SEPTEMBER, 1948

CQ

The Radio Amateurs' Journal

35¢

THIS MONTH

- Complete Simplified SSSC Rig
- De Luxe Regenerative Receiver
- What Makes the DX Man Tick?
- Putting the BC-455 on 28 Mc

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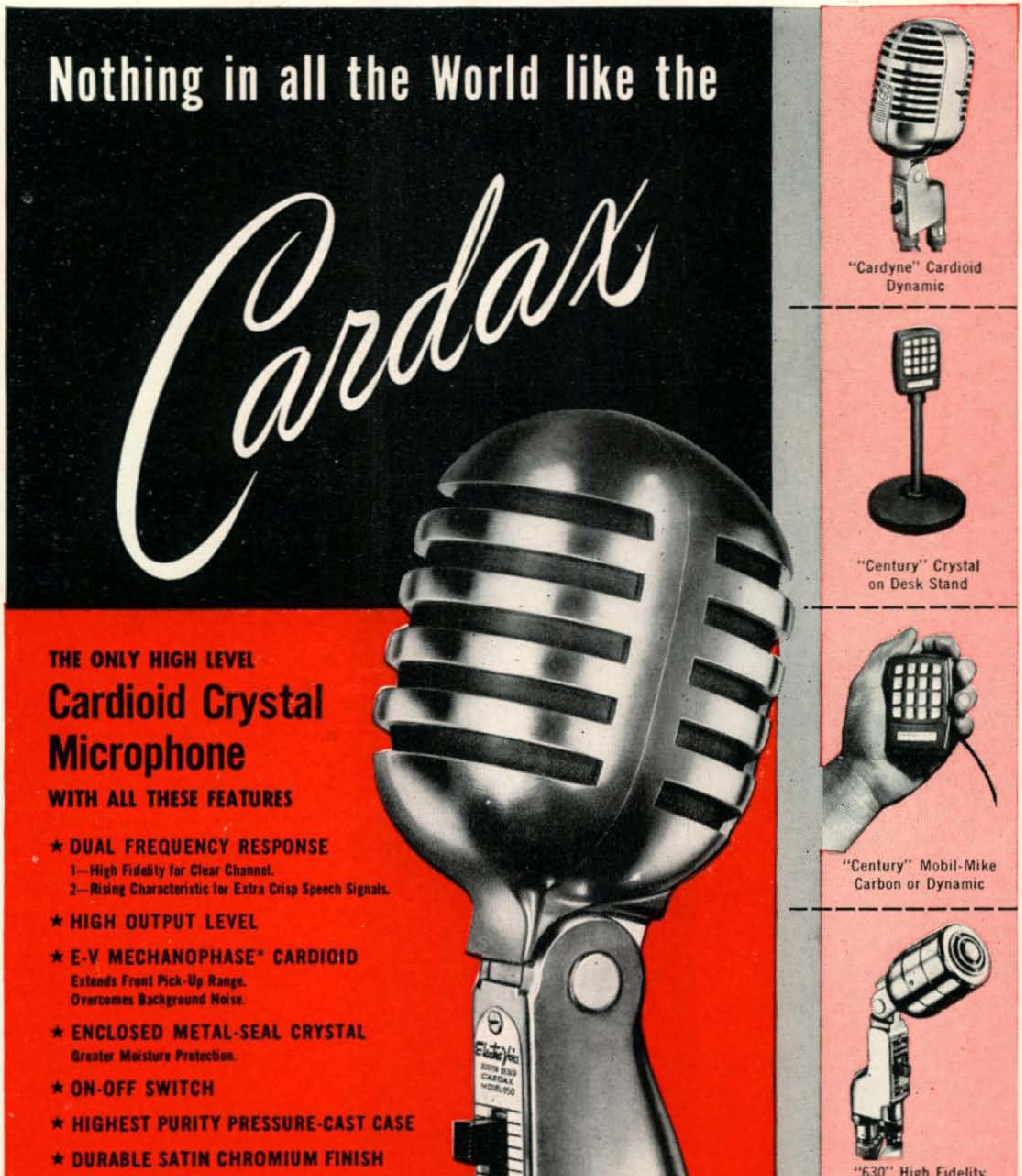

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CQ

The Radio Amateurs' Journal

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Vol. 4 SEPTEMBER, 1948 No. 9

In This Issue

COVER—The walkie-talkie comes of age. W2SVI demonstrates the portability of his crystal-controlled 2-meter transmitter and superhet receiver, which from an ordinary location has been used for successful communication to about 75 miles. The complete portable station will be described in detail in the October issue of *CQ*.

★ ★ ★ *Letters* ★ ★ ★

274N Transmitters

129 Quentin St., Sheepshead Bay,
Brooklyn, N. Y.

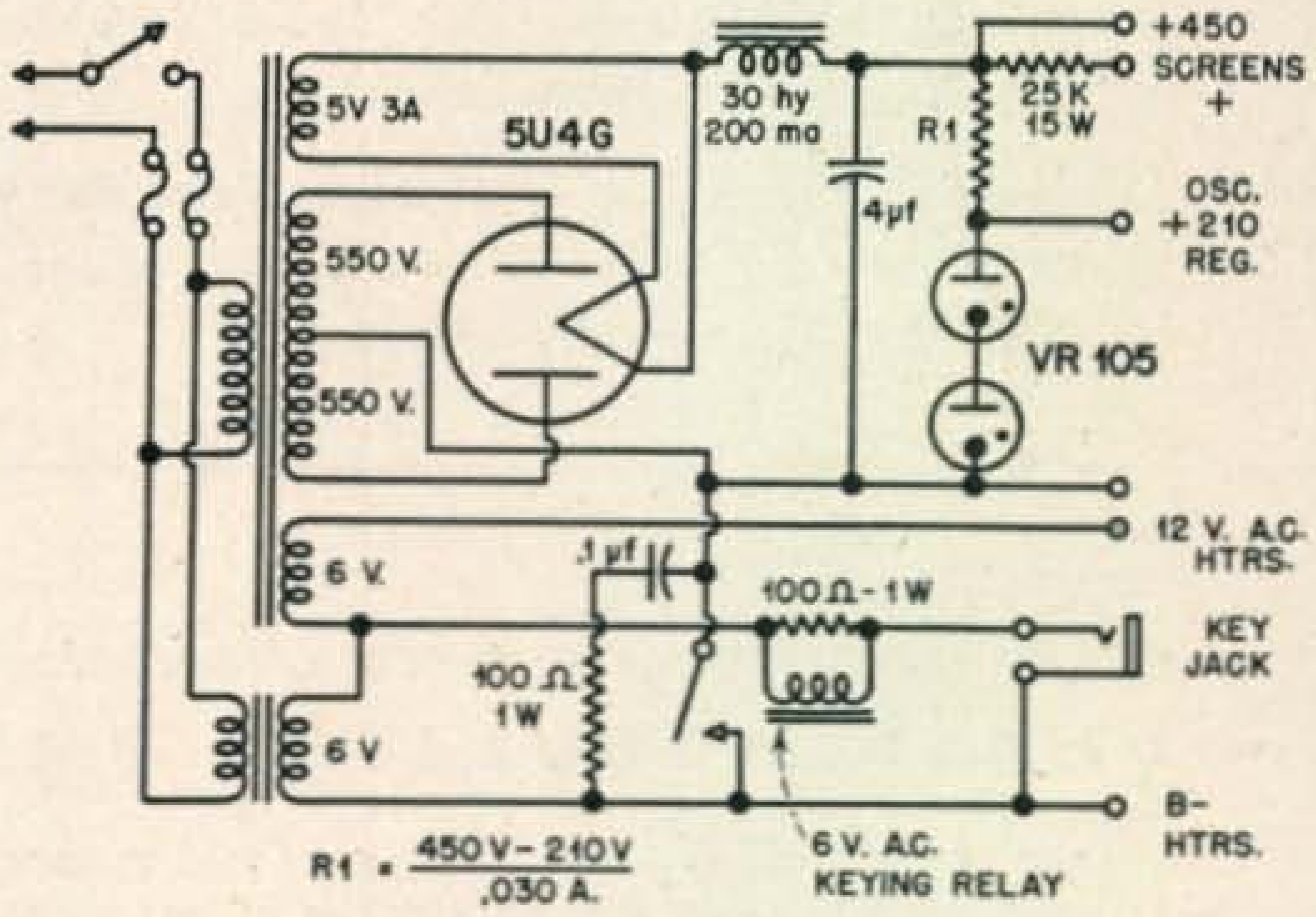
Editor, *CQ:*

The article on the 274N series transmitters in the July issue of *CQ* was of great interest inasmuch as four of these sets have been converted in my shack in the last six months.

I would like to add that the calibration crystal is not an oscillator in the set; in fact, it is only a high-*Q* resonant circuit of a permanent nature. Most of the crystals have two resonant points. The Army technical manual tells the operator to disregard the higher frequency resonant point and to use the lower frequency one which is correct for accurate calibration.

When converting the BC-459A the magic eye tube may be made more sensitive by removing the 390-ohm cathode resistor entirely and then cutting the 1500-ohm R-70 adrift at the heater pin but not the cathode pin. Now swing the R-70 around and solder the free end to ground.

Another item is the keying arrangement. Most of the poor notes, chirps, clicks, etc., originating from these transmitters have stemmed entirely from the power supply and the method of keying. I agree with the power supply on page 87 of July *CQ* except for one point. Every time the key is closed the entire filter has to *charge*—every time the key is opened, the filter has to *discharge* through the rig. I would like to offer the circuit shown below which is in successful use at my shack now, eliminating the above mentioned faults.



Several minor points might be brought to light here. The 1-μf capacitor and the 100-ohm resistor practically eliminated the spark at the relay contacts. The original keying relay was left in the rig and was blocked closed as I intend to try it later. The 100-ohm resistor across the relay coil eliminated the spark at the key contacts which had been causing considerable noise in the B-C receiver much to the XYL's annoyance. The relay used finally to key the rig was a 6-volt a-c relay and was mounted in the power supply chassis.

Jesse G. Sadler, W2UZF

Wanted! Cooperative Tuning

511 Ann St., Saginaw, Mich.

Editor, *CQ:*

Pat Miller is to be congratulated on his fine article, "Heaven for Hams," in April *CQ*.

I see that the ZS stations, as well as practically all DX stations, do not like the QRM between 28.5 and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28.6. My own experiences on that subject go like this: Around noon a South American station calls CQ and comes back to a W9, for instance. By some careful looking, I can usually find the W9 under two or three layers of W6 QRM, on about 28,505. The W stations do not operate on "QRM corner" because they like it—they do so because for each 10 kc that a W moves up from 28.5, his percentage of DX contacts falls off ten per cent. Any DX station doubting that should try calling anything but Ws from a clear spot about 29.1. It's a joke. Yes, there are DX stations who do not tune from 28.5, CR9AG for instance. But any high-powered W station who wants to work DX won't have to puzzle very long to figure what frequency to operate on. If a W operates on 28,503, and calls ten DX stations, he can be absolutely certain that nine of those stations will tune his frequency, if they venture into the American phone band. In short, 28.5 to 28.6 is the mess that it is because the DX stations make it that way—at least 90% of them tune from 28.5.

My only suggestion is that the DX stations mention where they will be tuning—say from the high end, or from 29 mc up or down, or what have you, and change it occasionally. If enough stations will do that, KW Korner will soon be just as congested as any other place, but not more so!

Richard J. Hart, W8ZHT

P.S. In case of any interest, my frequency is 28,618 or 29,222!

Why Not Encourage SWLs?

582 Warren Ave., East Providence, R. I.

Editor, *CQ:*

I have always been interested in short-wave radio. Years ago I tinkered with crystal radios, catswhiskers and all the elements of early radio. When vacuum tubes were introduced, I was one of the first in this little state to build a "1-tuber."

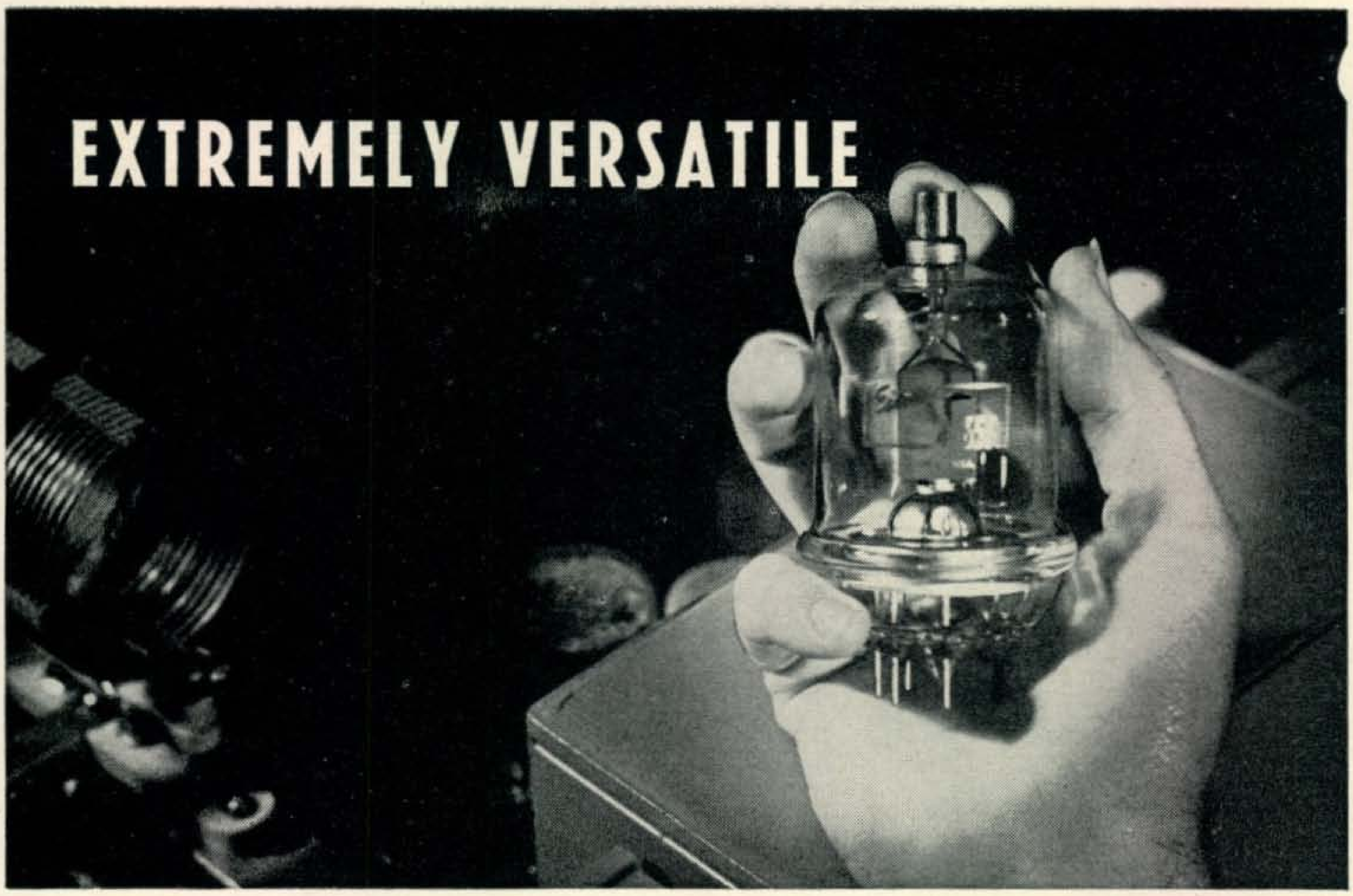
Came the two wars . . . one in which I served briefly, just reaching the age before the Armistice, then World War II in which I was an "over-aged destroyer" but in which my son was so seriously wounded that he is completely paralyzed from the waist down, and must spend the rest of his life in a wheel chair.

