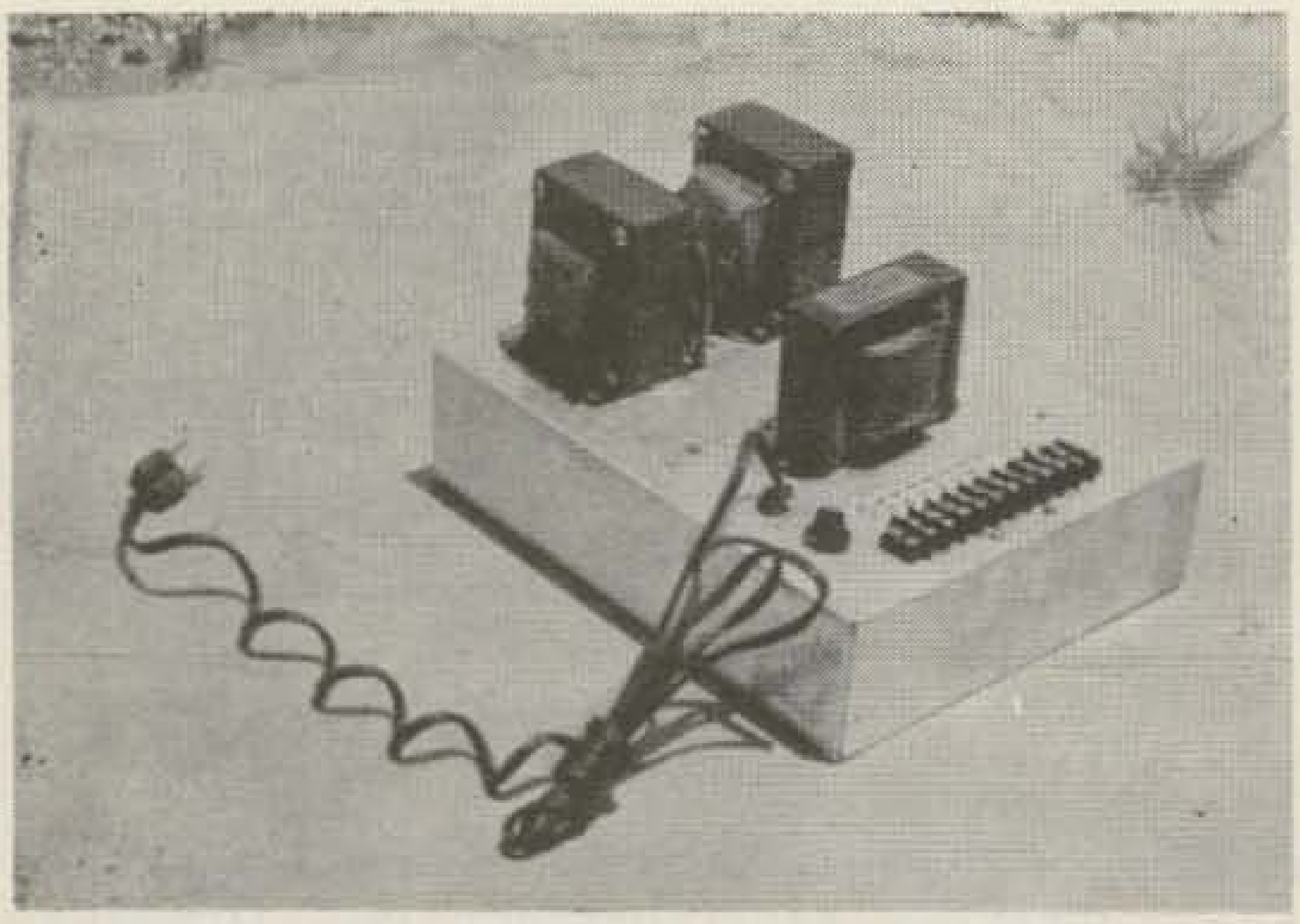


Power for the Old Pro

Jim Kyle K5JKX/6

ONE of the best buys around on the surplus market—when you can find it—is the BC-779 receiver. In its civilian dress as the Hammarlund Super-Pro, the rig is well-known and justly famous.

The old Pro, however, has one design feature which is at the same time an advantage and a disadvantage. The power supply is on a separate chassis from the rest of the receiver.

Most of the time, this is a great help. The receiver runs cooler, there is less trouble with induced hum, and weight of each unit is somewhat lessened.

The only time it proves to be a severe disadvantage is when you find one in your surplus supply house—without power supply.

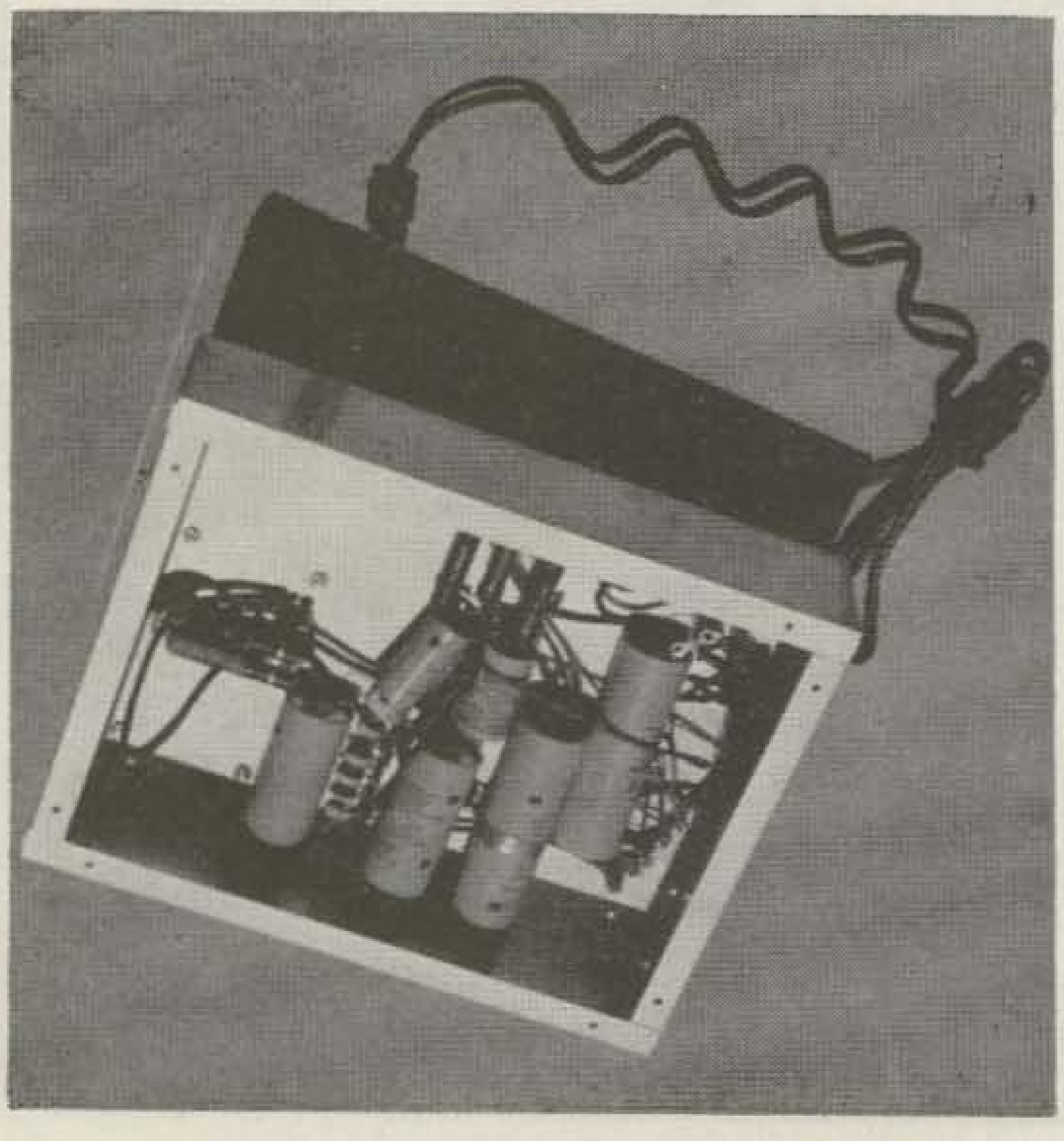
"So what," do I hear you ask? "What's so tricky about building a power supply?"

Really, it's not so hard. But the Super-Pro power supply, actually, is not one but two separate supplies. One furnishes 385 volts at 100 ma, 310 volts at 80 ma, and 270 volts at 50 ma. The other furnishes negative 50 volts for fixed bias. And duplication of the original power-supply circuit proves to be an expensive, time-consuming operation.

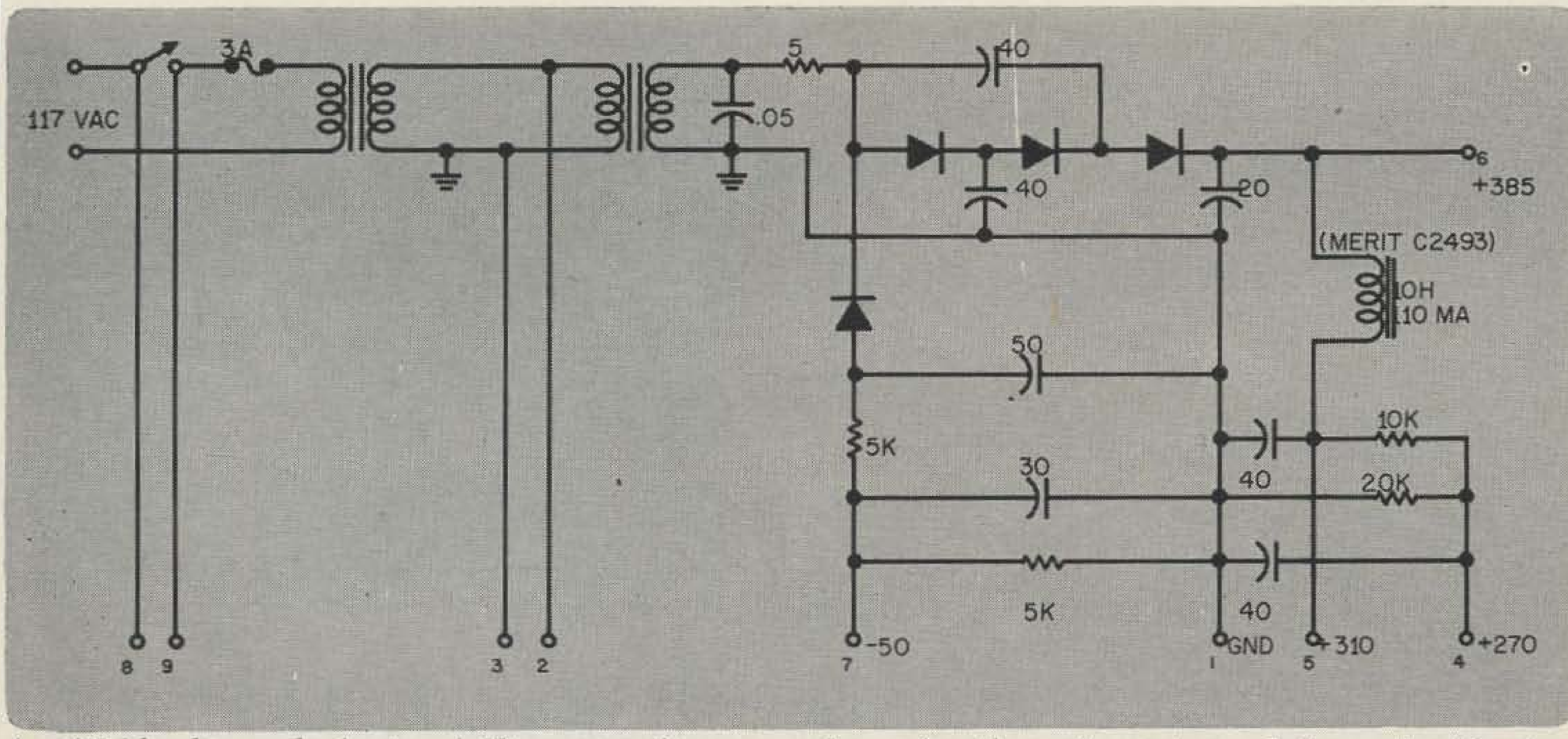
Here's a modified Super-Pro power supply, presently doing yeoman duty on my BC-779. Using a combination of old and new ideas, this supply furnishes all operating voltages for the Pro, at a total cost of less than $40 is all parts are purchased new. Any good surplus hound with a fair junk-box to dig through can trim the cost to $10 or less.