My son has recently become interested in amateur radio, and has re-awakened my interest in "my first love." We are studying the code together, and hope some day to have our tickets. In the meantime, we get a big kick out of listening to the hams on 10-20-40-75 meters (especially my son, who has many, many long hours to pass away). When we pick up stations that are putting through a good signal despite QRM, or stand out in some way, we send them cards, believing they are interested in hearing how they are getting out. In return, we courteously ask them to send us their QSL cards.

It would seem to me, that even though we are not yet on the air, more encouragement should be given to prospective hams. It would keep their interest at a high pitch and would speak well for the hams, too. It was refreshing to hear, during a recent transmission, CO2MG recommending that QSL cards be sent SWLs, even out of common courtesy for "their interest in writing to the ham operators."

In conclusion, I cannot urge too forcefully that all hams reciprocate when they hear from SWLs and favor them with the much-sought-after QSL cards. It will encourage the SWLs and bring increased interest and strength to the short-wave fraternity as a whole.

G. F. Aiken



THE EIMAC 4-65A POWER TETRODE

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GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated tungsten
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- Current - - - - - - - - - 3.5 amperes

Grid-Screen Amplification Factor (Average - - 5

Direct Interelectrode Capacitances (Average)
- Grid-Plate - - - - - - - - - 0.08 µuf.
- Input - - - - - - - - - - - 8.0 µuf.
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Audio Frequency Power Amplifier and Modulator

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D-C Grid Voltage (Approx.)	—85	—85	—90	Volts
Zero-Signal D-C Plate Current	30	30	20	Ma
Max-Signal D-C Plate Current	170	180	170	Ma
Zero-Signal D-C Screen Current	0	0	0	Ma
Max-Signal D-C Screen Current	24	14	17	Ma
Effective Load, Plate-to-Plate	9000	15,000	20,000	Ohms
Peak A-F Grid Input Voltage (per tube)	85	85	90	Volts
Driving Power	0	0	0	Watts
Max-Signal Plate Dissipation (per tube)	45	63	62	Watts
Max-Signal Plate Power Output	80	145	175	Watts

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Feenix, Ariz.

Deer Hon. Ed:

Having you ever been to a Hamfest in Arizona? Goodness gracious sakes Scratchi are just now recooperating from same. Only visible scar are blister on thumb from pushing push-to-talk switch on mobile ten meter rig in contest they are having. I are half-way through contest before I are discovering that they are only counting contacts made on six meters and higher. But this are only beginning.

Brother Itchi and I are deciding to attending Hamfest so we are driving over and showing up nice and early on registration day. After shelling out much bux for tickets and getting fixed up with lapel tags almost same size as 10 gallon hats we are trying to get a hotel room. This are turning out to be some trubble as Itchi and I are not wanting to share room with more than three other peeples. Itchi are fixing us up when he are slyly slipping clerk a slitely used 810 toob. Clerk are then suddenly discovering he having nice room available. Hee hee, Hon. Ed., we are lucky we are leaving before clerk are discovering that 810 toob are having slite case of open filament.

Local distributors are doing nice job in displaying new ham products. Itchi are very wisely having left check book at home, and I are also noting that stuff are pretty carefooly guarded, so Scratchi are in position of man who are only able to gaze wistfooly at stuff and not have any, one way or another. There are a cupple of nice new single sideband units that Scratchi are making mental note to look into later.

Itchi are all very confused about this single sideband stuff. He are asking me why have we amateurs been using two sidebands all this time as long as both sidebands are alike and carrying same voice and the same voice are being transmitted better with one sideband than with both. I are explaining that single sideband are not reely new, but that B.T.N.S.S.S.G.D. (Before The New Single Sideband System Got Discovered) it are taking hole ham shack full of equipments and toobs so that ham shack are looking more like local b-c station. Result are nobuddys using single sideband in ham radio in the past. Itchi are looking convinced so maybe Scratchi are giving him the rite answer.

That evening Itchi and I are invited to visiting some of the local ham shacks. Hon. Ed., you should be seeing what we are. You can having your Calif. Kilowhats—Scratchi will be happy with a Arizona Kilowhat. One ham are having power company bring 2200 volts directly into shack so can stepping it up to reely decent high voltage. Another ham are having steal tower so high he are practikally needing red lights on the red lights. This tower are so big at the base that ham shack are built under tower, and there are still room to string 20-meter half-wave

(Continued on page 99)

A man without an address is like a man without a country. Even his best friends never know where to find him! He misses all the beautiful, worthwhile things in life. Your radio "address" is the frequency on which you operate. Although you may share it with others your "spot" in the band becomes a treasured and personal thing ... the key to your amateur enjoyment. PR Precision CRYSTALS give you the finest, most stable, frequency control the art has developed. With a PR CRYSTAL in your rig you KNOW where you are ... you know you will STAY THERE! Every PR is UNCONDITIONALLY GUARANTEED. Order from your jobber.—Petersen Radio Co., Inc., 2800 W. Broadway, Council Bluffs, Ia. (Telephone 2760)

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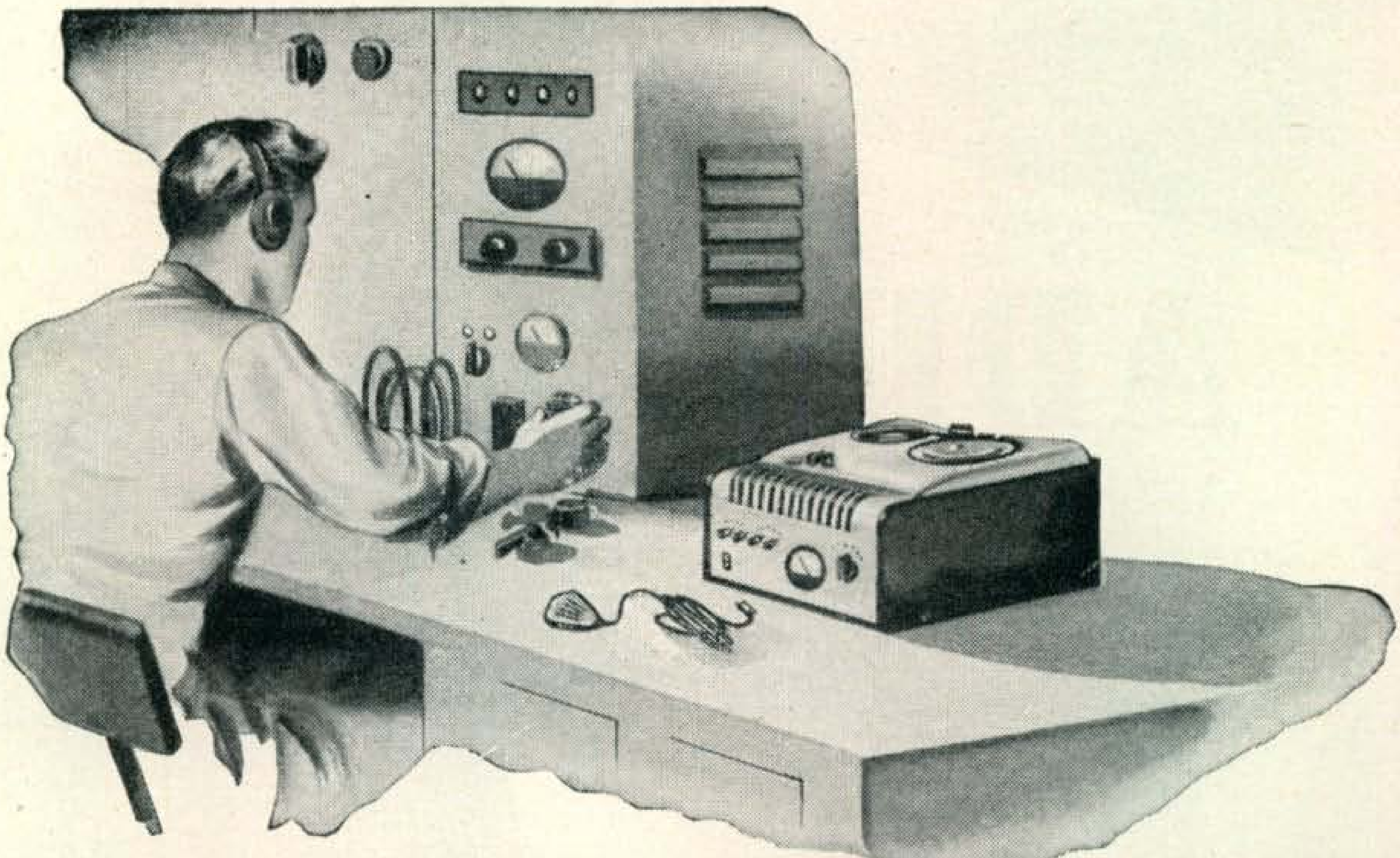

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Record your QSO's. Take down those Dx's for some well-earned gloating when the gang is in. Test your modulation levels and the quality of your rig.

Model 78 Wire Recorder is ideal for handling traffic—no chance of error in relaying important messages.

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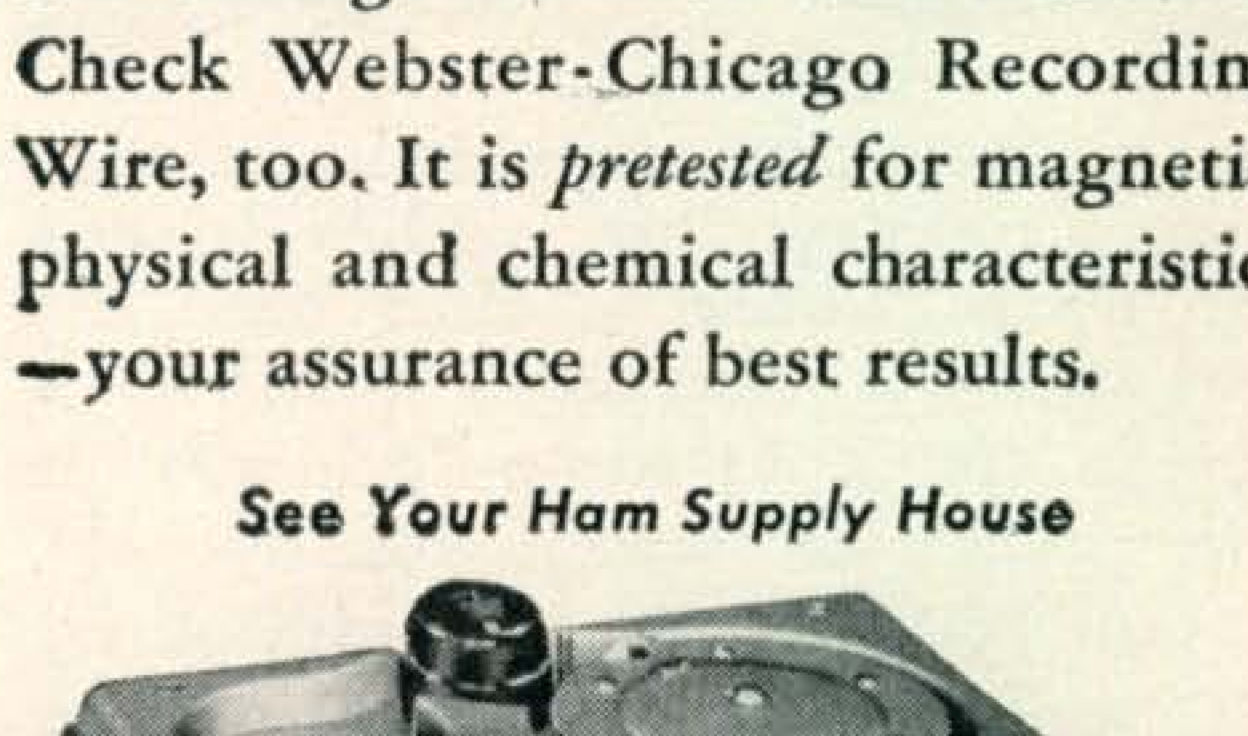
See Your Ham Supply House



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ZERO BIAS

E D I T O R I A L

TVI Progress Report

For the first time in many months it is possible for us to report encouraging news in connection with TVI. Perhaps the initial reaction to amateur-caused television interference when the full impact of TV broke after the war overemphasized the "impossibility" of the situation. Don't misunderstand us for a moment, it is still a serious problem which is extremely acute in many localities. But for the first time we are hearing of amateurs who have completely licked their TVI. And even more important is the very marked betterment of relations between many hams, their TV viewing neighbors, the TV set manufacturers, and installation people.

The largest manufacturer of television receivers in the business has embarked on a program of co-operation with the amateur that leaves absolutely nothing to be desired from the service standpoint. This organization has agreed, and, as a matter of fact, has been pursuing the policy of placing at the disposal of an amateur and a set-owner the services of a trouble shooter. Working together, the amateur and the serviceman have made progress that would have been impossible if all the work was done on the amateur station. Furthermore, at considerable cost to the manufacturer, these service calls are made at the convenience of the ham—in his off hours which usually means night time and week-ends for service personnel. We do not yet know what the policy of other manufacturers will be in regards to this matter, but if they take their cue from the leader in the field all will soon follow suit. It is unfortunately true that some of the smaller set manufacturers are using local service people not competent in every case to cope with the problems arising. But these local organizations must be honest and forthright in their dealings with the public or they run the considerable risk of losing their franchise. So amateurs who encounter cases of deliberate misinformation or lack of cooperation are again urged to come up with all the facts—either to us or directly to the manufacturer. But they must have facts—rumors are inadequate.

Incidentally, an interesting project is now under way that will have a vital bearing on the future of TV and particularly TVI. On Sept. 20, 1948, the F.C.C. will hold a hearing, docket 8976, on the utilization of the band 475–890 mc for television broadcasting. Cooperating with the F.C.C. is the Joint Technical Advisory Committee, the policy advisory group established by the IRE and the RMA. It is our intention to make available to the JTAC data gathered by the *CQ* staff in support of TV operation on these higher frequencies. Whether or not the F.C.C. eventually encourages operation from 475–890 mc we don't know, but we intend to back our support of this change with some concrete evidence.

It's Your Neck

When we published W3JAY's article "Life Insurance in the Shack!" we knew it was one of the finest pieces in its field ever written. In the same issue, November, 1947, we printed a two-color chart "Emergency Treatment for Electric Shock." The value of this safety material has been appreciated far beyond our own field as testified to by our correspondence file. Utility companies, industrial labs, manufacturers, schools, etc., have asked for reprints, for permission to quote, and for additional copies of the magazine. Any amateur who has missed the material owes it to himself (and his family) to read and re-read Dr. George J. Nichols' down-to-earth treatment of electric shock.

It is only natural after the appearance of such an article—even long after—that interested readers should send in comments. One such recent letter brought up a condition, or perhaps it would be better called a set of circumstances, existing in many well-designed amateur stations. The condition evidently makes the operator a highly eligible prospect for Doc's research.

The use of control relays, especially for the primary control of large high-voltage power supplies is good engineering. Our own rig is typical and contains 6 relays, 3 of them for primary control to supply a.c. to high-voltage power supplies. Now we practice what we preach and never work on equipment with even the filaments on. But our correspondent, who has interlocks on all doors and parallel pilot lights to guard against failure, told us he felt he had taken "reasonable" safety precautions . . . until. The "until" came into the picture when he went behind the rack to lift a power supply just high enough to slide a control cable through a louvre on the side of the rack. In lifting the supply he gave it a sharp bang against the side of the rack.

The jar was sufficient to slam closed the primary control relay of his 2000-volt supply. By some inexplicable trick of fate the relay stayed closed, probably because it has been knocked slightly askew on its pivots. There was our friend kneeling behind a transmitter rack, holding in his two hands a 2000-volt power supply in operation, and the supply getting heavier by the moment. At this point we ought to change the subject and look for an agent to sell this story to a soap opera producer.

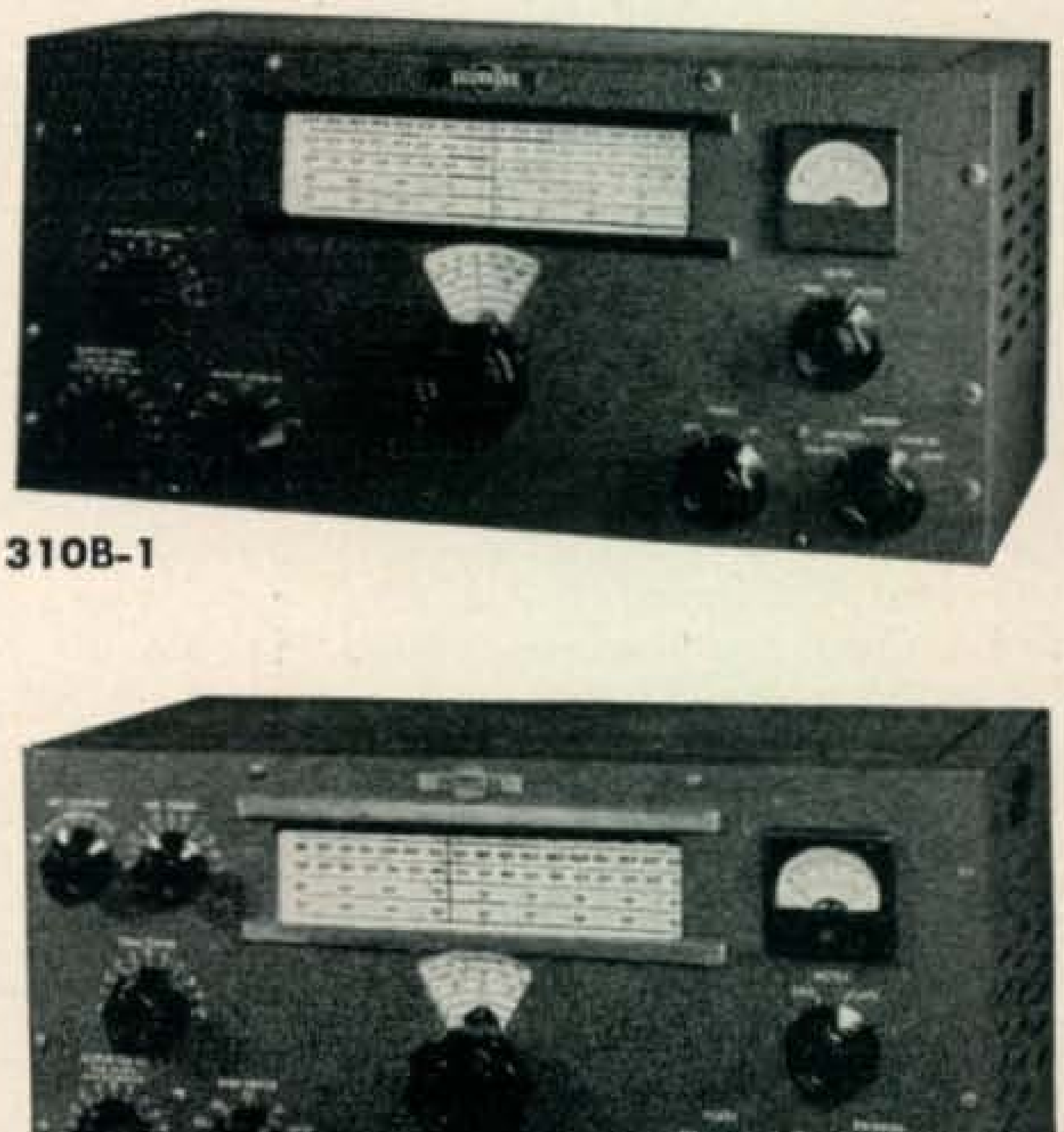
A month probably wouldn't seem as long as the next few interminable seconds must have to this unfortunate amateur. Happily (or otherwise we wouldn't have the story) the outcome was all right. The supply was lowered to the deck and the equipment, at least, was little the worse for wear. Some good may have come from the incident if our writing about it prevents the reoccurrence of this sort of thing. Working around high-voltage demands an uncompromising attitude toward safety rules. And the number one rule in your shack should be to *never* work around high voltage with *any* a.c. applied to the equipment. Don't get caught with your relays down!

—*W2IOP*

More contacts, more quickly, easily, with a . . . COLLINS PTO Exciter Unit

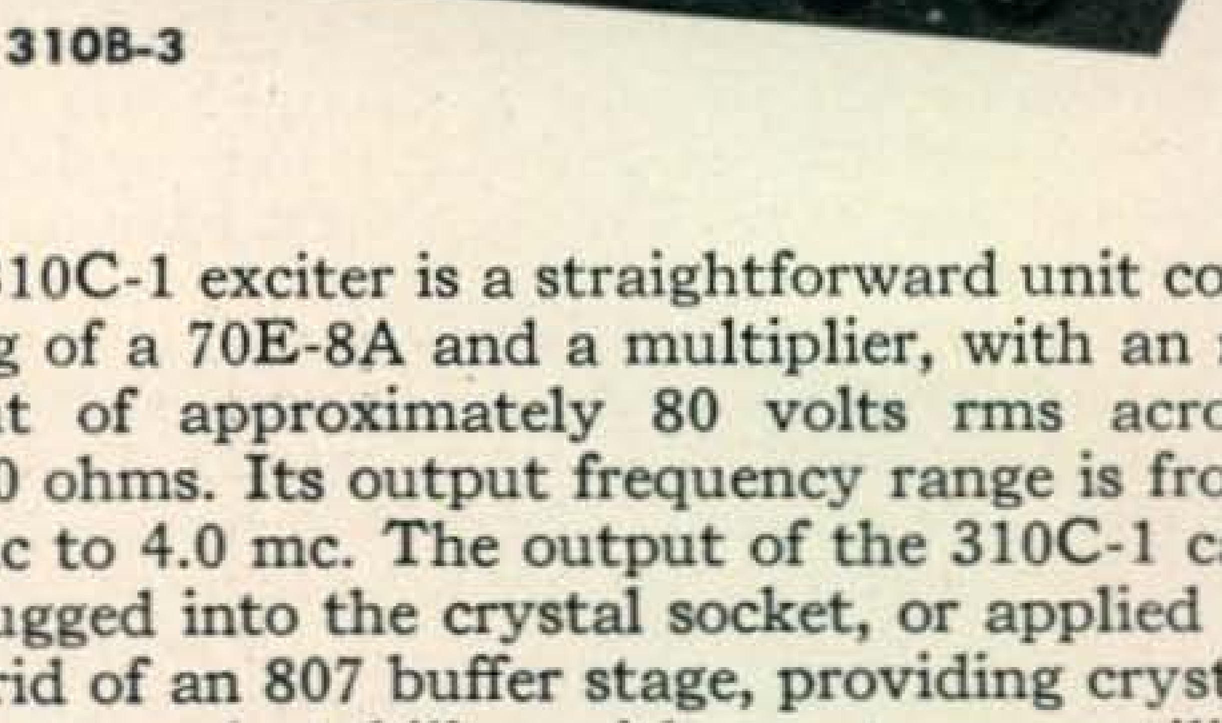
All these Collins exciters give you the flexibility of variable frequency, with the accuracy of calibration and remarkable stability inherent in the 70E-8A PTO around which they are engineered. The slide rule dials of both the 310B series and 310C series roughly indicate operating frequency, while their vernier dials read directly in kilocycles. See them at your Collins dealer's. If you don't know him write us for his name and address. And stop by our booth at the National ARRL Convention in Milwaukee, September 4, 5, and 6.

The 310B-1 is a versatile, bandswitching, self-powered unit with an input of 40 watts on all ham bands under 32 mc. Output coupling is by means of a link in the plate tank coil. The tube complement consists of 1—6SJ7 PTO, 3—6AG7 multipliers, 1—2E26 r-f amplifier, 1—6SL7GT sidetone oscillator, 1—5R4GY H. V. rectifier, 1—5Z4 L.V. rectifier, 1—6H6 bias rectifier, 1—VR105 voltage regulator, 1—VR150 voltage regulator. Price, $190.00.

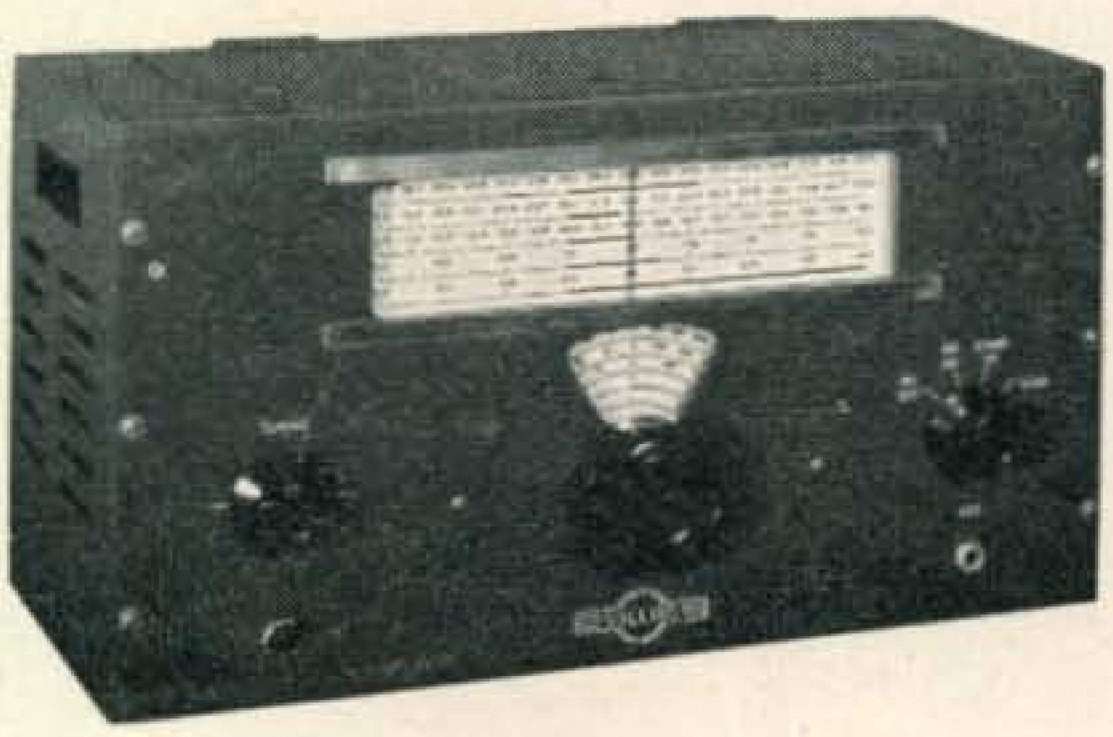


310B-1

The 310B-3 has a series-parallel tunable matching antenna network, of the universal type, which will match balanced or unbalanced antenna systems over a wide range of impedances. Otherwise it is identical with the 310B-1. It makes a fine standby transmitter, is excellent for spot frequency network and, because of its low power requirements, for emergency work. Also, it is unexcelled for the beginner. Later, when more power is called for, he has only to add the final amplifier stage. Price, $215.00.



310B-3



310C-1 and 310C-2

The 310C-1 exciter is a straightforward unit consisting of a 70E-8A and a multiplier, with an r-f output of approximately 80 volts rms across 40,000 ohms. Its output frequency range is from 3.2 mc to 4.0 mc. The output of the 310C-1 can be plugged into the crystal socket, or applied to the grid of an 807 buffer stage, providing crystal accuracy and stability with greater versatility than a large number of crystals would afford. Price, $85.00.

The 310C-2 is identical with the 310C-1, but with self-contained power supply. Price, $100.00.

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 West 42nd Street, New York 18, New York — **458 South Spring Street, Los Angeles 13, California**

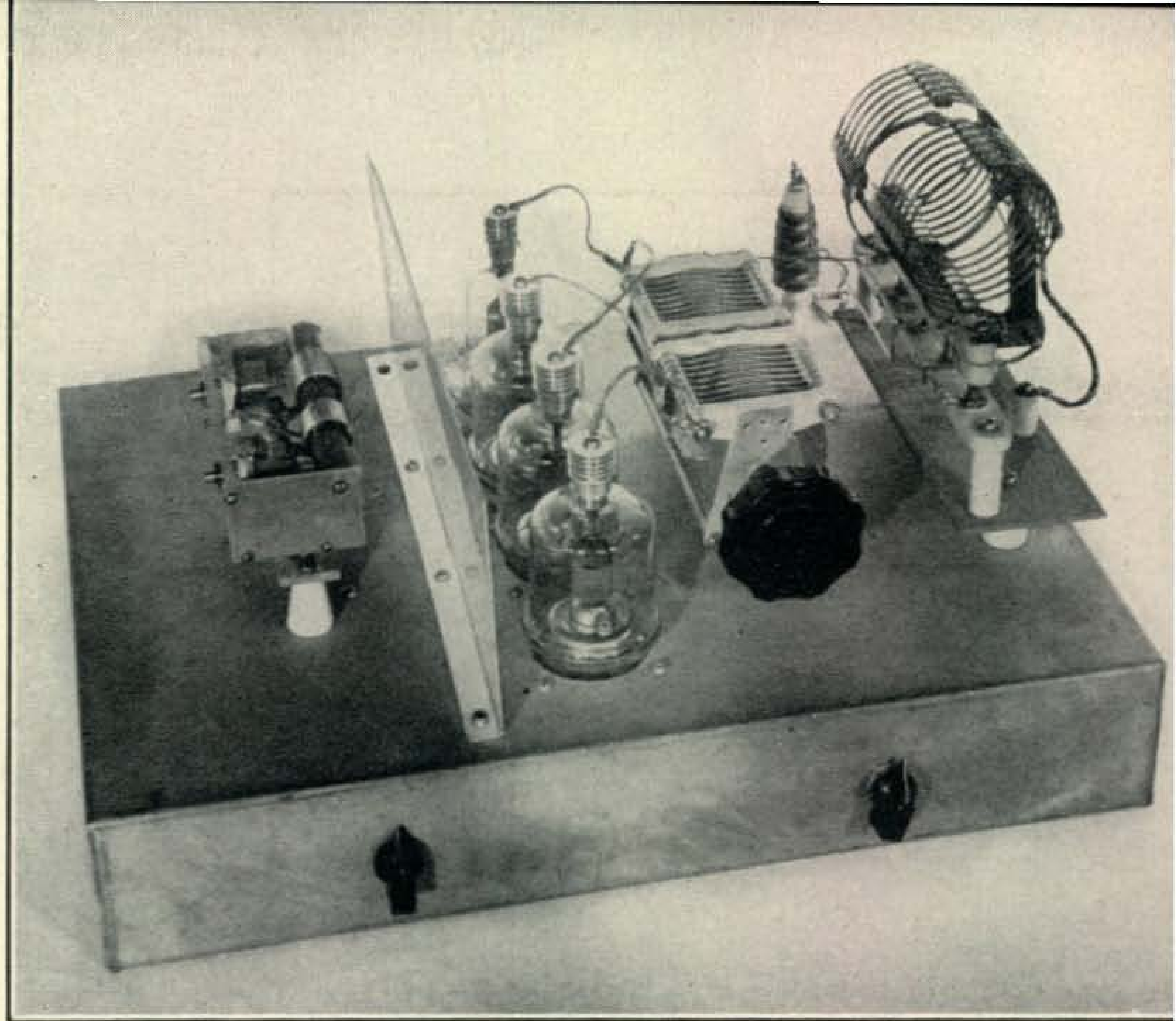


Fig. 1. The 200-watt single-sideband generator. Plug-in grid tank and phasing circuit at the left, plate circuit at the right. This photo, which was taken before the addition of a panel, does not show the insulated coupling and grounded shaft which should be used between the plate tuning capacitor and its knob in the interests of safety.