This supply uses two 10-amp, 6.3-volt filament transformers, connected back-to-back, for isolation purposes as well as to supply heater power for the receiver. The isolated 117-volt ac then goes to a voltage tripler using silicon diodes. This tripler provides the positive voltages. Highest potential under load is approximately 350 volts. Although this is slightly lower than the design value for the receiver, no ill effects have been noticed.

In addition to feeding the tripler, the transformers also feed a half-wave rectifier which also uses a silicon diode. This diode is connected with reversed polarity to provide bias voltage.



WELL JIM YOU SHOULD HAVE YOUR KW FINAL HOOKED IN NOW, SO LETS SEE HOW IT SOUNDS ACROSS TOWN HERE...



A stiff bleeder and plenty of filter capacity assure steady bias voltage regardless of overall load on the supply.

All connections are shown on the schematic diagram, Fig. 1. No part of the writing is critical. However, be sure the solder joints are good—the original model blew one filter capacitor because of a poor solder joint.

If you want to raise the output voltage of the tripler a bit, double the capacity of each capacitor in that part of the circuit. This will raise output voltage to 395 under load, but will also raise the voltage tapped down the bleeder accordingly and some modification of bleeder-resistor values may be necessary.

If you have a Super-Pro sitting around the shack waiting for a power supply—or know where to find one cheap but have been held back by lack of power for it—this simple circuit may be the answer to your problem. Try it and see!

Editor's Note: Even if you never see a Super Pro this is a darned good power supply idea to keep on file.

Ham Headlines

If ham radio makes the newspapers in your town please send a clipping to Marvin Lipton VE3DQX, 311 *Rosemary Road, Toronto* 10, *Ontario, Canada. Marvin runs the 73 News Service, a montly publication sent to all editors of club bulletins. He will digest the most important stories that are submitted each month for us to print in* 73.

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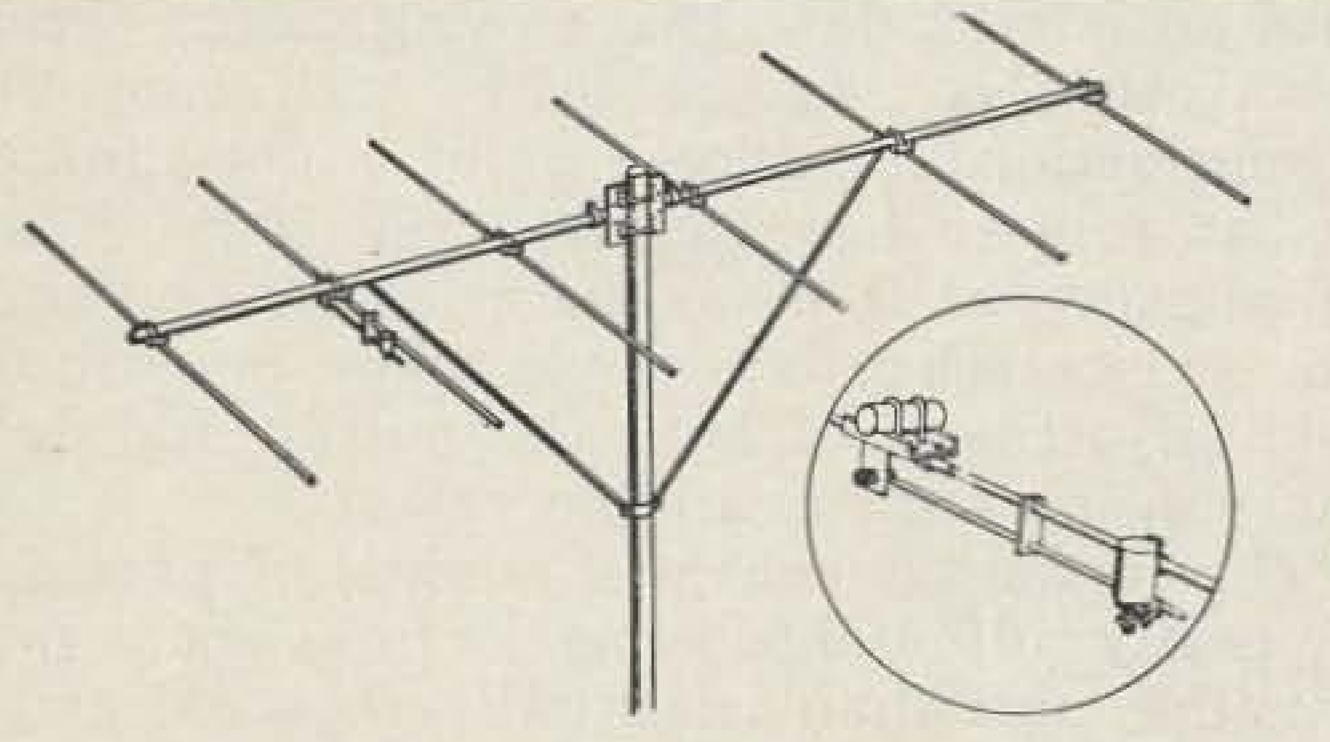

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Design Center	50.5 MC
Gain	13 DB
F/B Ratio	23 DB
V.S.W.R.	1:1, less than 1.5:1 within 2 MC
Horz. Beam Width	45° (½ power points)
Impedance	any standard co-axial cable
Overall length	21' - 6"
Net Weight	15 lbs.
Shipping Weight	20 lbs.

We are proud of this new Long John Antenna. We've tried to put in every feature you could want. The result is a reasonable cost high gain beam which can easily be put up and which will stay there practically forever. It has a wide enough lobe so you don't have to swing it around all the time, yet gives you tremendous gain where you want it.

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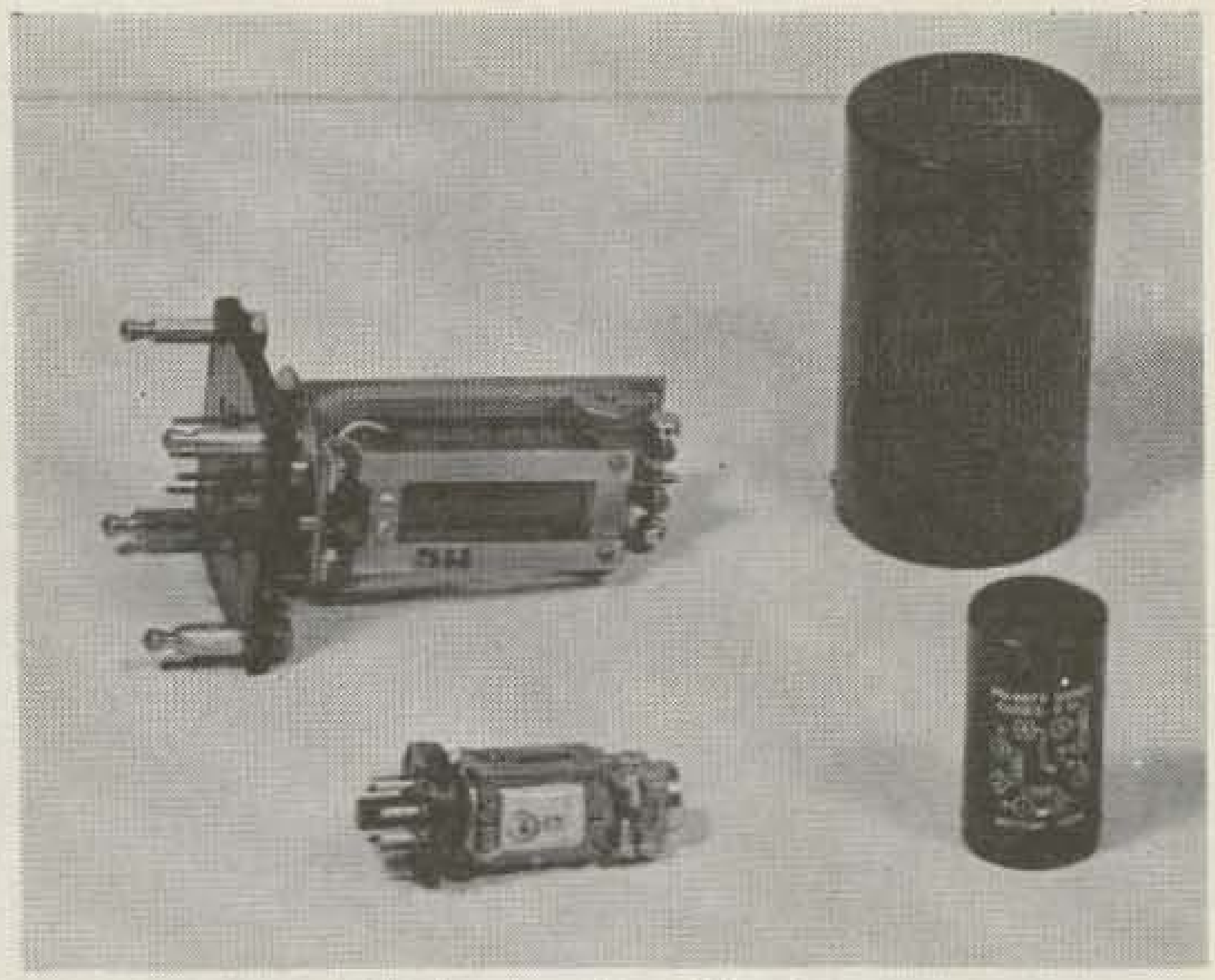


Photo by Jim Gardner

The Sigma Series 72 polar relay is shown in contrast with the much larger Western Electric 255A relay.