R. LEIGH NORTON, W6CEM*

One Sideband, One Stage, 200 Watts!

At last—a single sideband rig which can be duplicated by any amateur! Here is an SS transmitter which delivers the equivalent of 400 watts of AM at an average input of less than 250 watts.

ELSEWHERE in this issue will be found a discussion of the operating theory of a system for producing a single-sideband signal by what might be called "frequency addition," if the word "addition" can be used rather loosely. This article is a description of a practical 200-watt peak output single-sideband generator using that system, with as little of the basic theory as possible. Readers interested in the theory of operation are referred to the discussion starting on page 23.

Throughout this article the term "single sideband" and the abbreviation "SS" will be used to denote what is sometimes called "single-sideband-suppressed-carrier," as it seems somewhat pointless to drag the carrier into the picture unless there is actual need for it.

The new SS system requires two basic units: (1) an r-f amplifier containing four tubes connected in such a manner that the output developed in the load is progressively shifted 90 degrees in phase from tube to tube, and (2) a modulator delivering four outputs from the same audio signal which are also shifted 90 degrees from one output to the next, to modulate the four r-f tubes.

There is another way of looking at the progressive 90-degree r-f and audio phase shifts. Two 90-degree shifts in the same direction add up to 180 degrees, so one pair of r-f amplifiers can be connected to deliver output to the load 180 degrees apart, while the other pair does the same thing but is shifted 90 degrees in phase from the first pair. The same situation holds in regard to the modulation, which can consist of two 180-degree-out-of-phase audio outputs, with a 90-degree shift between them.

Requirement (1) above can be met in several ways. *Figure 2* shows one possibility. Here a pair of two-tube amplifiers are used with the grid circuit of each amplifier consisting of an ordinary split tank such as is used to drive push-pull tubes 180 degrees out of phase. Excitation is supplied to one grid circuit by a conventional link, while the second circuit receives excitation by inductive coupling from the first. Two circuits inductively coupled and tuned to the same frequency develop voltages 90 degrees apart in phase, so the required 90-degree phase shift between tubes is obtained. If the grid voltage on the upper tube in *Fig. 2* is assigned a reference phase of 0 degrees at some particular instant, the other three tubes are seen to have relative grid voltage phases of 180, 90 and 270 degrees. To add the outputs of the four tubes in a common output circuit, the four plates are merely tied together and connected to a single tank circuit.

The arrangement of *Fig. 3* accomplishes the same thing as *Fig. 2*, as far as the output is concerned, be-

* *Rt. 1, Box 231A, San Mateo, Calif.*

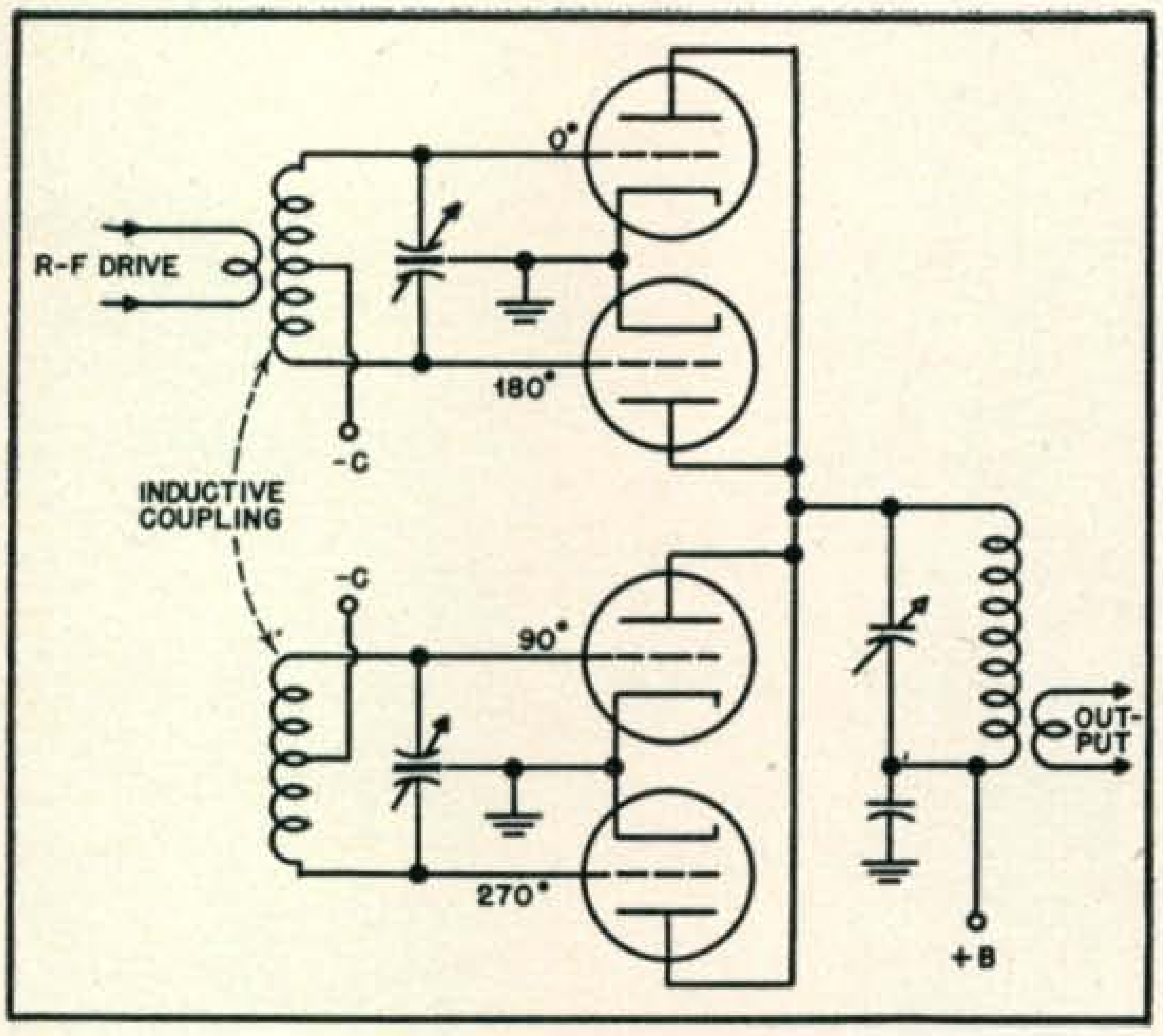


Fig. 2. One basic SS r-f circuit.

cause the tubes which are excited in parallel induce voltages 180 degrees out of phase in the load circuit, due to being connected to opposite ends of the plate tank circuit. An advantage of *Fig. 3* is that single-ended circuits are used in the portion of the unit where the 90-degree phase shift must be produced, and any simplification of the phase-shifting section tends to simplify the adjustment of the amplifier. The balanced plate circuit of *Fig. 3* is also somewhat easier to handle in a practical amplifier than the single-ended arrangement.

Requirement (2) is met by the use of the Dome phase-shift networks, which are described in the other SS article in this issue referred to above. If the networks are used ahead of a pair of modulators and each modulator has a center-tapped output transformer, the required two sets of 180-degree out-of-phase voltages shifted 90 degrees are obtained.

Modulation Methods

The amplifiers of *Figs. 2* and *3* will not deliver any output if they are used as shown. In either case, the phasing is such that the excitation-frequency is canceled in the output. If, however, the amplifiers are unbalanced by changing the outputs of the individual tubes in respect to each other, there will be a net output in the load circuit. If a fixed, or "static," unbalance is introduced, the r-f excitation frequency appears in the output. If a regularly varying unbalance is introduced by applying the four modulator voltages in such a way that each pair of tubes which is driven from the same grid circuit gets 180-degree-shifted modulation, with the 90-degree audio shift being between tubes connected to different grid circuits, the unbalance under modulation is such that a single sideband is produced. As there is no unbalance when there is no modulation, the excitation, or "carrier," frequency does not appear in the output. *Figure 4* shows in block form how the audio is applied to the r-f arrangement of *Fig. 3* to produce SS output.

Any of the conventional systems of modulation may be used with this scheme, the only requirement being that the modulated amplifiers are linear in at least one direction with respect to the modulation. Due to the fact that the audio phase shifting is best done at a relatively low level, a low-level modulation scheme is advantageous in that it allows a minimum number of audio stages after the phase shift has been obtained, and therefore lightens the burden of keeping the modulation in the proper phase. Either control-grid, screen-grid, or suppressor-grid modulation may be used, depending on the type of tubes used in the r-f section and the preferences of the constructor. Screen-grid modulation of tetrodes has certain advantages, and is used in the unit to be described.

Control-grid modulation has the disadvantage that the r-f impedance looking into the grid varies over the modulation cycle. When the phase and amplitude of the r-f grid voltage must be closely controlled, as it must in this type of SS generator, the grid r-f circuit must be heavily swamped by loading resistance to prevent changes in r-f phase and amplitude under modulation. If the modulation is applied to the screen-grid, the change in control-grid impedance under modulation has been found to be small enough so that no r-f grid circuit loading is necessary, with a resulting saving in driving power. Screen modulation requires somewhat more audio power than control-grid modulation, but the difference between the two in many practical cases is so small that the same modulator would be required for both types of modulation. For example, the transmitter to be described employs screen-modulation with 6L6Gs as modulators. If control-grid modulation were used, 6V6 modulators would probably be required, and there would be only a slight saving in modulator cost.

The SS generator has one important characteristic which makes the difference between low and high-level modulation much less than it is in a conventional AM transmitter. As the SS r-f stage is not required to supply a carrier which can be modulated up and down around an average value, the operating conditions can be selected so that the input is quite low until modulation is applied. If

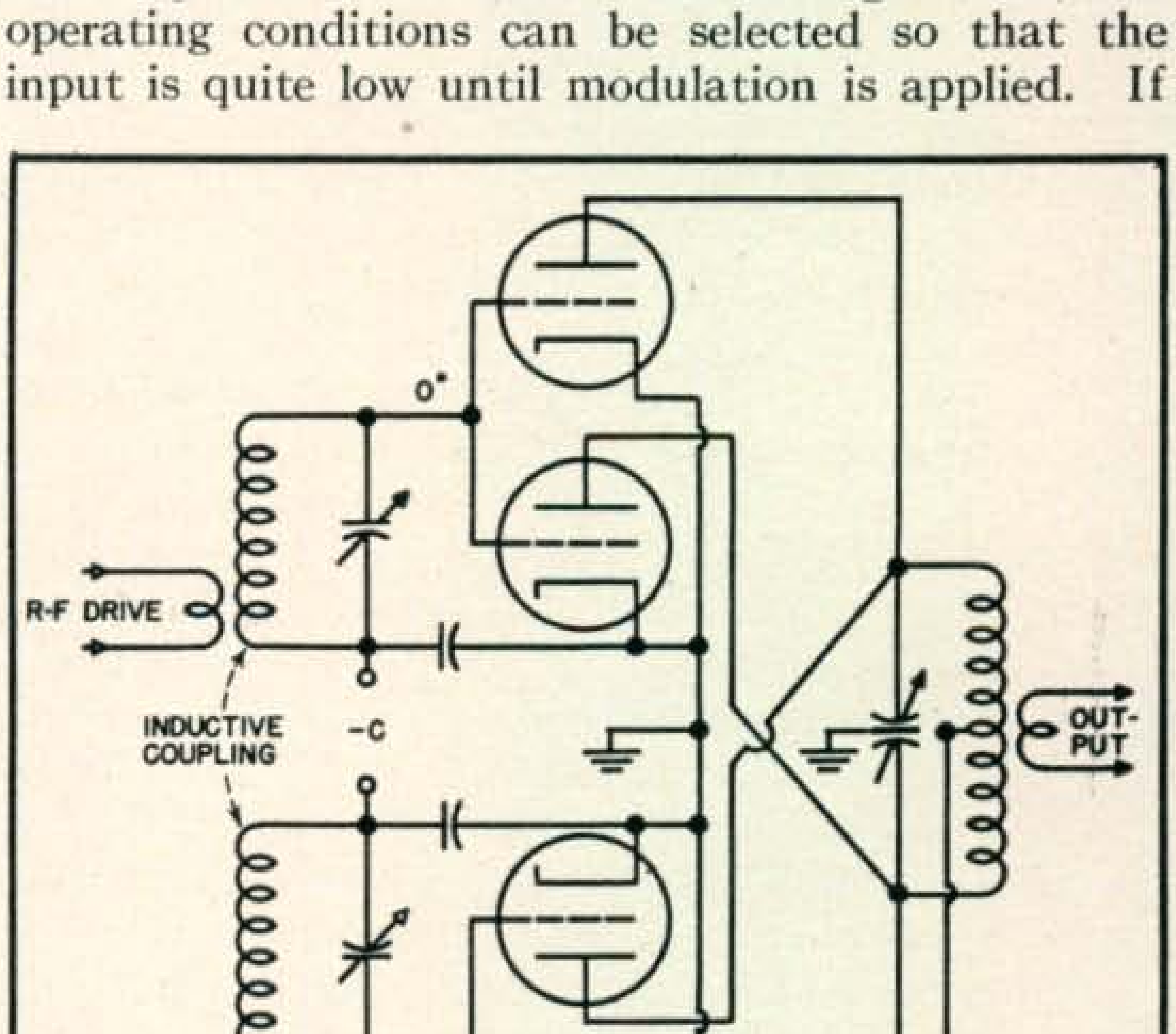


Fig. 3. Alternative basic r-f circuit.