Roy E. Pafenberg
P.O. Box 844
Fort Clayton
Canal Zone

Differential Switching with Polar Relays

THE need for relay operation at an easily adjustable, preset current level is a common requirement that is very difficult to meet with conventional relays and standard circuitry. Commonly available relays are designed and factory adjusted to trip at a specified voltage or current and to release at a point substantially below the closing point. While the closing current is fairly well controlled in production, the release point is not and generally ranges between 30 and 60% of the value required to close the relay. A real problem exists when an application necessitates field adjustment of both the pull-in and drop-out points of an available relay.

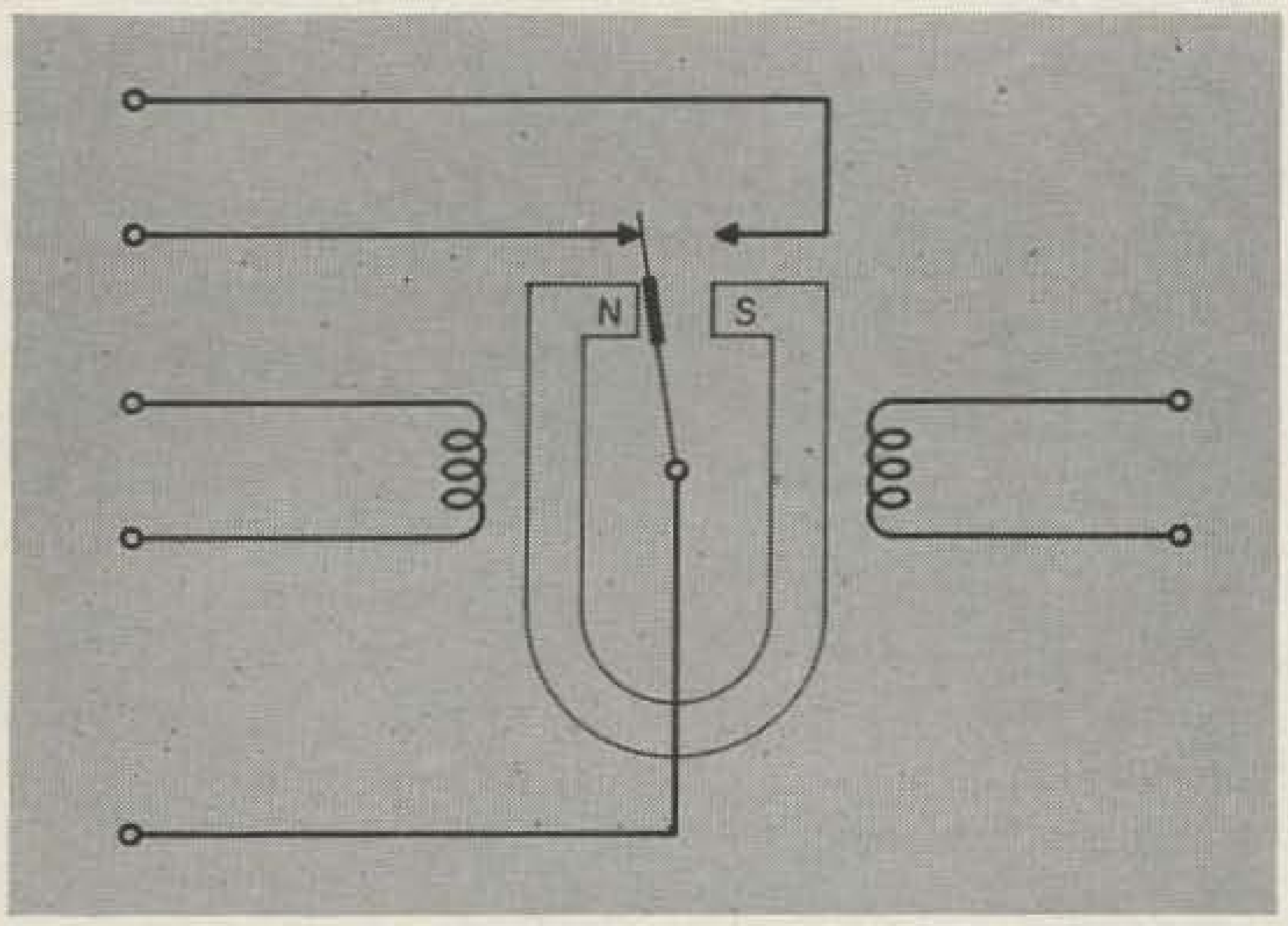
The commonly accepted method of providing an easily adjustable relay is to select a more sensitive unit than is actually required and to shunt the operating winding with an adjustable or variable resistor. An example will show that this further increases, in actual current, the undesirable spread between the operate and release points of the relay. Assume that the winding of a relay, which normally closes on a current of 100 ma and releases when the current drops to 60 ma, is shunted with a resistor of the same value as the resistance of the winding. The relay will now close on 200 ma and drop out at 120 ma. The

Sigma Type Number	Resistance Each Coil	*Basic Relay Sensitivity	Operating Range Min. Max.	Bias Supply	Bias Series Resistance
72AOZ-10-TS	10 ohms	5.60 ma	5.60—240 ma	6 v	12— 1,250 ohms
72AOZ-160-TS	160 ohms	1.40 ma	1.40— 60 ma	12 v	25— 10,000 ohms
72AOZ-400-TS	400 ohms	0.90 ma	0.90— 38 ma	18 v	50— 20,000 ohms
72AOZ-1000-TS	1000 ohms	0.56 ma	0.56— 24 ma	32 v	250— 60,000 ohms
72AOZ-2500-TS	2500 ohms	0.35 ma	0.35— 15 ma	48 v	600—150,000 ohms
72AOZ-4000-TS	4000 ohms	0.28 ma	0.28— 12 ma	54 v	400—200,000 ohms

*Current required through one coil to switch unbiased relay.

difference between the operate and release points has increased from 40 to 80 ma. This characteristic could easily make an otherwise suitable relay unusable in certain shunted applications.

Fig. 1. Basic elements of the polar relay. The signal winding current must overcome the "bias" of the permanent magnetic field before the relay will switch.



The deficiencies cited above can, for many applications, be overcome by the use of a polar relay. This relay, in its most common form, consists of a floating armature positioned between the poles of a permanent magnet field. The armature may rest against either pole of the field and is magnetically latched in either position. This configuration is known as the "either side stable" type of polar relay. The armature is the center contact arm of the signle pole, double throw contact arrangement normally provided. Two identical operating coils are provided as signal windings, either or both of which may be used. Operating current, applied to a winding, depending on the polarity, either presses the armature more firmly against the contact or transfers it to the other contact. Once transferred, the armature remains in this position until an operating coil signal of the

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opposite polarity returns it to the original position. Figure 1 shows the basic elements of a polar relay.

These relays have been used in the communications field for decades. They are precision sensitive relays, with the sensitivity very closely controlled in manufacture and adjustment. The magnetic latching characteristic of these relays is known in the communications industry as bias and this normal permanent magnet bias may be augmented by flowing a current through one of the two windings. When current, of the proper polarity, is passed through the other winding and exceeds the bias current by an amount equal to the basic sensitivity of the relay, the relay will switch. When the signal current drops below the bias current by the same amount, the relay will switch back. In other words, regardless of bias current, the differential between the operate and release conditions of the relay is always constant and equal to twice the basic sensitivity of the relay. Therefore, by regulating and controlling the bias current, it is possible to extend the basic precision of these relays over an extremely wide range of operating currents. As an example, if the unbiased sensitivity of a polar relay is 0.5 ma and a bias current of 50 ma is applied, the relay will switch on a signal winding current of 50.5 ma and switch back when the signal current drops to 49.5 ma.

While many manufacturers make polar relays, the new Sigma Instruments, Inc. Series 72 units are representative of the various types and are readily available in a number of basic sensitivities. The chart shows the published characteristics of the various types and also gives bias supply values and operating ranges computed for the application shown in Fig. 2 and described herein:

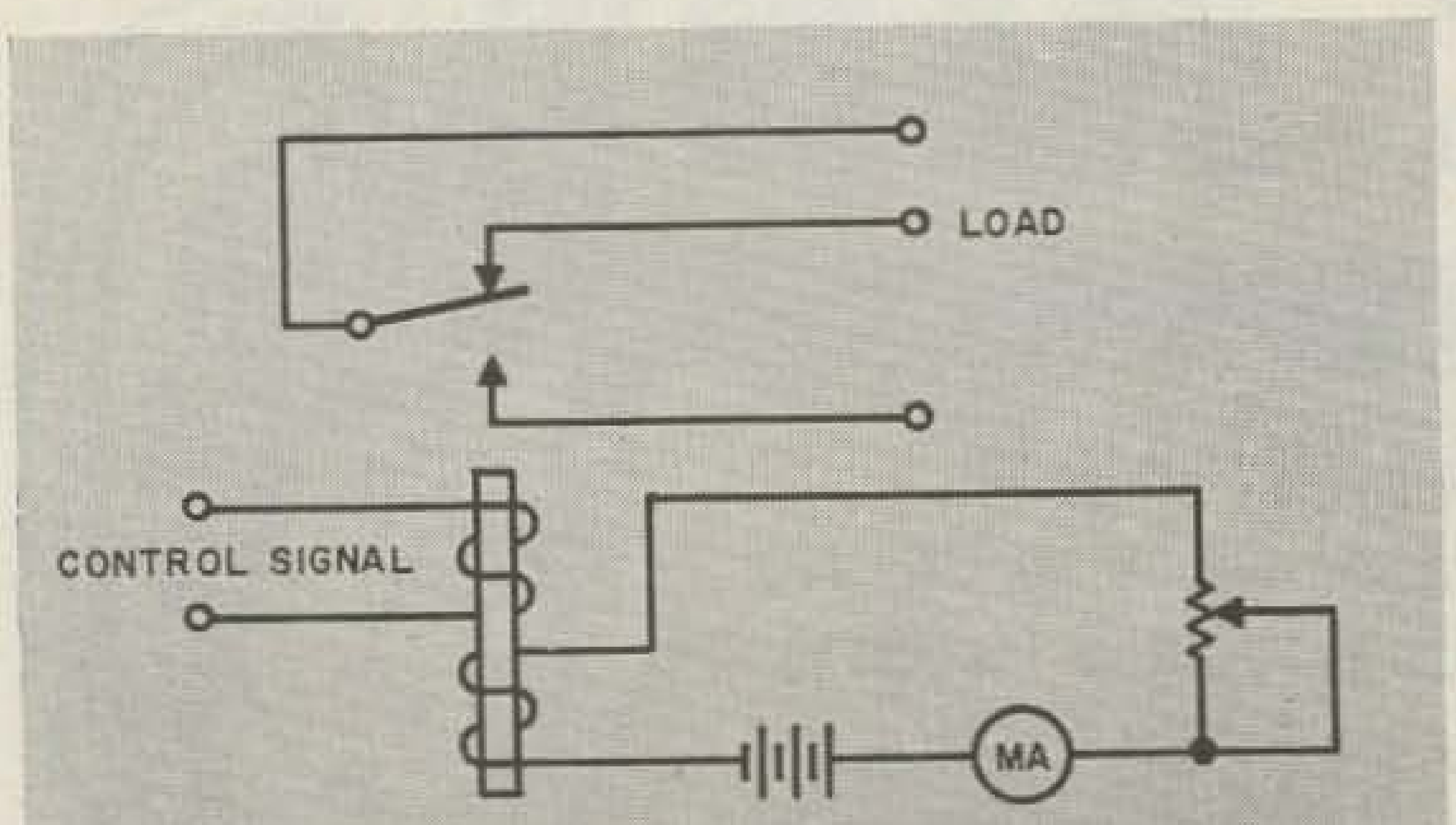


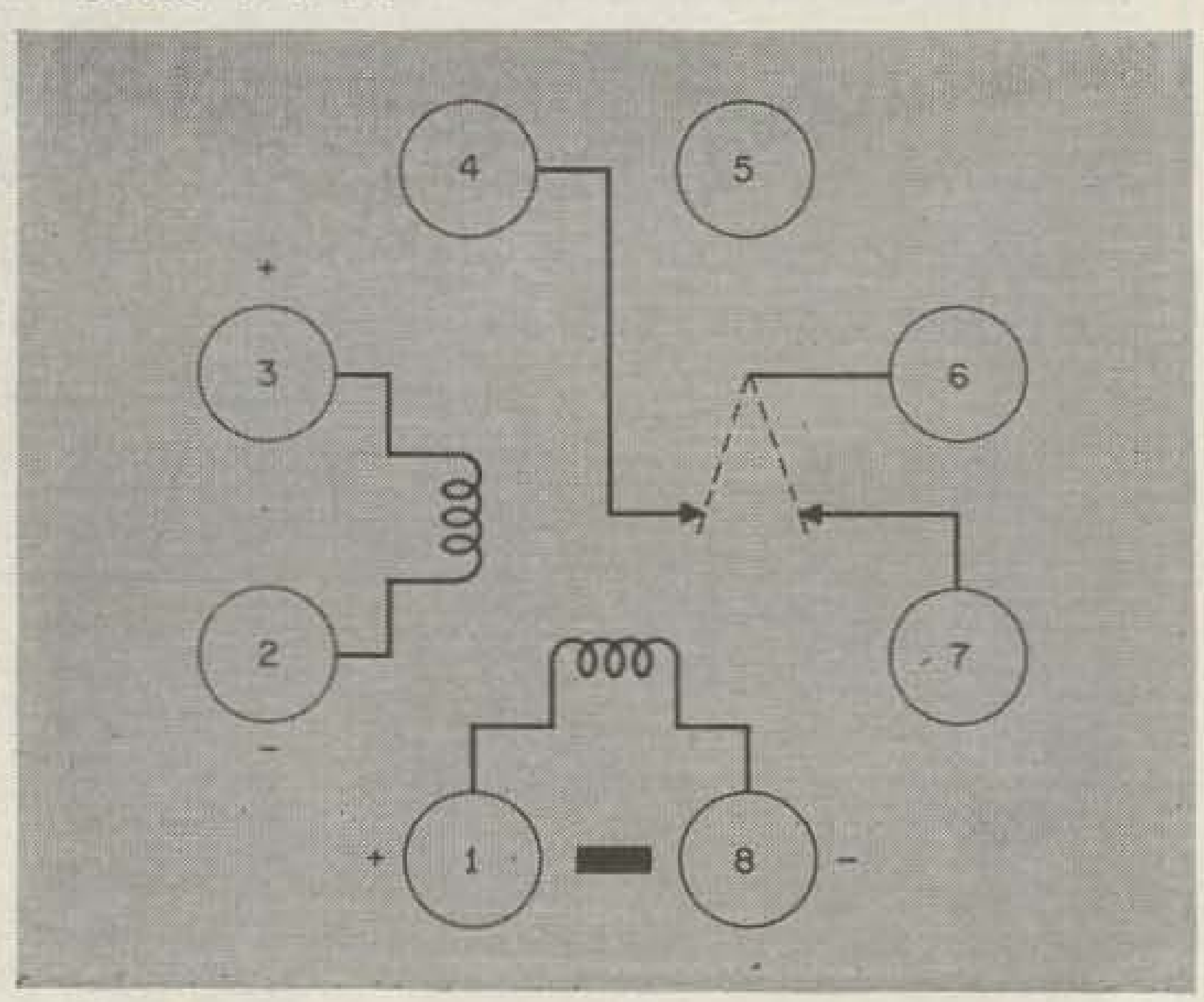
Fig. 2. This circuit provides precision switching at easily adjustable signal current levels. See text for component values.

Fig. 3 shows the base connection of the Series 72 relay. The operating range shown in the chart indicates the range of bias current adjustment possible for each type of relay. The pull-in current will be this value plus the indicated sensitivity of the relay, while the drop-out current is the value shown minus the sensitivity of the relay. The minimum currents shown are limited by the sensitivity of the relay, while the maximum current is determined by the rated dissipation of the relay windings. The bias supply voltages listed were arbitrarily selected to provide a voltage greater than that actually required to allow a full range of adjustment. The same considerations apply in the maximum and minimum values of resistance specified. In one extreme, the maximum dissipation of the relay coils is slightly exceeded and the bias current is dropped below the sensitivity of the relay in the other extreme.

Care should be exercised in the selection of the series resistors in the event an application requires adjustment through the complete range of current. While adjustable and variable resistors are rated in wattage dissipation, a maximum current limitation is imposed. This rating is usually that value of current which results in the rated wattage dissipation when the total resistance of the unit is in the circuit. Use of switched fixed resistors and a lower value adjustable or variable resistor will permit the use of lower wattage units.

Those readers that have regarded relays as necessary evils, to be used only when a remotely located switch must be actuated, are in for a pleasant surprise when they explore the infinite variety of circuit functions that may be more simply performed by modern relays. The example cited herein is only one of many valuable applications of the polar relay. While semi-conductor devices are being used for many switching functions, the relay will be with us for many years to come. While apparently simple, the application and use of relays is an intriguing subject and familiarization and experience with these components can be of great value in the development of the technician. 73

Fig. 3. Bottom view of the base connections for the Sigma Series 72 polar relay. Polarity shown closes 6 & 7.



(. . . de W2NSD from page 8)

A combination of curiosity about this record and a desire to add to the 45 rpm program material which I have been collecting to use on my car record player made me throw caution to the winds and send in the quarter.

The record came. It was interesting too. I turned up the volume a bit as I bounced along. Suddenly I almost went through a red light when I heard my own voice coming from the record talking to Mirko, YU1AD as part of the demonstration of what you might hear on the ham bands. What a surprise! I looked around for someone to tell, but all around me were the usual kids in Buicks waiting to outdrag my little sports car at the light and fat cigar smoking men in Cadillacs trying to elbow me off *their* road. It's very frustrating when you have something exciting to tell and no one to tell it to.

Perhaps finding my own voice on the record colored my opinion, but I sure found the record interesting. It (the record) should, I think, help get a lot of people listening to the short waves.

Late January

The January issue of 73 was mailed on January 3rd to all subscribers from our post office in Norwalk, Conn. All copies were mailed at one time. A checking copy was included to our office in Brooklyn. Thus turned up on the tenth! Copies were reported being received from Long Island hams as late as the 16th. The ways of the postal service are hard for us mortals to understand.

New Books

John Rider has just published a book which will be of great interest to our younger readers, though the price is a bit stiff for them. This is **Basics of Analog Computers** by Truitt and Rogers. How come such a complicated book for youngsters? Well, first of all, as any of you who have invested in Rider books know, by the time John gets through publishing a book the subject has been rendered understandable. Secondly, as everyone knows, computers are growing into a tremendous field, one which you would do well to consider if you still are trying to decide which way to head in this life. Teenagers who take up ham radio are years ahead of the fellows who go into electronics in or after college. It is a shame to waste all this time just in playing around on two meters when it could be used to develop understanding in computers, UHF, or some of the obviously big electronic fields ahead. In addition to giving you a good foundation for understading analog computers, this book is fun to read. You will never be quite the same once you've read it. 400 pages. $12.50. John Rider, 116 West 14th Street, New York.

Gernsback Library has a new book by G. J. Christ; **Tubes and Circuits.** This book goes into good detail on the theory of vacuum tubes and their applications. When you get through with this 192 pager you should have a good understanding of the whole subject. $3.45 paper covered; $5.00 cloth bound.

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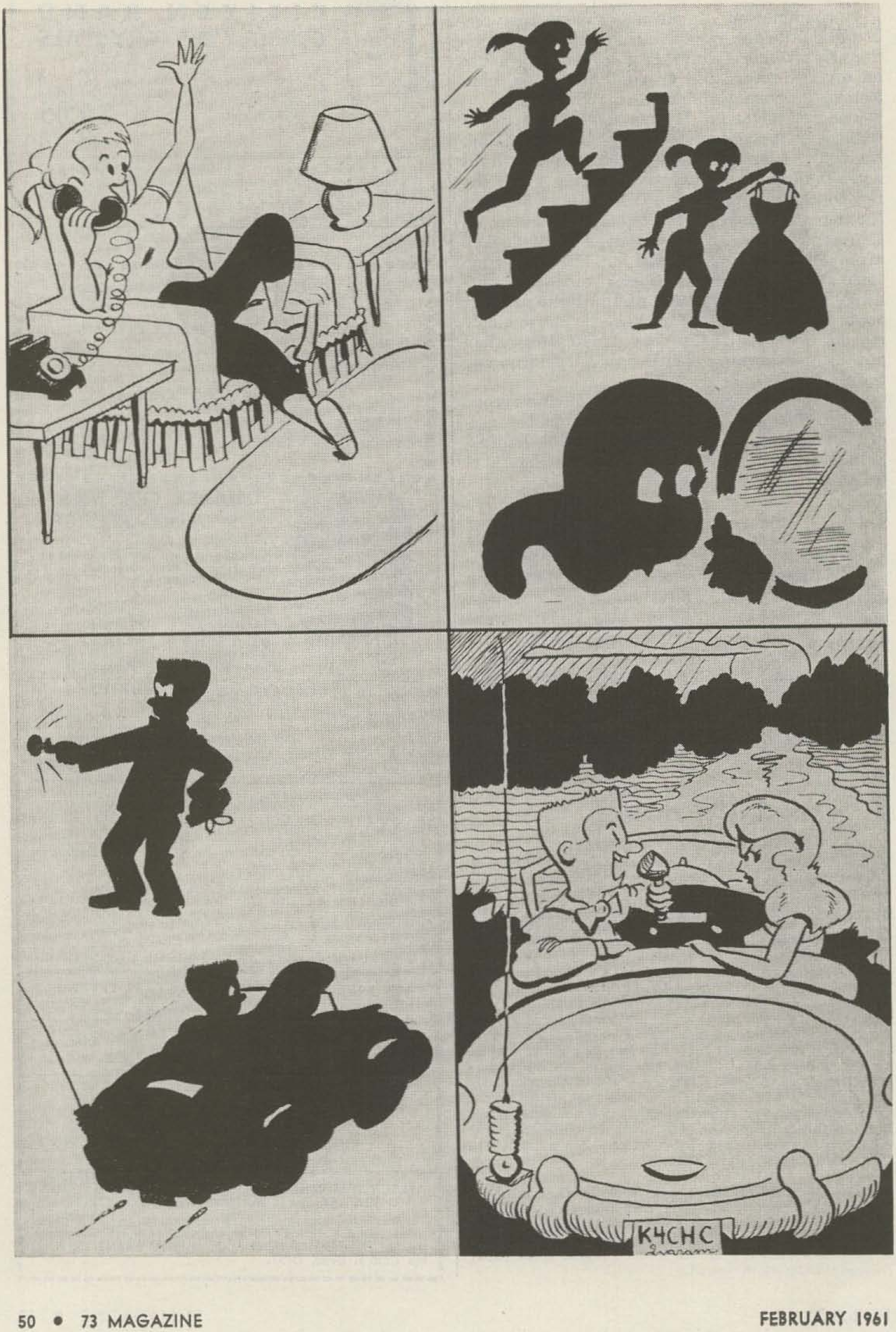
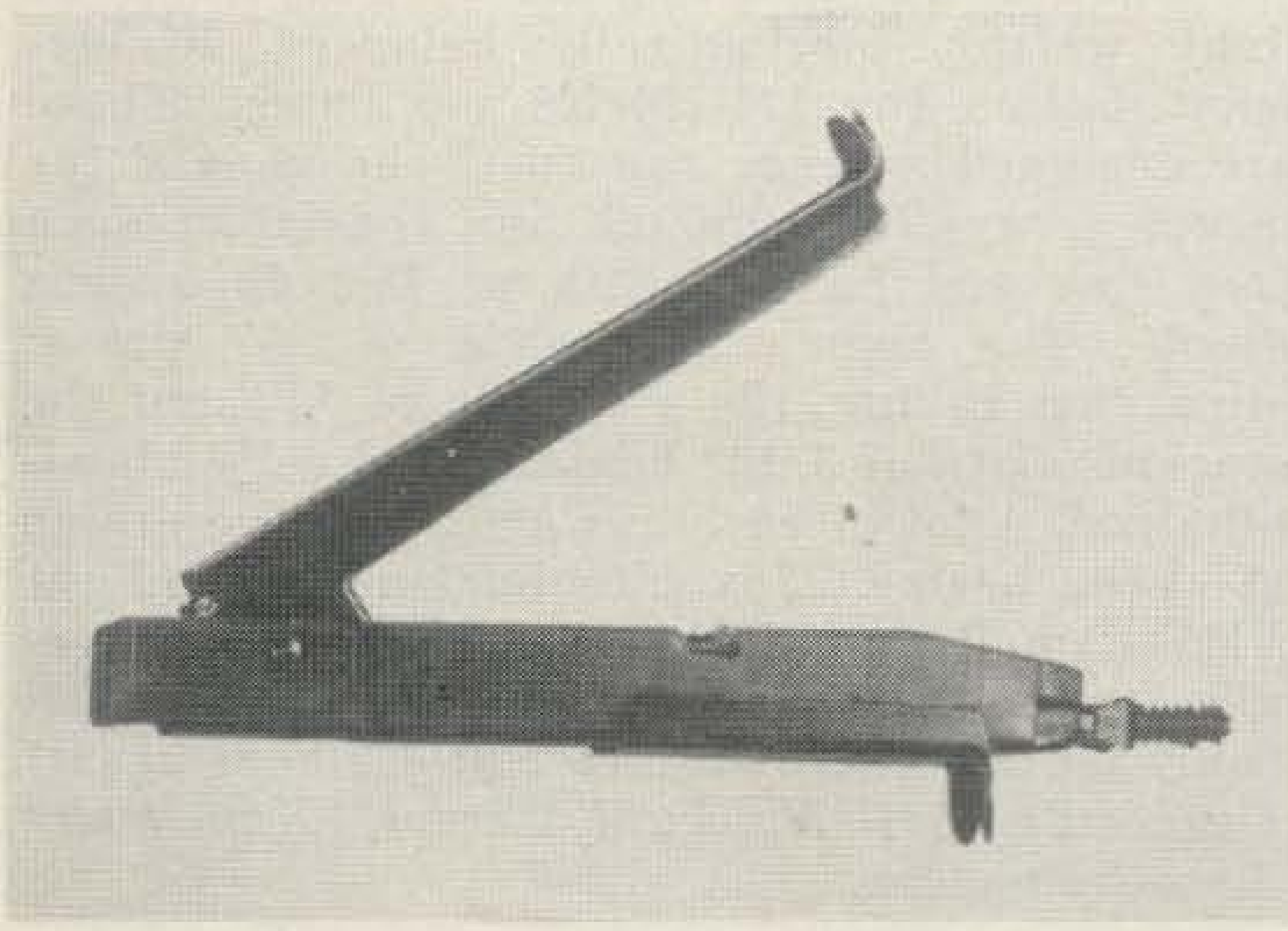

K4CHC

Here's a New One in Tools

We have recently had occasion to try out a most exciting new tool addition to the workshop equipment of the ham who likes to build his own gear; the ADEL NIBBLING TOOL. And it's *just* that; a "nibbler." Mystified? Well you might be unless you're "in the know." This tricky little device takes all the hard work out of cutting odd-shaped holes in metal panels and chassis as well as in tubular metal parts within its generous thickness liimts.

The "nibbler" will bite holes in sheet metal up to 18 gauge steel or 1/16" copper or aluminum in just about any formation you can



think of. Cut your initials in a piece of rain pipe down-spout or your call letters in a panel; square, rectangular, oval or round cutouts for component mountings, as easily as you punch cardboard with a paper punch! Enlarging holes of any shape is 'duck soup' for this little hickey; stick his snout in the hole and do a bit of 'click-click' finger squeezing and you've got a clean, smooth hole of the size and shape you want!

And . . . the *best* part . . . less than $4.00 for this handy contrivance and we'll bet that your local ham jobber already stocks it. If not, write Adel Tool Co., 4640 Ronald Street, Chicago 31, Illinois for further information.

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CUT IT OUT!

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—Rolling Your Own
—Varicap Amplifier
—Simplest Patch
—2M Pip-Squeak
—Squawk
—6M Converter
—Heath Patch
—Life Insurance
—Absorption Wavemeter
—Interference Chaser
—Mobile Whip
—VFO Modern
—EICO GDO
—Pro Power
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—Propagation Guessing
—Editorial
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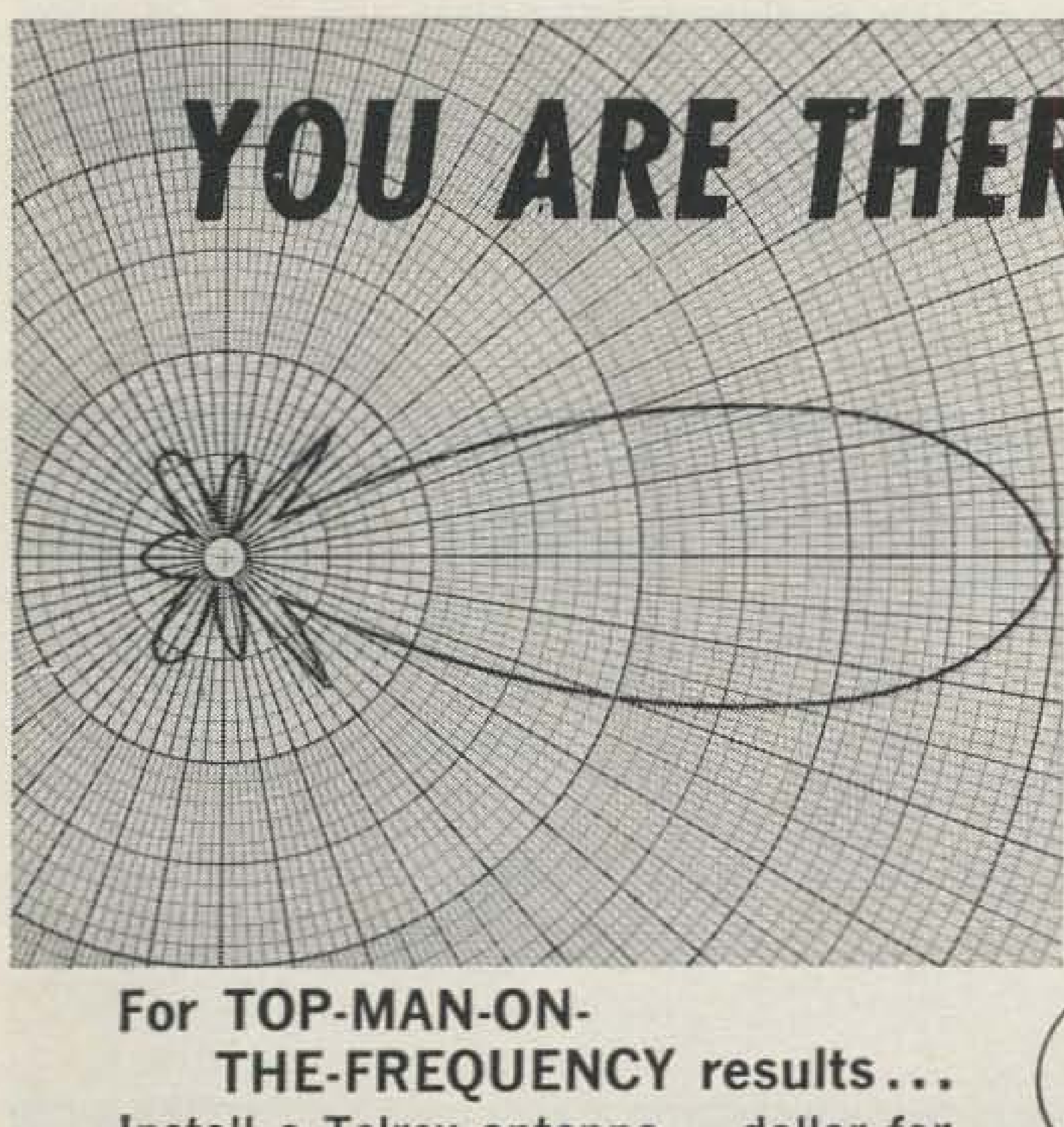

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"I'M KNOCKIN' OFF FOR A COUPLE HOURS DAVE - GETTING MARRIED."