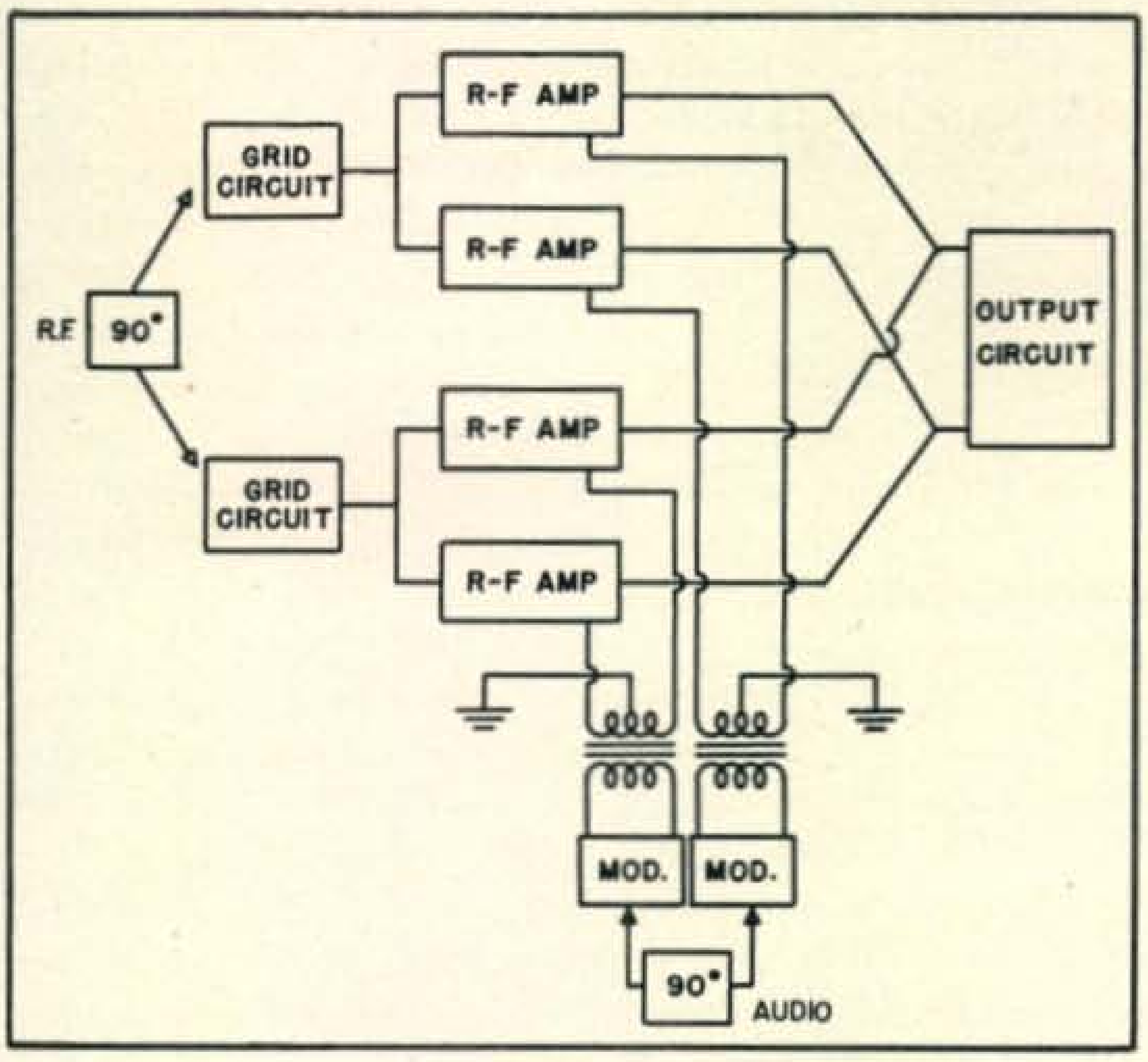


Fig. 4. Block diagram of complete SS generator.

low-level modulation is used, the plate voltage may be quite high, and the bias on the modulated electrode may be adjusted so that the input is very low when there is no modulation. The increase in plate dissipation under conversational voice modulation is so low as to be almost negligible.

The SS signal may be produced at any level. Generating SS at a relatively low level and amplifying it in one or more subsequent linear amplifiers has advantages in the form of economy, but also has the great disadvantage of requiring that the stages following the SS generator be truly linear, which is no small accomplishment if several stages are involved. The use of the SS generator as a final amplifier eliminates the linear-amplifier problem and lets one concentrate on securing linearity in the SS stage itself, but this is done at the expense of over-all efficiency. The r-f unit to be described here is intended to be used as a 100 to 200-watt (peak output) final amplifier stage, depending on the plate voltage used. At the lower power level, it may obviously be used to drive a high-power triode linear-amplifier stage, even after the necessary swamping of the triode grid circuit has been done. The modulator section is a basic unit which may be used to modulate nearly any SS r-f section, regardless of power level. By replacing the r-f tubes in the unit to be described with smaller ones, and using smaller plate-circuit components, an SS generator capable of serving as a low-level exciter may be had.

The Equipment

The SS generator consists of two units, an r-f chassis and an audio chassis. The r-f chassis contains the four tubes and their grid and plate-tank circuits, including the grid-circuit phase shifter. It is intended to be driven by an r-f exciter capable of delivering about 10 watts. The audio chassis contains the complete audio system from microphone input to modulator output and includes the necessary power supply for the audio as well as a screen-bias source for the r-f section. *Figures 1, 5, 8* and *9* show top and bottom views of the two units. It is easily seen that the r-f section is little more complicated than an ordinary push-pull r-f stage, except for the addition of another pair of tubes and another grid tank circuit. The modulator is likewise not much more pretentious than the audio driving equipment needed for a medium-power modulator, except for the addition of a second output transformer.

R-F Section

Figure 6 is a circuit diagram of the r-f section. The upper pair of tubes receives excitation in parallel from tank circuit L_1-C_1 through blocking capacitor C_3. The lower pair of tubes gets excitation from tank circuit L_2-C_2 through C_4. Grid bias voltage is shunt fed to each pair of tubes through RFC_1 and RFC_2 to allow the measurement of grid current to each pair separately across metering resistors R_3 and R_2. Bias voltage is furnished by grid leak, R_1.

Rather than couple the excitation directly to L_1, as suggested in *Fig. 3*, a small mutual inductance, L_3, is used. L_3 is connected between the bottom end of L_1 and ground, and the incoming coaxial line is connected across L_3. The purpose of this method of connection is to reduce the direct inductive coupling from L_2 to the excitation, which might occur if an ordinary link were used around L_1. L_3 is mounted at right angles to L_1 and L_2. The whole grid circuit consisting of L_1, L_2, L_3, C_1 and C_2 is arranged to plug in as a unit, to allow band changing. Details of the grid-circuit construction will be given later. A dual capacitor, C_7, is provided for retuning both grid circuits simultaneously, if necessary, when changing frequency within a band.

The screen grid of each tube is brought out to a separate terminal, to allow modulation to be applied in the necessary manner. The upper pair of tubes is

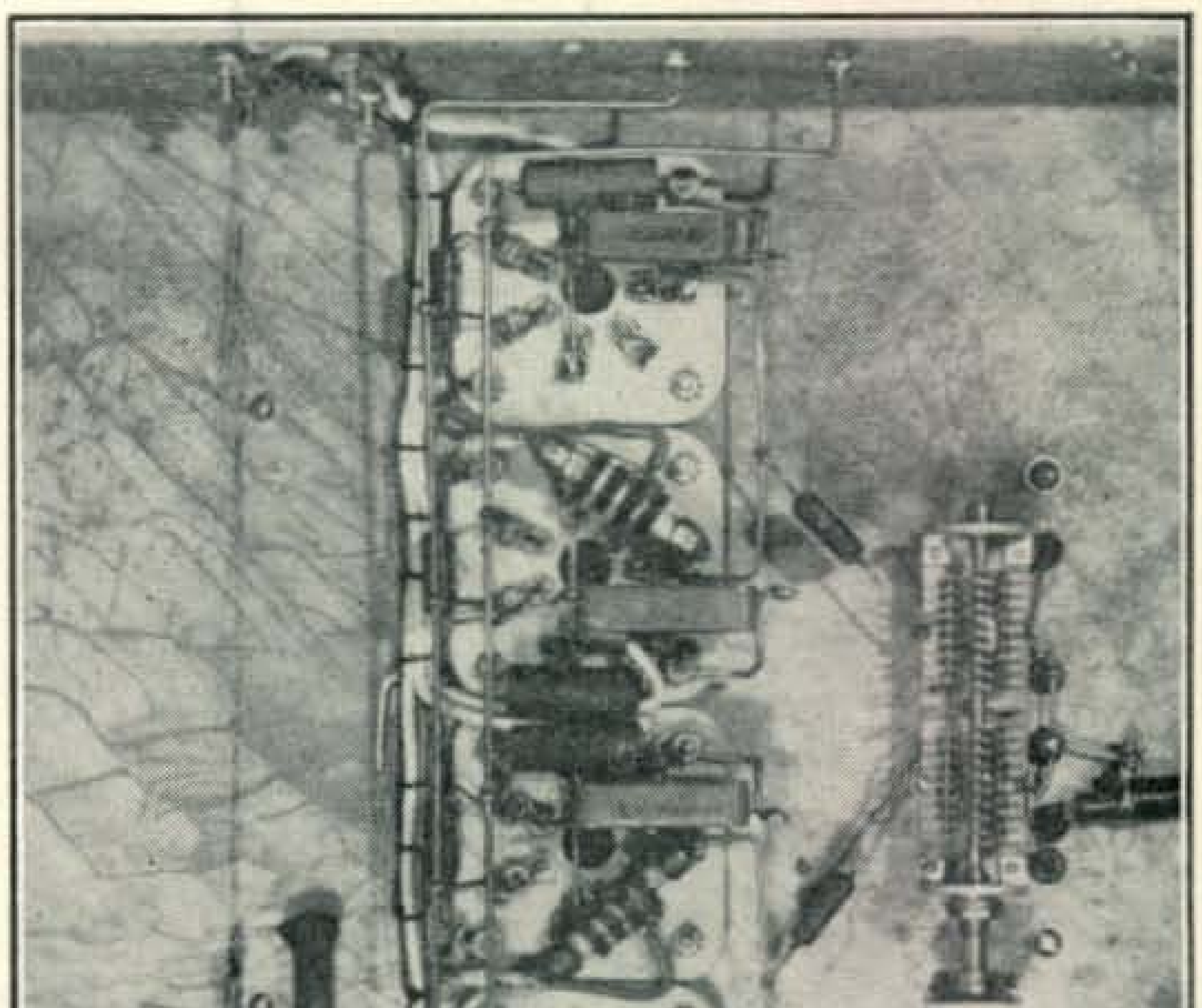


Fig. 5. Bottom view of the r-f section of the single-sideband generator. In this view, the grid-trimming capacitor appears at the right and the grid-current switch at the left.

modulated in push-pull fashion from one voltage source, while the lower pair gets the same type of treatment, but their modulation is shifted 90 degrees from the upper pair. The phase shifting is done in the modulator. Capacitors C_8 through C_{11} are the usual screen by-pass capacitors. These four capacitors must be reasonably close to the same value, so that each will have the same effect on the modulation amplitude and phase. Ordinary commercial-tolerance capacitors have been found adequate. Resistors R_5 through R_7 are included in the screen leads to prevent parasitic oscillation in grid-screen circuit due to the intermingling of grid and screen wiring below the chassis. The resistors are placed on the "far" sides of the screen by-pass capacitors, and not between the capacitors and the screens. Although the resistors are shown as 5-watt, non-inductive, wire-wound units in the diagram, ordinary 2-watt carbon "sticks" would serve as well. The non-inductive wire-wound resistors are some which happened to be on hand when the amplifier was built.

The plate circuit is strictly conventional, except for the unusual way of connecting the tubes to the tank circuit. To reduce the possibility of flashover, d.c. is fed to the rotor of C_{13} through R_8. The use of an insulated coupling and a grounded shaft for the knob which operates C_{13} is strongly recommended, although it is not shown in the photo, which was taken before the addition of a metal panel. The plate coils are of the conventional push-pull type fitted with a swinging link.

Modulator Circuit

The modulator circuit is shown in *Fig. 7*, and is intended to be used with a crystal or high-impedance dynamic microphone. Because the phase shift network is effective only over a range of about 150 to 3500 cycles, special attention has been given to limiting the audio pass band. For voice work, audio pass-band trimming is good practice in any case, but it is doubly important in this type of SS equipment. When the phase shift between the modulator output voltages departs appreciably from 90 degrees, as it does at the extremes of the audio range, the suppressed sideband begins to appear in the r-f output. This effect is probably not too important as concerns the lower audio frequencies, except for the increase in distortion it causes with slight mistuning at the receiving end. The appearance of the unwanted sideband at high audio frequencies causes interference far on the

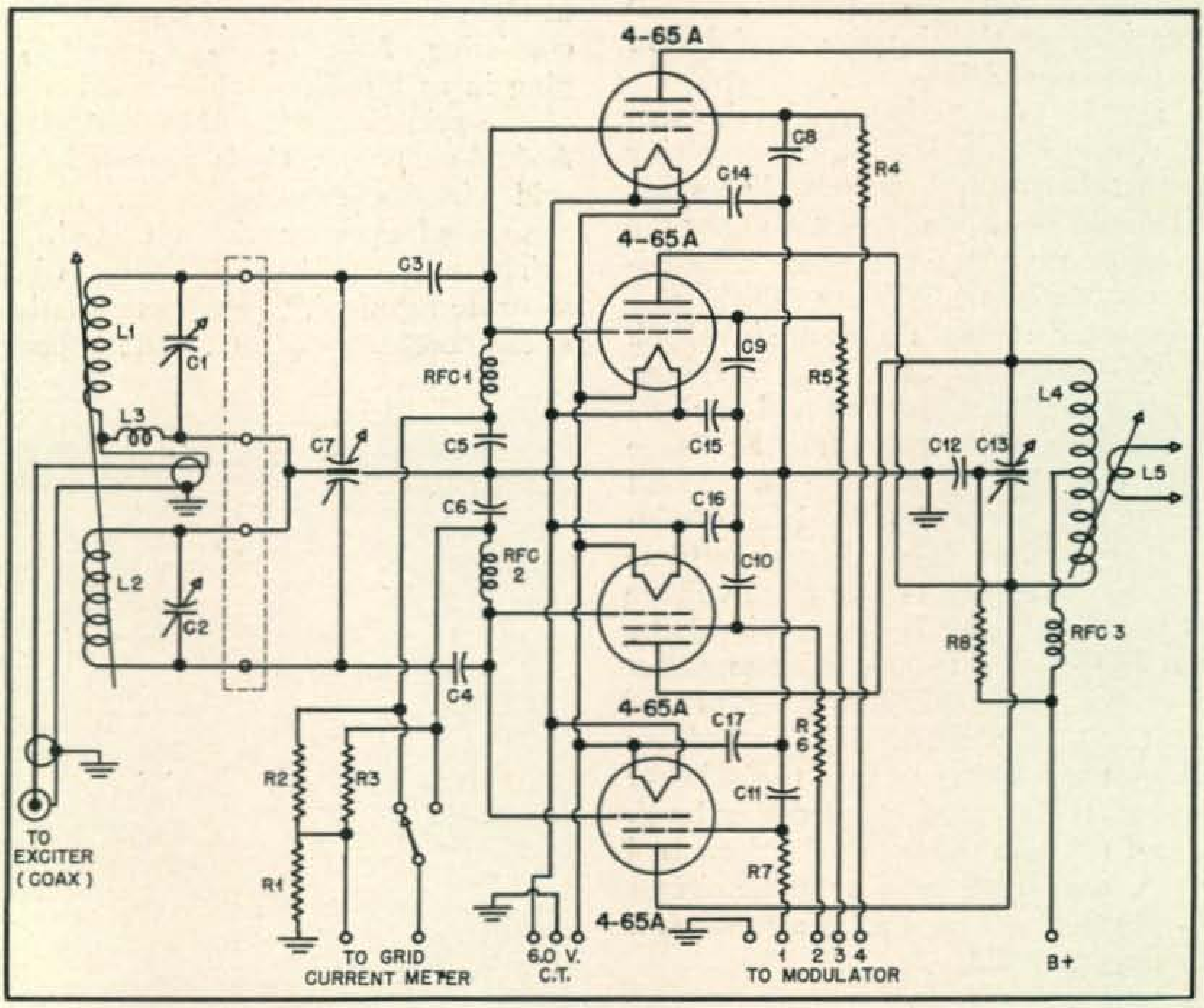


Fig. 6. Circuit diagram of the r-f section. Meter switch is S1.