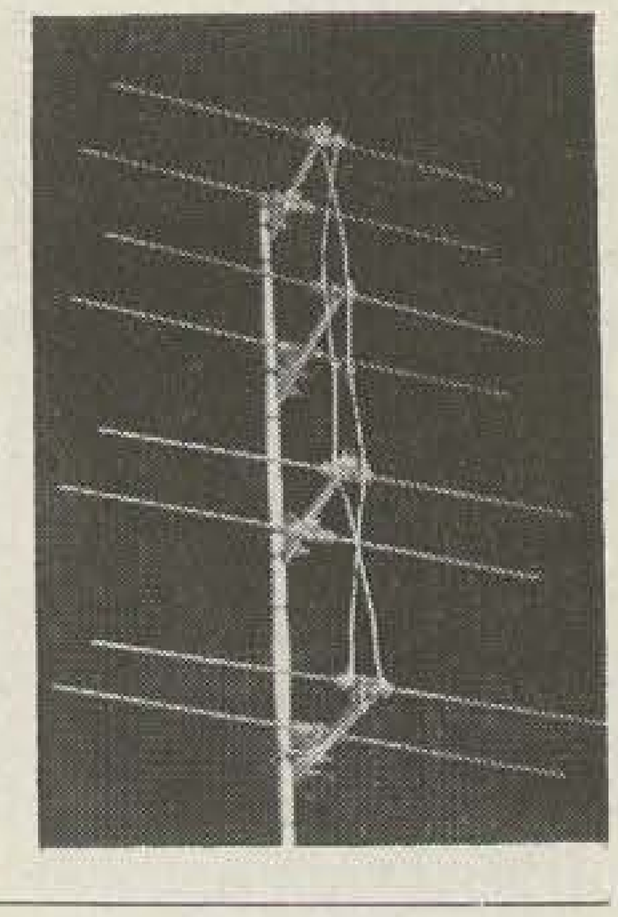
A Use for the Surplus 717A

The surplus 717A is a World War Two vintage high frequency pentode that has been seen in "Radio Row" for as little as ten cents. It was used extensively in military VHF gear. It has the same base connections as the 6SK7 and is directly interchangeable with it. The ARC-5 receivers have three 12SK7's used as rf and *if* amplifiers and the 717A comes in handy when converting these receivers for six volt operation. The 717A is also useful in increasing the gain and sensitivity of older receivers employing 6SK7's in the rf or *if* stages. This is because the 717A has almost double the transconductance of the 6SK7.

. . . WA2AKT

New Product

VHF Beams



Cushcraft has just announced a new line of light weight, mechanically balanced 16 element beams for 144-220-420 mc bands. These are designed so they can easily be ganged for larger arrays. They match any coaxial or open feed line and have a gain of 13.2 db over a dipole. The booms are made of ¾" drawn aluminum tubing, the elements of ¼" and the stacking bars of 3/16" heat treated solid aluminum rod. A lot of care has gone into the design of these beams. If you're buzzing around the VHF's you'll want to have all the info on these new beams. The prices are very reasonable (only $16 for the Two meter 16 element beam). ***Cushcraft, 621 Hayward Street, Manchester, New Hampshre.***

Letters

Dear Wayne:

Three cheers for W9EAM (on p. 57) for the boost for CW.

According to WØHKF (on page 6) 50 cycles is dead. For the record I would like to state that approximately half of my salary for the past year was earned modifying equipment &/or proving it would work properly on 50 cycles as well as on 60 cycles. Yesterday was really a looloo. The equipment likes to have one side of the power line grounded, but the 50 cycle generator has one side 40 volts and the other side 60 volts above ground, with about 118 volts betwix the two leads. A 5 cycle component is also impressed on the 50 cycle. Doesn't he like to work DX? Japan uses 50 cycles at 100 volts, Germany 50 cycles at 220 volts, and others use 25 cycles and 43 cycles.

Roy A. McCarthy, K6EAW
Fullerton, California

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P. O. BOX 3915, TERMINAL ANNEX **CALL-D-CAL** LOS ANGELES 54, CALIFORNIA

Letters

Dear Wayne:

Congratulations on the January issue of 73 Magazine. I found it many times more interesting than the corresponding issues of brands X & Y. K8ERV's article on the Nuvistor Converters for 6 & 2 was excellent; loaded with food for thought and caused a good many friends and myself to ask, "Why didn't I think of that?"! The "See-Saw Bleeder" of KV4CI was a novel take-off on an old "Hints & Kinks" idea but deserves praise for bringing it "up-to-date." Heaps of luck, keep up the good work on 73.

Al La Placa K2DDK
Manhasset, N. Y.

Dear Wayne:

I just finished reading the January 1961 issue cover to cover. There really **is** a lot of article-pages inside. Here is a run-down on my thoughts on the contents.

The following were, I thought, above ordinary. They are listed in order of preference.

1. **Polarity Test Paper**—W2QCI. This article was worth the cost of the magazine. It is the cleverest and most useful idea I have seen in a long time. However, why not use sodium chloride instead of potassium chloride? It works just as well and might be easier to come by (table salt, you know). This system is really sensitive.
2. **1296 Mc/s**—Very good article.. Glad to see things on the pioneering phases of hamdon.
3. **Lost in a Tunnel**—Same thing goes for this one.
4. **Nuvistor Converters for Six & Two**—Very good construction article. One thing I don't understand, tho. What is a "conventional turned plate circuit" (P. 10)?
5. **A-M Detectors**—Very good techical article.
6. **Transistorized . . . Receiver**—Good "see what can be done" article.
7. **Down with Drift**—Another good technical article. I would also like to add the use of heat dissipating tube shields to his list.

The rest of the articles were satisfactory. They are not listed except for three which deserve some comment.

Goblin Patrol—Good "public service" article but it paints a horrible picture of teenagers.

Transistorized Frequency Standard—Gives the impression that a 100Kc/s oscillator is the trickiest circuit in existence.

6N2 Completed—Gads ! ! ! Is this a sign of the future? Will the technical magazine of 1965 be a collection of permutations of commercial equipment? Will the amateur become like the Hi-Fi Fan (audiophile?) who "constructs" his own system? 'UZN could have at least built and designed his own power supply. This one really shook me up.

All in all this was a very good issue. I did not realize that there was so much space devoted to articles until I read the whole thing in one sitting. Keep up the good work.

Arnold Reinhold, K2PNK

Ha, ha, ha . . . he doesn't know what a turned plate circuit is.

Dear Wayne:

K3EBB (Mack) loaned me his copies of your first three issues and I was delighted with what you are doing. I particularly like the preponderance of construction and technical articles and was further pleased to note that so many of your writers were top drawer. If you can continue to entice articles from men like Herb Brier, Jim Kyle and my very good friend John Specialny, then you really have it made. Thanks too, for the nice plug of the AF-MARS Eastern Technical Net Sunday afternoon broadcasts, my particular interest. Query: Who got number 1 on the Xmas cover, you or Jim?

Earl Henson, W3ZNF

Me.

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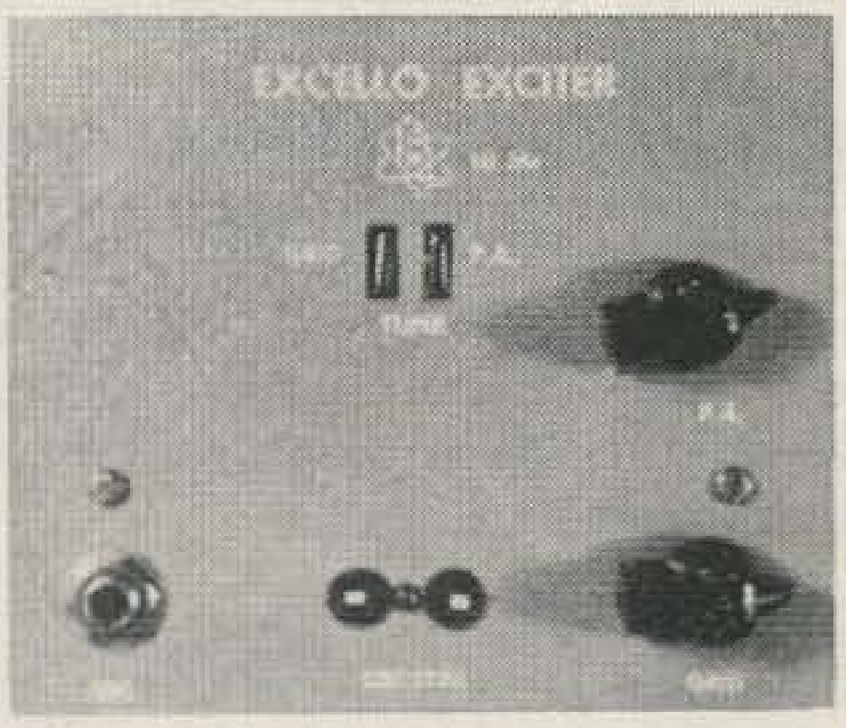

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RF meter in antenna relay box for ARC-5—see conversion March 1960—CQ-BC442 box—new.......$2.95—2 for $5.00
BC 733 UHF receiver—10 tubes—dynam.—CQ conversion for 2 or 6-clean ....$5.95—2 for $10.00
Filament—cased—her. sld.—pri.—115 v—60 cy. sec. #1—2.5 v—23a ct. sec. #2—2.5-23a ct. use a 2.5 v ct 46a or 5 v-23a. 6 x 4½ 4—10 lbs. ....$6.95—2 for $13.00
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Split stator variable condenser—dual 350mmfd. lkv.—New $2.95—2 for $5.00
Hypersil core plate and filament xformer—pri. 115 v ac sec. 6.3 v at 10a, 6.3 v at 8a, 170 v at 1.6a, 170 v at 1.6a—used in voltage doubler circuits to achieve 450 or 900 v at 600 mils—new 5½ x 6½ x 6—201 lbs...$7.95—2 for $15.00
Selenium—full wave bridge—input 0-150 v ac—2½a x 2½ x 4 $3.95—2 for $7.00

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Flying Hams

Jack Gutzeit W2LZX
75-02 168th Street
Flushing 66, New York

FOR some time now I have been noticing that more and more of the fellows I contact are also interested in the hobby of flying. After talking to a dozen or so fellow flyers, I began to keep a list. The list has grown and grown, but still is far from complete. I would appreciate knowing of any additions that you could suggest. Some of the better known flying hams are:

W1ZD—John M. Wells of the Harvey-Wells Company, a pilot since 1930 and a ham since 1920, now flys his Beech Travel Air for business and pleasure.

W2AQK—Frank Melville of the Melville Radio Distributing Company, White Plains, New York, another old timer now flying a Bonanza.

W2DIO—George Zarrin of the Harvey Radio Company, New York, who started both ham radio and flying more than 25 years ago, today is very active in both radio and CAP activities.

K4LIB—Arthur Godfrey (need we comment?)

K6BX—Clif Evans received his Navy Wings in '27, has flown 138 different types of aircraft and has over 14,000 hours logged, now retired as Commander and very actively engaged in ham radio and The Directory of Certificates and Awards.

W8QBF—J. Donald Shirer, Chief of Police at Olmstead Falls, Ohio.

K4RFA—Curt LeMay, General in the United States Air Force.

KØDWC—Francis "Butch" Griswold, General in the United States Air Force. 73

W1BMR
W1BZH
K1EGO
W1IZ
K1IZM
W1JIB
W1JM
W1JTB
W1LZV
W1NPY
W1PRI
W1SBM
W1TIM
W1VLT
W1YUO
W1ZD
W2AS
K2AAN
W2ABK
W2AQK
WA2AVT
W2BAE
W2BHD
WA2BCS
WA2BRY
W2BKX
W2BMV
K2BPM
W2BPV
W2BUS
K2BVY
W2CAN
K2CNF
K2CTK
K2CTR
K2CYA
K2DGI
W2DHN
W2DIO
W2DR
W2DZV
W2EHV
K2ENC
K2EZC
W2FCJ
W2FDL
W2FME
W2FWG
W2GG
W2GJX
K2GBN
K2GMV
W2HBK
W2HDM
WA2HDP
W2HHK
W2HNG
K2HOK
W2HTI
W2HZC
K2IEY
K2IHD
WA2IMA
K2IND
K2IOG
K2IQX
W2ISY
KN2IUM
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K2JGG
K2JHM
K2JQO
K2JVQ
W2KAH
W2KZS
WA2LGD
W2LHK
WV2LKN
K2LUR
W2LZ
W2LZX
WA2LXH
K2MGQ
W2MHM
K2MMM
W2MRJ
W2MRY
K2MWN
W2NNU
W2NRM
W2NSD
W2NXZ
W2OBW
W2OZD
W2PNR
W2PYK
W2PZE
W2RCQ
K2REC
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W2RJM
K2RMA
W2RNN
W2RRP
W2SCH
W2SIM
K2TAQ
K2TOL
K2VAU
W2VEG
W2VGQ
W2VHS
W2VKS
W2VZF
W2ZGA
K2ZMX
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KL7AHP
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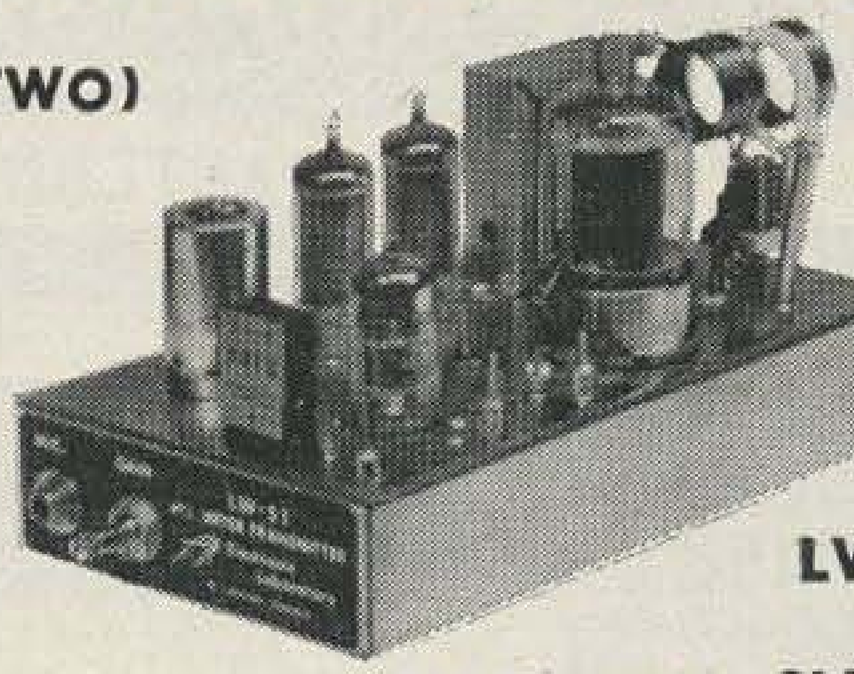
LU2ZR
LU2ZS
LU2ZY
LU8CW
LUØCQ
VE2GQ
VE2WW
XE2FA

THINKING SIX

(OR TWO)



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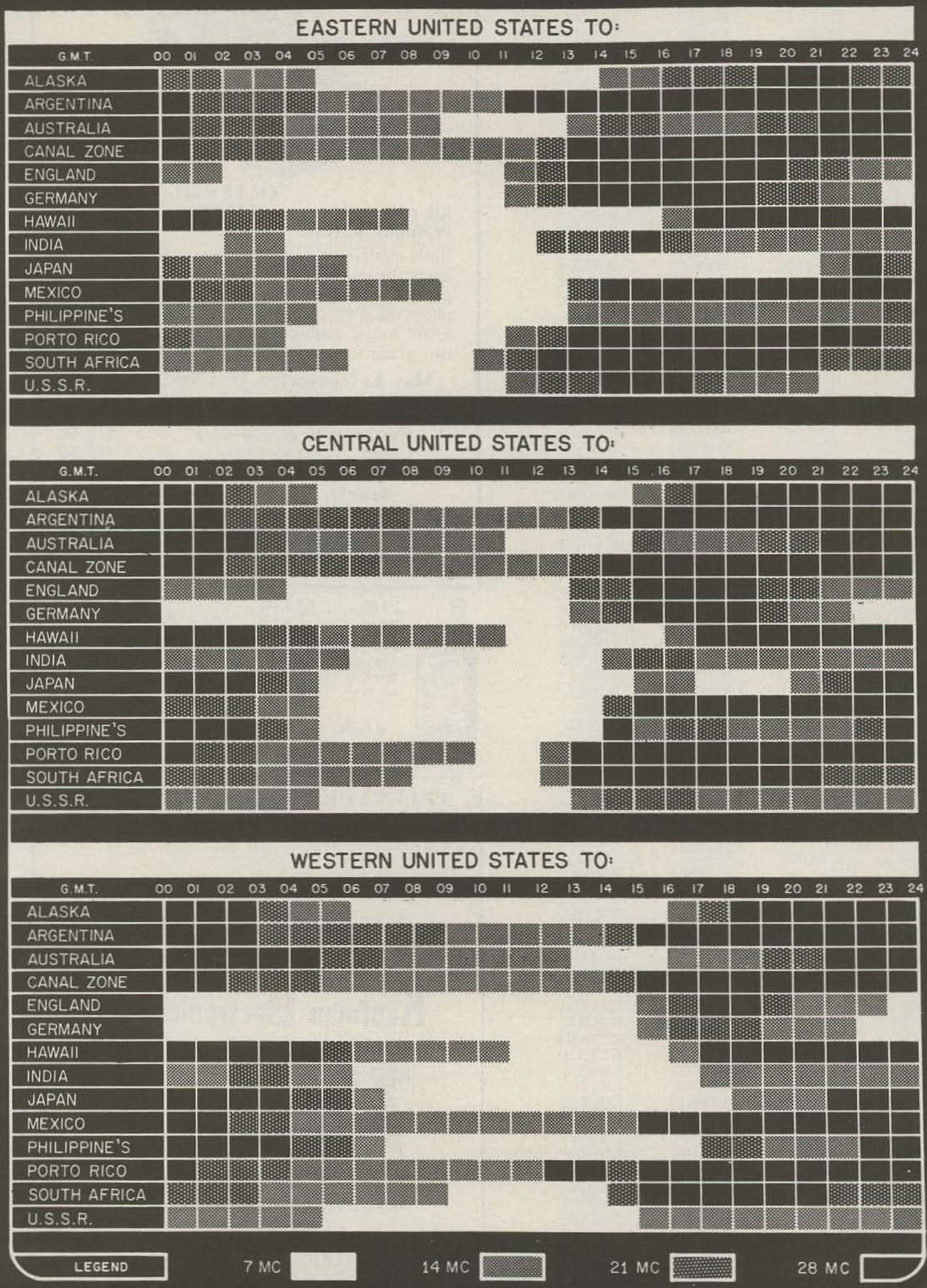
PROPAGATION CHART



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The bands listed are MUFs and a higher band will not work for the time period listed. Lower bands will work, but not nearly as well. Times are GMT, not local time.

These charts are to be used as a guide to ham band openings for the month of February, 1961 to the various countries listed. I will be interested to hear of your results in using these charts and to know what other areas you might wish included in future charts.

Advanced Forecast: February 1961

Good 5-10, 16-21, 24-28

Fair 1-2, 4, 11-13, 15, 22-23

Bad 3, 14

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One of the details that seems to puzzle embryo crystal grinders is where to latch on to the necessary abrasive powder. Simple. There are almost as many rockhounds around the country nowadays as there are hams. The stuff is known to them as "grits" and they use it by the pound in their tumblers to smooth and contour their rock specimens. It shouldn't be difficult to get on the trail of one and talk him out of a few spoonfuls of 400 or 800 grit. Failing that one can always look up "Lapidaries" in the classified phone book and buy it like the rockhounds do . . . by the 5 lb. bag.

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Feb. 12—Fr. Clarence Schubert: The Electronic Emission Microscope
Feb. 19—Robert Gunderson: Electronic Test Equipment For the Blind Communicator
Feb. 26—Vice Admiral Robert B. Pirie: Patriotic Rearmament Through Education
Mar. 5—Dr. C. R. Kelly: Physics and Chemistry of Pure Metals

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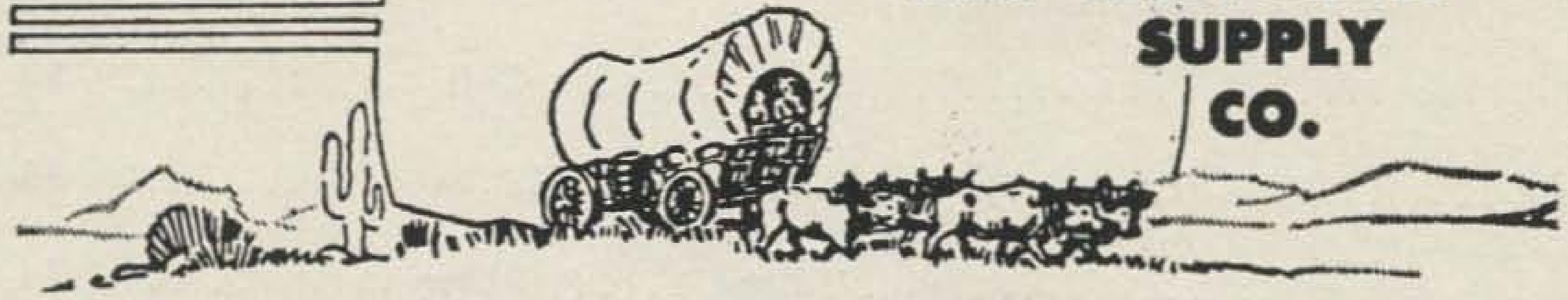

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Capacity Meter (December 73)

Make a note on page 15 of the December 73 that L1 is 65 turns of #32 wound in three layers on a ½" slug tuned form. The tap is 15 turns from the ground end. L2 is 37 turns of B&W Miniductor 3012 (Air-Dux, 632, ¾" idameter, 32 turns per inch), tapped at six turns. Better put this note in now so you won't have to hunt when you start building this gadget.