C1, C2—14-mc: 50-μμf midget variable. 3.9 mc: 75-μμf midget variable.
C3, C4, C5, C6—.002 μf, 500 volts, mica.
C7—30 μμf per section midget variable, double spaced.
C8, C9, C10, C11—.002 μf, 1250 volts, mica.
C12—.002 μf, 5000 volts mica.
C13—100 μμf per section, .077" spacing.
C14, C15, C16, C17—.002 μf, 500 volts, mica.
R1—10,000 ohms, 10 w.
R2, R3—100 ohms, 1 w.
R4, R5, R6, R7—100 ohms, 5 w., non-inductive.
R8—50,000 ohms, 2 w.
RFC1, RFC2—2.5 mh, 125 ma.
RFC3—5 mh, 500 ma.
S1—SPST.
L1—14 mc: 11 turns, 16 t.p.i., 3/4" dia., B & W No. 3011. 3.9 mc: 30 turns, 32 t.p.i., 1" dia., B & W No. 3016.
L2—14 mc: 14 turns, 16 t.p.i. 3/4" dia., B & W No. 3011, 3.9 mc: 32 turns, 32 t.p.i., 1" dia., B & W No. 3016.
L3—14 mc: 2 turns, 16 t.p.i. 1/2" dia., B & W No. 3003. 3.9 mc: 6 turns, 16 t.p.i., 1/2" dia., B & W No. 3003.
L4—"500-watt" coils with swinging center link. B & W TVL series.

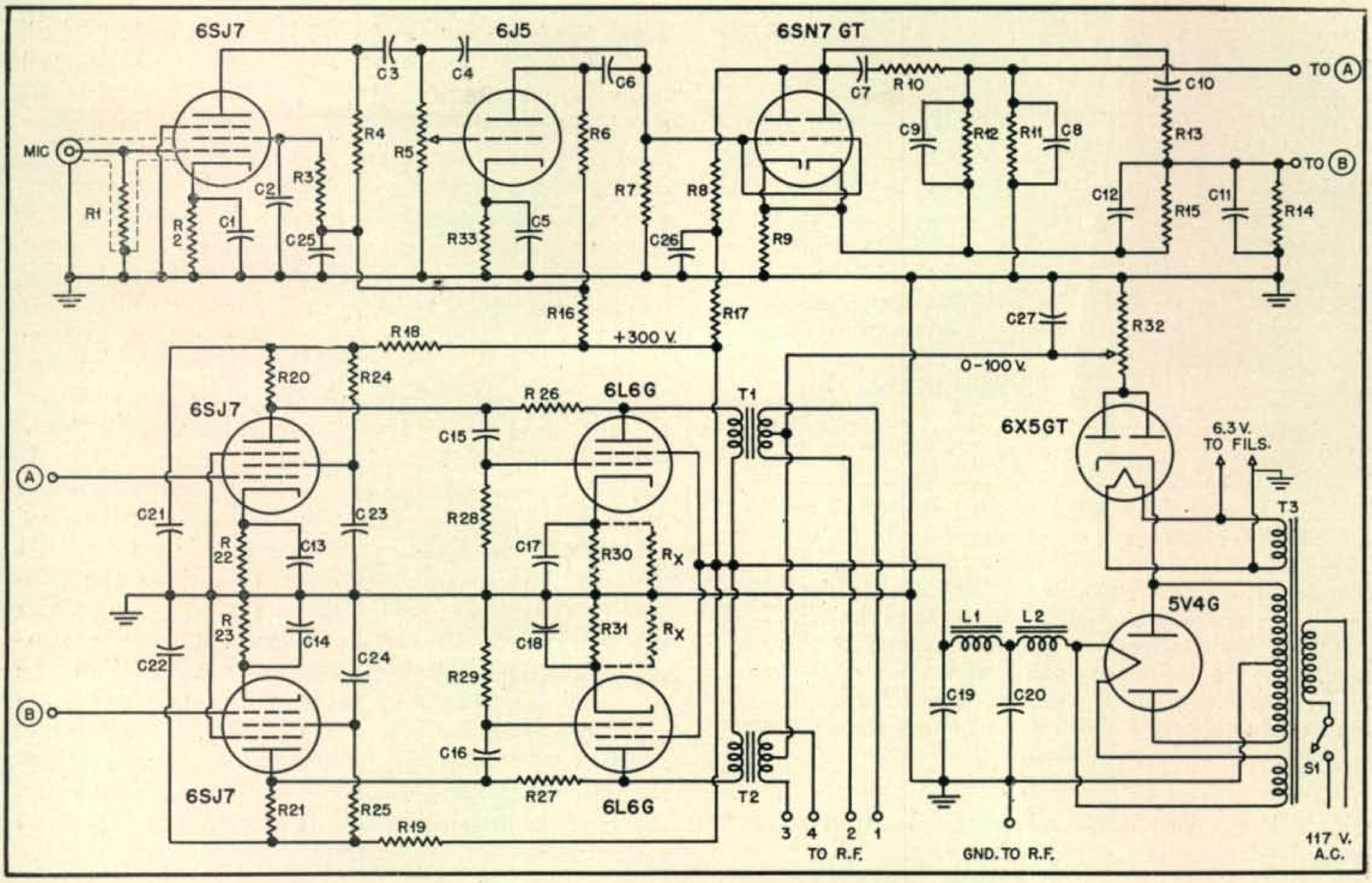


Fig. 7. Circuit diagram of the modulator.

C1, C5, C13, C14, C17, C18—10 μf, 25 volts, electrolytic.
C2—.04 μf, 600 volts.
C3—.002 μf, 600 volts.
C4—40 $\mu\mu$f, mica.
C6—.004 μf, 600 volts.
C7—.003 μf, mica.
C8, C12—.001 μf, mica.
C9—.0005 μf, mica.
C10—.006 μf, mica.
C11—.002 μf, mica.
C15, C16—.005 μf, 600 volts.
C19—16 μf, 450 volts, electrolytic.
C20—8 μf, 600 volts, electrolytic.
C21, C22, C25, C26—Dual 8 μf, 450 volts, electrolytic.
C23, C24—.10 μf, 600 volts.
C27—50 μf, 150 volts, electrolytic.
R1—1 megohm.
R2, R22, R23, R33—1500 ohms.
R3—2 megohms.
R4, R20, R21, R24, R25, R26, R27—500,000 ohms.
R5—500,000-ohm potentiometer.
R6, R18, R19—40,000 ohms, 1 w.
R7, R28, R29—250,000 ohms.
R8, R9—2000 ohms, 1 w.
R10—33,000 ohms.
R11—100,000 ohms.
R12—200,000 ohms.
R13—75,000 ohms.
R14—225,000 ohms.
R15—450,000 ohms.
R16—25,000 ohms, 1 w.
R17—5000 ohms, 1 w.
R30, R31—200 ohms, 10 w.
R32—25,000 ohms, 50 w.
Rx—See text.

All resistors are one-half watt unless otherwise specified.

T1, T2—15-watt universal modulation transformers. Thordarson T21M60.
T3—750 v., c.t., 200 ma.; 5 v., 3 a.; 6.4 v., 4 a.
L1, L2—5 hy, 200 ma.
S1—SPST.
MC—Microphone connector.

wrong side of the non-existent "carrier" frequency. The interference produced is no worse than that regularly produced by ordinary AM, of course, but SS is supposed to be an improvement over AM.

The audio-band trimming takes place in the first two stages of the speech amplifier. Through the use of an under-size screen by-pass capacitor at C_2 and small coupling capacitors at C_3 and C_6, a low-frequency droop starting at about 400 cycles is obtained. To pare down the high frequencies, capacitor C_4 is used to introduce degenerative feedback which increases with frequency. The response starts to drop at about 2000 cycles and is well down at 4000 cycles. This simple method of trimming both ends of the voice spectrum does not produce the flat band-pass characteristic of the more elegant multi-section *L-C* filter, but it listens well, is economical and serves the purpose quite nicely.

The two phase-shift networks which follow the 6SN7 phase inverter are the heart of the modulator section. One network contains C_7-R_{10}, C_8-R_{11}, and C_9-R_{12}. The other consists of C_{10}-R_{13}, C_{11}-R_{14}, and C_{12}-R_{15}. These networks each have a phase shift which varies with the frequency applied, but they are designed so that the difference in phase between the points marked "To A" and "To B" is close to 90 degrees over the whole voice-frequency range. To work properly, the networks must be driven from a source which is low in impedance compared with the network impedances, and for this reason the two halves of the 6SN7GT are connected in parallel and operated with 2000-ohm cathode and plate loads. A 6J5 would probably work equally well, but the output would be reduced. The cathode and plate resistors, R_8 and R_9, need not have a value of exactly 2000 ohms but they must be matched

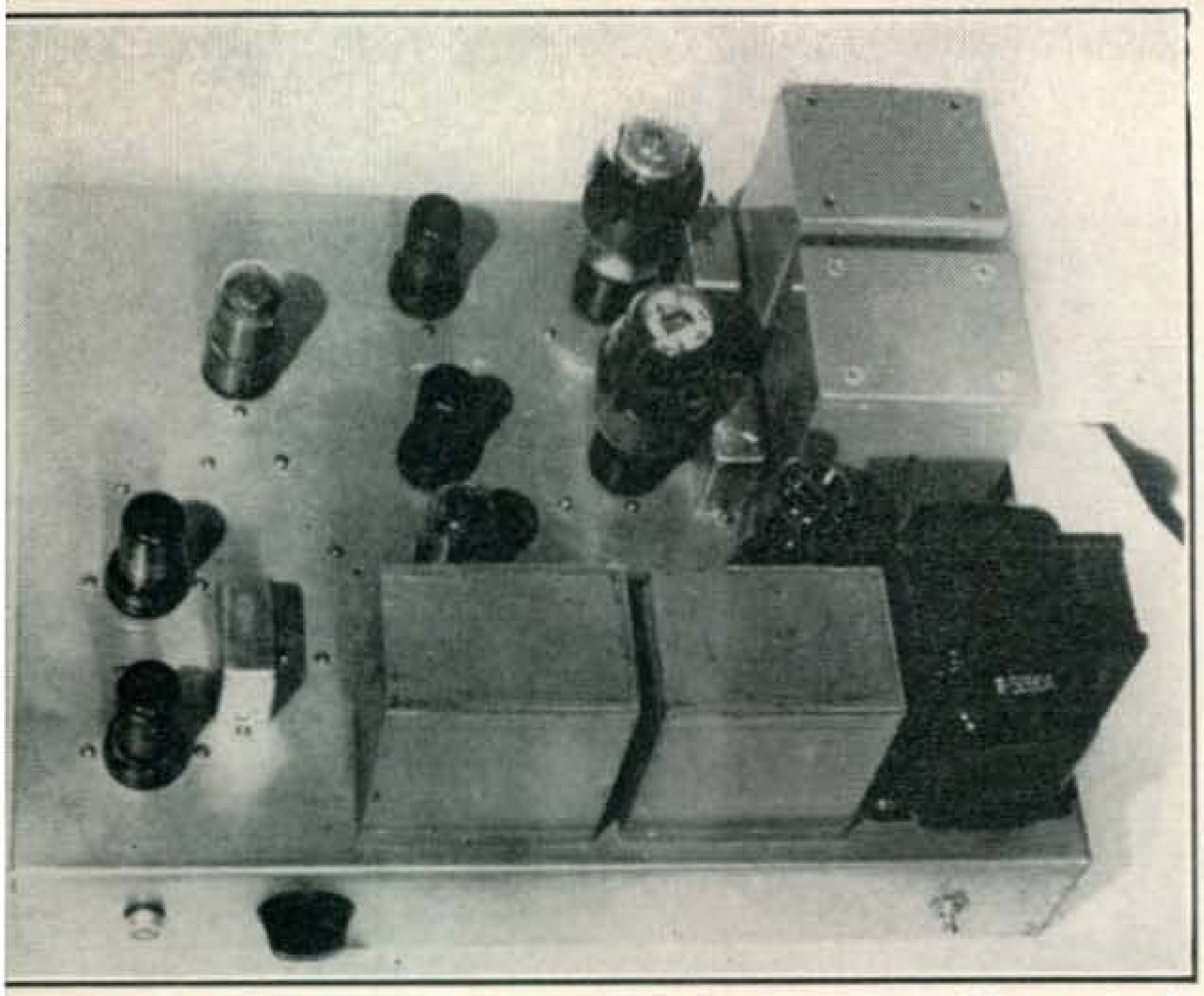


Fig. 8. Top of the audio chassis. The 6SJ7 and 6J5 pre-amplifier stages are at the left front with the 6SN7GT phase-inverter stage near the left-rear corner. The two 6SJ7-6L6G "A" and "B" channel amplifiers are side by side to the right of the 6SN7GT, followed by the two output transformers at the right rear. The power-supply components are at the right-front, with the 6X5GT screen-bias rectifier behind the left-hand choke and the 5V4G behind the right-hand choke.

within 1 or 2 per cent, to assure equal output voltages from both sides of the phase inverter.

Judging from information published to date, most phase-shift networks of the type used here are designed to employ round-number resistances and odd values of capacitance which can only be obtained by the series or parallel arrangement of standard capacitors or the use of trimmers. The networks for this modulator have been designed around standard capacitors, and the resistors have been allowed to fall where they may, the theory being that it is easier to locate odd sizes of resistors or make them up from combinations of standard units than it is to get the odd capacitance values. By shifting the frequency band upward slightly from that originally given by Dome, the resistor values have for the most part also been given easily obtainable values. Rather close tolerances are required for both the capacitors and resistors, and unless an accurate capacitance bridge is used to select capacitors within 5 per cent or better of the specified values, it is recommended that standard 5-per-cent-tolerance silver-mica capacitors be used. Closer tolerances are desirable, if available, however. Surplus capacitors of any type are to be viewed with suspicion in regard to tolerances until proven innocent, as some of them appear to be rejects which fell outside specification limits. It is not unusual to find surplus capacitors having an actual capacitance differing from the marked value by as much as 50 per cent. The resistors may be selected from the stock of a friendly parts jobber with the aid of a resistance bridge or an ohmmeter of good accuracy. The ohmmeter may be checked for accuracy against precision resistors around the points where resistance is to be measured. The resistors should, like the capacitors, be within 5 per cent or better of the specified values. The resistance values required are 33K, 100K, 200K, 75K, 225K and 450K. Only the last two of these resistors are "odd" values not normally stocked. A 30K resistor having a value of 33K is not difficult to find, and the 225K and 450K may usually be selected from 200K or 250K and 400K or 500K stocks without too much difficulty. At least one manufacturer is offering resistor "pairs" which achieve high accuracy through the use of two wide-tolerance resistors, and the use of these pairs or combinations of them offers one fairly simple solution to the resistor problem. It appears likely that some enterprising capacitor and/or resistor manufacturer will offer complete phase-shift-network components in the future.

The "A" and "B" outputs from the phase shifter are amplified in two separate channels. Each channel contains a 6SJ7 and a 6L6G with parallel feedback from the plate of the 6L6G to the plate of the 6SJ7, to reduce the effective output impedance of the 6L6s. These two sections are designed for good wide-band frequency response, to reduce the possibility of different phase shifts taking place within the sections. Ordinary commercial-tolerance components have been found entirely suitable in the two sections, and the outputs easily retain the phase difference established at the inputs. To prevent audio from one portion of the modulator from finding its way into another via the power supply, rather complete plate-circuit decoupling has been used throughout the unit.

To compensate for slight differences in the amplitude of the two outputs, due to differences in tube characteristics or differences in the output of the phase-shift networks, resistor R_x has been used to equalize the two outputs. It should be applied to the section having the lower output. In the modulator shown here, R_x was 1000 ohms, and was used in the "B" channel. A better system would be to adjust the two outputs to equality by juggling the sizes of the feedback resistances, R_{26} and R_{27}, reducing the resistance in the channel having the higher gain.

Screen modulation has a number of advantages, as previously pointed out, but it also has the rather annoying disadvantage that high modulating voltage at low audio power is required. Put another way, the audio impedance looking into the screen is quite high. This makes it impossible to use some sort of standard modulator "driver" transformers as modulation transformers, and it was therefore necessary to use a pair of 15-watt Class-B modulation transformers. To allow experimentation with the modulator unit, tapped transformers capable of handling a variety of impedance ratios were used, but the tapped feature is not a requirement if the modulator is intended for only a single application. The normal center-tapped "primary" of each transformer is connected to the screen-grids of the r-f tubes, and the 6L6Gs are connected to the "secondary." The transformers are connected to give a turns ratio of 1:2.5 from the 6L6G end to the screens, or an impedance ratio of 1:6.25, and a maximum allowable impedance of 20,000 ohms on the screen side. A somewhat higher ratio would be desirable, but was not found possible with the particular transformers used without running into poor frequency response. This is a result of an excessive load impedance on the screen-grid side, and is not a fault of the transformers.

The modulator power supply is conventional, with the exception of a 6X5GT connected to deliver a negative voltage which is needed for screen bias on the 4-65As in the r-f section when plate voltages of 2000 or more are used.

Mechanical Layout

The arrangement of parts on the two chassis presents no particular problems. Both chassis measure 17″ by 13″ by 3″. The audio circuits are arranged with the first stage near the left-front corner of the chassis, with the stage progression being down the left side of the chassis, through the phase-shift network near the left-rear corner, with the "A" and "B" channels side by side across the back. The two output transformers are at the right-rear, with the power supply components occupying the right-front corner and center of the chassis.

Because of their method of connection, the r-f tubes act as neutralizing capacitors for each other. This makes it possible to place the grid circuit above the chassis with only a simple shield separating it from the plates of the tubes and the plate tank circuit. Because of the self-neutralizing feature, the net grid-plate capacitance in the amplifier is probably no higher than would be obtained in a conventional un-neutralized push-pull tetrode stage with the tank circuits on opposite sides of the chassis. By placing the plug-in grid circuit above the chassis, band changing is greatly simplified. The grid and plate tank circuits are located at the left and right ends of the chassis, with a 13″ by 5″ shield placed between the grid circuit and the four tubes, which are located in a line near the center of the chassis. The grid trimming capacitor, C_7, is located under the chassis near the grid circuit, and the grid-metering switch occupies a corresponding position at the right side of the chassis. Other details of the under-chassis wiring are visible in *Fig. 5*.

R-F Phase Shifter

The proper operation of the r-f section requires that two equal, 90-degree-phased voltages be obtained. This is accomplished by the two inductively-coupled circuits consisting of L_1-C_1, L_2-C_2 and L_3, as previously mentioned. To allow easy band change, this whole assembly has been arranged to plug-in. *Figure 10* shows the 14-mc grid circuit. It consists of a 2¼″ by 5″ by 3/16″ polystyrene (Lucite will do as well) base plate carrying the 5 banana jacks needed to make the connections. The baseplate is surmounted by a miniature panel of the same material 1-5/16″ high and 5″ long. At the ends of the L-shaped structure thus formed are two 1½″ by 2¼″ aluminum end plates which support a 5/8″ diameter bakelite rod, which in turn carries L_1 and L_2 (poly or Lucite would also serve for the rod). The panel supports C_1 and C_2, while L_3 is tucked down alongside L_1 and supported by its own leads.

For the 14-mc assembly, a B & W type 3011 Miniductor is used for L_1 and L_2, and type 3003 for L_3. L_1 and L_2 fit loosely on the rod, and are held in position by their leads. Sufficient lead length is looped under the coils to allow them to be slid back and forth about an inch. In *Fig. 10* the coils are shown in approximately the proper position for equal excitation to both pairs of tubes.

The 3.9-mc assembly is quite similar to the 14-mc one, except that the base plate is 2¾″ deep, the panel section 1-13/16″ high, and the end plates are 2″ high by 2¾″ deep. The rod is 7/8″ in diameter. The larger dimensions on the 3.9-mc unit are necessary to accommodate the larger coils and capacitors.

Tuning Up

To cover all the things which could possibly occur in tuning up a transmitter of this sort would take more space than is available here. The future will probably bring a number of articles on tuning procedures and correction of various possible faults. For the present, it will be assumed that nothing beyond the ordinary difficulties usually encountered in any new equipment will be found in the more-or-less conventional portions of the r-f and audio sections.

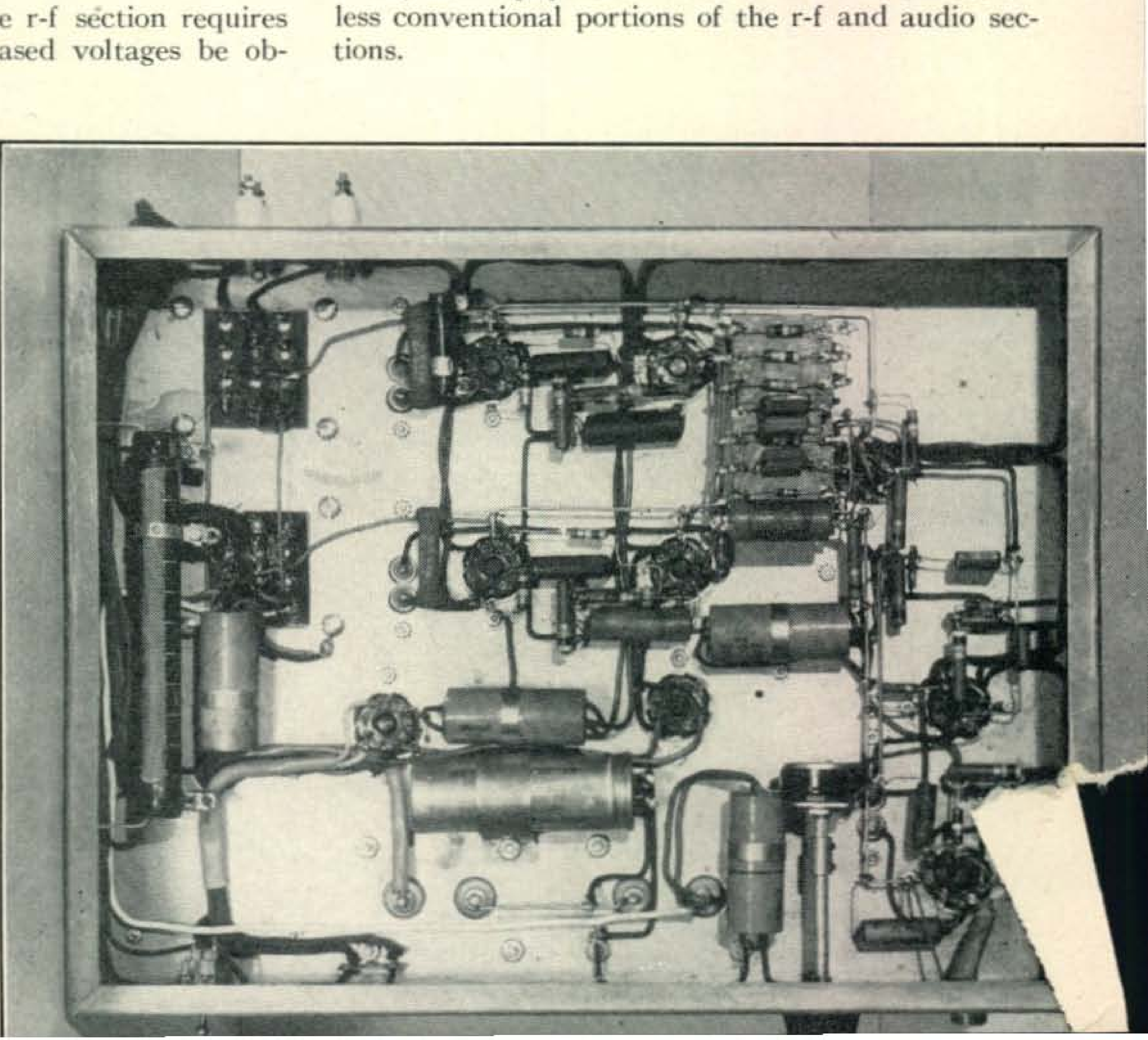


Fig. 9. Bottom view of the audio section. The low-level audio stages appear at the lower left in this view, and the "A" and "B" channels are at the top center. The two networks which deliver voltages 90 degrees apart are located on the card at the upper right.

To tune up the transmitter, a good variable-frequency audio oscillator, an oscilloscope, and a dummy load of some sort will be needed. The audio oscillator should preferably be accurately calibrated near the 350 and 1600-cycle points. Light bulbs will serve for the dummy load, although their rapid change in resistance at low brilliance may lead to confusion at the lower modulation levels, where the output is low. In addition, the usual r-f exciter, a plate supply for the r-f stage, and grid and plate d-c meters will be required.

The modulator section should be tackled first. Connect 10,000- or 20,000-ohm 10-watt resistors across the output of each modulator section and apply the a.c. to the power supply. Check voltages throughout the unit to make certain that they appear reasonable, and correct any obvious errors. Connect the audio oscillator to the microphone terminals and use the oscilloscope to observe voltages throughout the unit. Audio voltage should appear at each grid and plate, and at the cathode of the 6SN7GT. The audio voltage at the 6L6G grids should be roughly of the same amplitude as that at the 6J5 plate. When making this preliminary check, the output of the audio oscillator should be reduced to a point where it does not drive the grid of the first stage positive. Some audio oscillators use a output-level control which is in the grid circuit of their last stage, and produce a rather high percentage of hum output when set to deliver low audio output. If this condition is encountered, it will be necessary to use an external potentiometer, so that the oscillator output can be high enough to reduce the hum to a small portion of the total output. If all appears well at this point, the next step is to check the operation of the phase-shift networks. First, however, feedback resistors R_{26} and R_{27} should be disconnected at one end.

Checking the Scope

Before checking the networks, it is necessary to investigate the oscilloscope for internal phase shifts. To do this, the sweep should be removed, and the horizontal amplifier set to accept external signals. The vertical and horizontal inputs should be strapped together and connected to the grid of one of the 6L6Gs. The audio oscillator should then be run through the range from 150 to 4000 cycles while observing the pattern on the screen with various settings of the horizontal and vertical scope gain controls. A diagonal line on the screen indicates no internal phase shift. Internal phase shift will be indicated by the presence of an elliptical pattern at some frequencies. If an ellipse appears, it may be possible to eliminate it by juggling with the settings of the horizontal and vertical gain controls. The object is to maintain a straight line at an angle of 45 degrees over the whole audio range. This indicates equal vertical and horizontal sensitivity and zero relative phase shift. To check the sensitivities of the two inputs, it is probably easiest to apply the input separately to the vertical and horizontal amplifiers, one at a time, and measure each deflection, rather than attempt to determine whether the angle is actually 45 degrees. If the 'scope is of average quality, it should furnish the required results. If it is not possible to get equal deflection sensitivities when the two gain controls are set for zero phase shift, the 'scope will be usable, but the accuracy of the tests will suffer.

Interpreting the Pattern

Assuming that the 'scope is of average quality, and that it is possible to secure equal vertical and horizontal sensitivities and zero phase shift by appropriate settings of the gain controls, connecting the two 'scope inputs directly to the 6L6G grids (after removing the two 250,000-ohm resistors) should give a circle on the screen, if the oscillator is between 180 and 3200 cycles. The circle will appear very slightly elliptical and tilt slightly as the frequency is varied over this range, but no pronounced tendency toward an ellipse should be obtained until the frequency reaches 150 or 3500 cycles. The pattern should become smaller in size toward both ends of the range, indicating that the audio band-pass arrangement is working. If the 'scope had to be set with unequal horizontal and vertical deflections to eliminate internal phase shift, an ellipse should be obtained instead of a circle. The axes of the ellipse