/MM's

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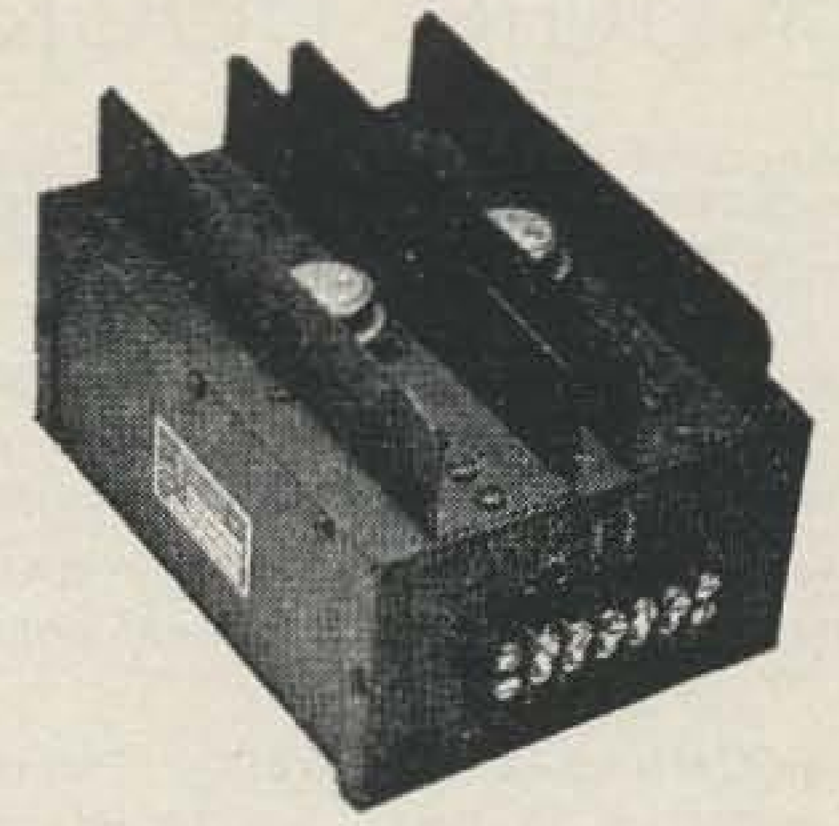

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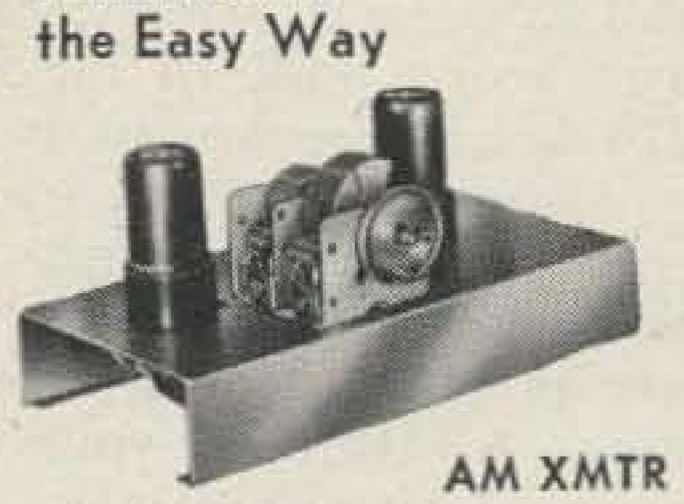
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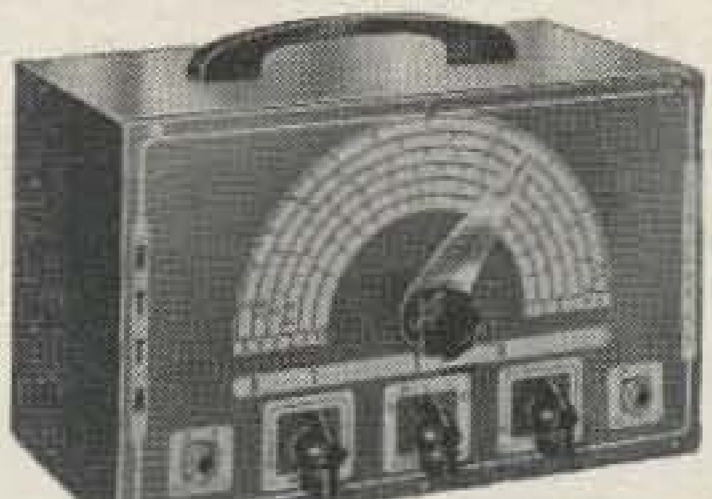

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THE MONITOR. Mar-Jax Publishers, 507 West Davis Street, Dallas 8, Texas. $1 a year, 3 years for $2.50. Monthly. Largely operating news. Columns: YL, Club Meetings, Arkansas News, Mississippi News, Florida News, DX, Missouri News, MARS, California News, Louisiana News, VHF News, Oklahoma News, Rio Grande Valley News, Novice News.

VHF AMATEUR. 67 Russell Avenue, Rahway, New Jersey. $3 year. Monthly. Operating news for VHF men. Some technical info.

DX-QSL News Letter. Clif Evans, K6BX, Box 385, Bonita, California. Published quarterly. 40¢ each; Annual subscription $1.25 (four copies) by first class mail ($1.50 for DX stations). Lists all QSL Bureaus, managers for rare DX stations, etc. Why not send your old Callbook to a DX ham? Write Clif for the name of someone who needs it.

DIRECTORY OF CERTIFICATES AND AWARDS. Clif Evans, K6BX, Box 385, Bonita, Cal. Complete Directory plus one year of revisions (quarterly) $3.50. Add 75¢ for 1st class mail; $1.25 for airmail; DX stations 1st class mail add $1.00. Needless to say, this is the most complete collection of data on the hundreds of certificates and awards available.

MOBILE NEWS. Published monthly by the Amateur Radio Mobile Society, 79 Murchison Rd., Leyton, E. 10, England. Joining fee and 1 year sub. is $2.50.

DX BULLETIN. Don Chesser W4KVX, RFD 1, Burlington, Kentucky. DX news in depth. Published weekly. 3rd Class mail $5 year; 1st class $6; Airmail $7.50. DX rates on request.

WESTERN RADIO AMATEUR. Don Williamson W6JRE, 10517 Haverly Street, El Monte, California. Monthly. Subs are $2 per year, $3.50 for two years, $5 for three years. Operating news of west coast activity, columns on DX, SSB, YL, and some articles. 48 pages.

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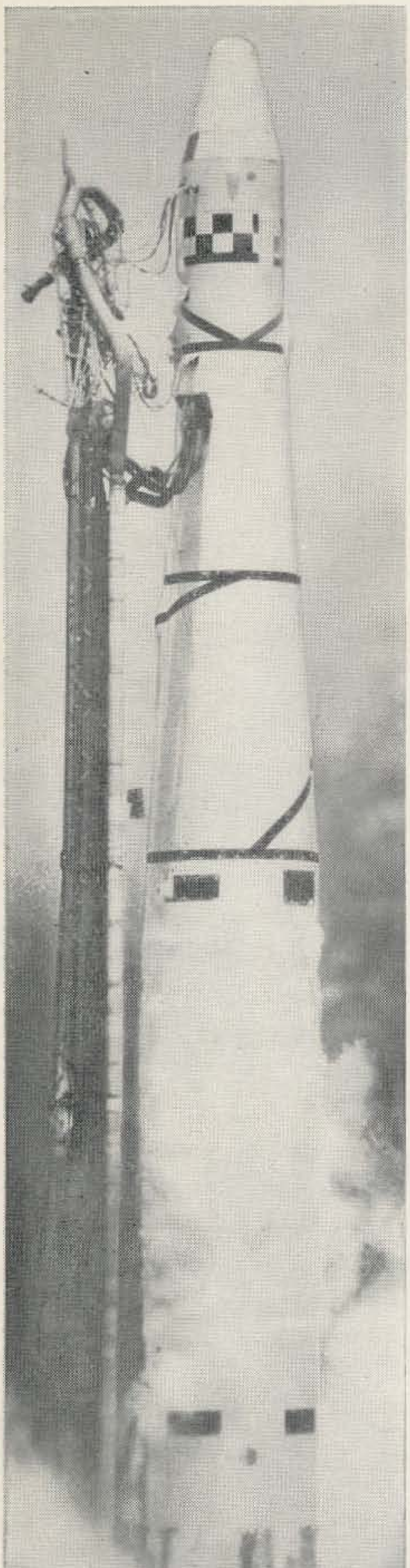

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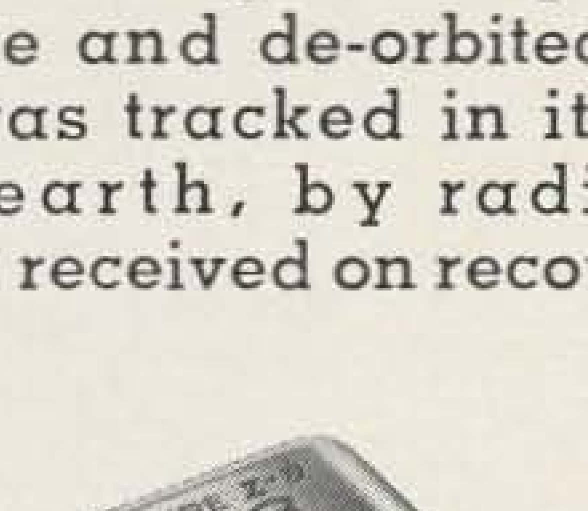

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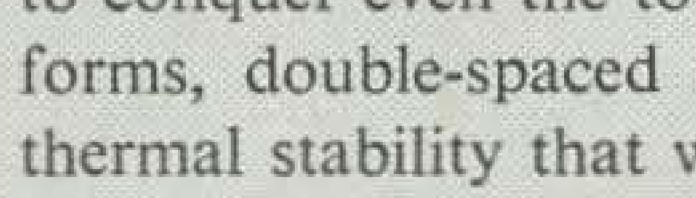

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