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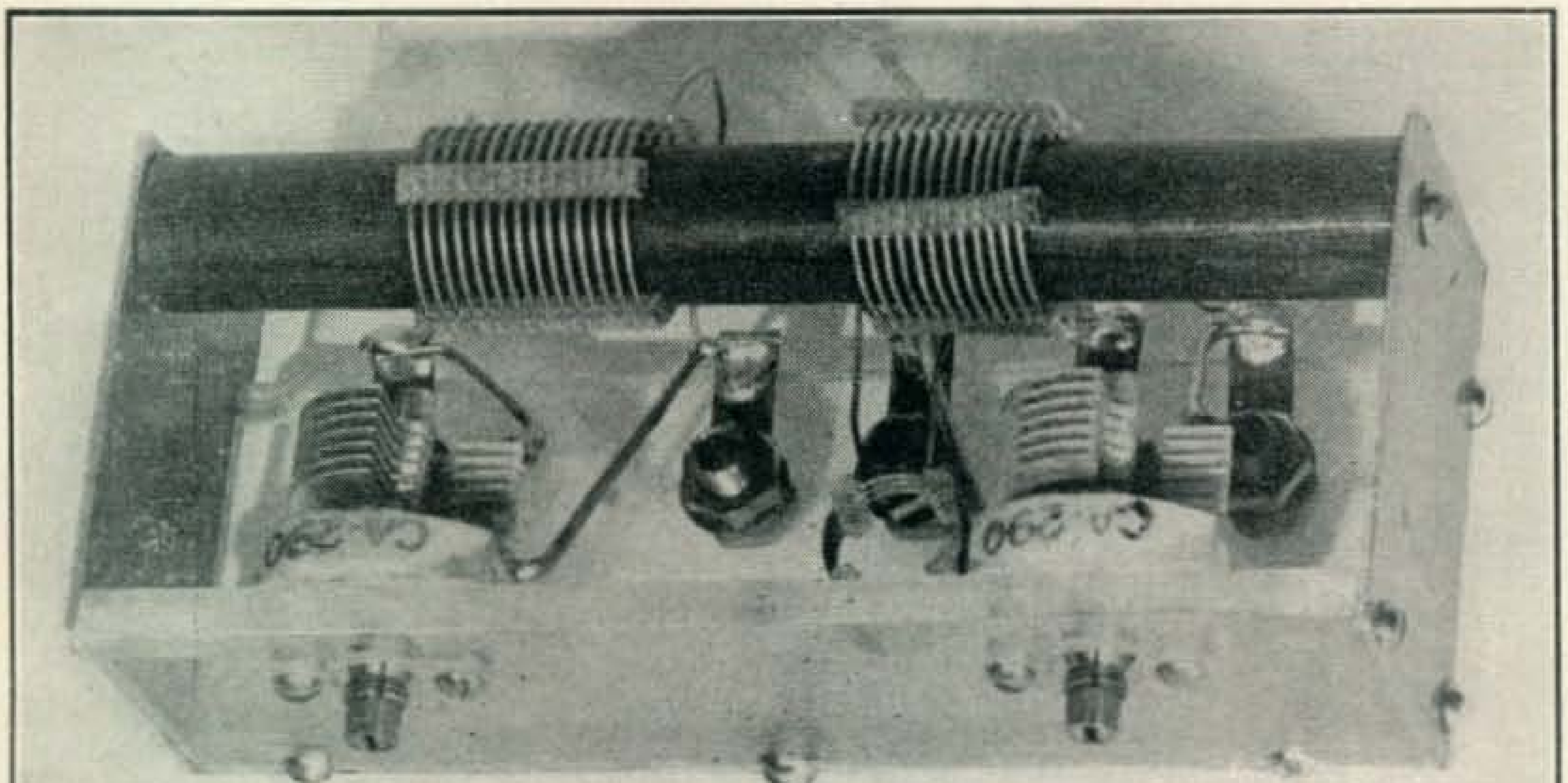

Fig. 10. Close-up view of the 14-mc plug-in grid-tank and phase-shifting circuit. L_2 and C_2 are at the left, and L_1 and C_1 are at the right. L_3 is supported by its leads and located just to the left of C_1. Details of the construction are given in the text.

Understanding Simplified SS

R. LEIGH NORTON, W6CEM*

How and why the 200-watt SS transmitter described in the preceding article operates is discussed from the theoretical aspects.

THERE SEEMS TO BE little doubt that single-sideband phone transmission is destined eventually to supplant the now conventional double-sideband-plus-carrier AM system. Even if the well publicized—and, in some instances, overoptimistic—signal-to-noise gain features are ignored, simple reasoning leads to the conclusion that a communication system which occupies twice the space needed for the purpose it serves can not long be tolerated in view of the perpetual squeeze for more frequencies for every imaginable type of service. When it is obviously possible to eliminate one sideband and a carrier, one is hard put to find a good argument for continuing to waste valuable spectrum space with superfluous emissions.

In spite of the doubts often expressed by the uninitiated, we amateurs are reasonably human, and generally act as human beings. When we as individuals see a definite advantage for ourselves we wholeheartedly adopt a new technique. Most often, we go for a system which will give our signals a boost over the other fellows'. Single-sideband transmission is such a technique, permitting more "communication" signal for our transmitter dollar, and giving the other fellow a break in the bargain. It is hard to see how such a system can lose.

But it has been losing for many years, because the necessary transmitters have been too complicated for general application. Systems involving several balanced modulators and one or more critical filters have been too awesome for any except a few fixed services. Now, however, there is available a relatively simple and direct method of producing a single-sideband signal directly at the output frequency. Not that the new method is the ultimate in simplicity, but, it is at least within the technical reach of the average amateur. Before examining the new system, let's consider phone communication in general.

Requirements of Voice Communication

To transmit what we so hopefully call "intelligence" from one place to another by voice, it is only necessary that we supply the listener with information concerning the frequency and amplitude of the original vocal output. If this is done, and the relative phase relationships of the frequencies which go to make up the original signal are not too greatly altered, the listener has all he needs. Unfortunately, the distance which can be covered by the original vocal energy is extremely limited, due to the high attenuation by the atmosphere of the frequencies involved. To increase the range, it has become common practice to use the original signal to change, or "modulate," in some manner a high-frequency wave whose radiation is capable of covering great distances. At the receiving end, the high-frequency wave is "demodulated" by a suitable device, and the original intelligence is recovered. This is not new to anyone who has the slightest familiarity with ordinary radio communication, but it is set forth here to point out that it isn't necessary to even mention a sideband to define in broad terms a system of radiotelephone communication. The sidebands are just a "nuisance" introduced during the process of applying the original audio frequency signal to the high-frequency wave.

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One of the popular ways of applying the intelligence to the high-frequency wave is to vary its amplitude in accordance with the intelligence to be transmitted. This, of course, is conventional AM, which is usually accomplished by mixing the modulating signal and the r-f wave in some sort of a linear mixer, such as a Class-C amplifier. In common with almost all mixers, the amplitude modulated amplifier generates in its output circuit a current having components at a minimum of four different frequencies. The four frequencies produced are the two original signals (the r-f and audio), the sum of these two, and their difference. The audio component is sufficiently far removed in frequency from the other three components that it develops only a negligible audio voltage across an output circuit tuned to the r-f excitation frequency. The sum and difference frequencies are usually too close to the excitation frequency to be separated by the output circuit, and appear in the output along with the excitation frequency.

Either the sum or the difference component contains all the information necessary for communication. Either one has frequency components which bear a fixed relationship to the modulating frequency components, and, because the modulated amplifier is essentially linear, have amplitudes proportional to the intensity of the modulating signal. If the modulating signal is a single frequency, the sum and difference output frequencies are known as side-frequencies. If the modulation covers a *band* of frequencies, as it nearly always does, the sum and difference components likewise cover a band of frequencies, and become *sidebands.*

It is possible to eliminate the r-f excitation frequency, or carrier component, by performing the mixing of r.f. and audio in a *balanced modulator.* If this is done at a sufficient low radio frequency it is possible to separate one sideband from the other by

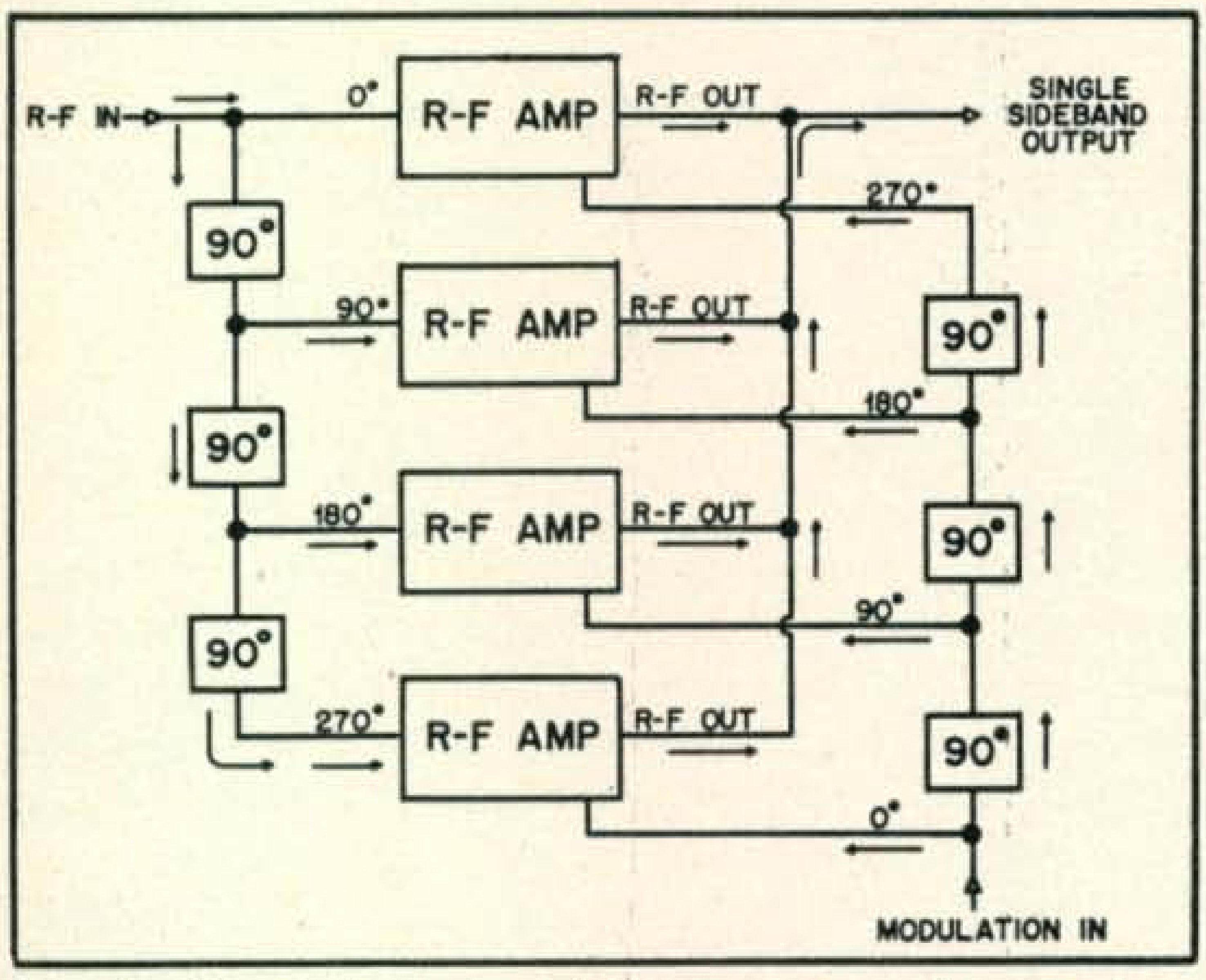


Fig. 1. Block diagram of the system used to produce a single-sideband signal directly at the output frequency. A four-tube amplifier is driven by 90-degree shifted r-f and audio signals.

using a selective filter circuit which passes only one sideband. This scheme works only when the radio frequency is comparable to the modulation frequencies, so that the sidebands will be relatively widely separated, percentagewise, and thus capable of being separated by a practical filter network. To transform the signal produced in this manner to a relatively high radio frequency it is necessary to resort to frequency conversion, usually in one or more balanced modulators, as frequency multiplication would also multiply the audio frequencies represented in the sideband. In spite of these complications, this system works well in practice.

A New Scheme—Frequency Addition

We have seen that the sidebands are merely the sum and difference of the r-f and audio signals. It is possible to produce the sidebands either by adding the audio and r.f., or subtracting the audio from the r.f. As subtraction is merely the addition of a negative quantity, this whole process could be called addition. If the device which effected the addition were arranged so that it would only produce the result of the addition, and would not deliver the r-f component without the audio first being present, a single-sideband generator capable of operating at any radio frequency without filters would be possible. A device of this sort has been known for years, but it has been waiting for a simple, practical way of producing the special type of audio modulating signals needed to make it work.

Figure 1 shows the frequency adding circuit in block diagram form. It consists of four r-f amplifiers with their output circuits connected. The four amplifiers are excited from a common source with r.f. which is shifted 90 degrees in phase from one amplifier to the next. They are all modulated by the same audio, but the audio is also shifted 90 degrees in phase between amplifiers. When there is no modulation applied, the net output of the four amplifiers is zero. With modulation, the output is either the sum of the r.f. and audio or the difference between the two, depending on the polarity of connecting the r.f. and audio to the amplifiers.

It is difficult to discover the originator of this system. The earliest mention so far unearthed by the writer is an article by Loyet [1] in 1942 which describes the system without going into details regarding the audio phase shifter. In 1945, Honnell [2] described the system in its entirety, although his audio phase-shift network had rather poor frequency response for general use.

In December, 1946, Dome [3] described relatively simple audio networks capable of giving a 90-degree phase shift over a wide band, and discussed their application to the production of single-sideband signals. Dome's audio networks have precipitated the present surge of interest in amateur single sideband transmission because they bring the system within reach of the average amateur. The first known application of the system to amateur work was by W6YX at Stanford University in September, 1947.[4]

Theory of Operation

There are several ways of describing the operation of the arrangement of *Fig. 1.* One way is to observe what doesn't happen—how the carrier and one sideband are eliminated by cancellation in the output. A more straightforward approach is in terms of what actually does happen. To do this it is convenient to represent the r-f and audio signals as vectors. A vector representing an alternating current or voltage is a line which revolves around a point once every cycle. The distance from the end of the vector to a horizontal line passing through the point and lying in the plane of rotation (the paper in the present case) indicates the amount of the

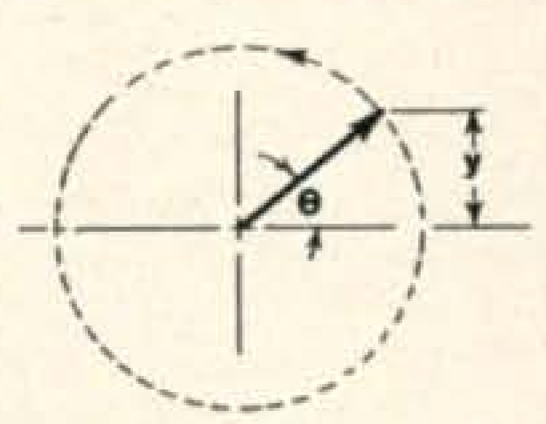


Fig. 2. A vector. At any instant the amplitude is given by "y" and these phase angle is given by "θ". The vector turns counter-clockwise, and makes one revolution per cycle.

quantity at any instant. When the vector is above the line, the quantity is positive; when it is below, the quantity is negative. The angle between the vector and the line at any instant is equal to the phase angle of the quantity at that instant. A vector is usually assumed to be revolving in a counterclockwise direction, and the angle increases as the vector rotates. A low-frequency wave is represented by a vector revolving slowly counter-clockwise. The vector of a higher-frequency wave revolves more rapidly, but in the same direction.

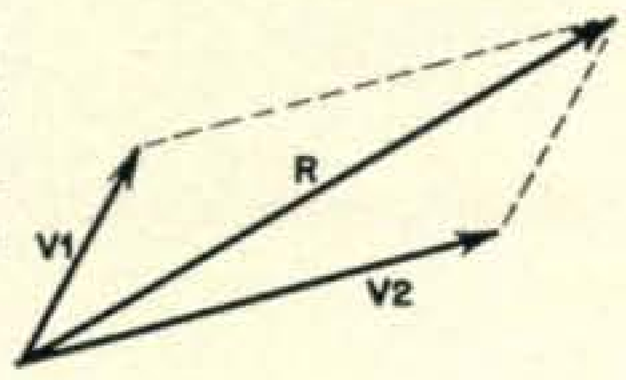
The dotted circle in *Fig. 2* shows the path of the

1 Paul Loyet, "Experimental Polyphase Broadcasting," *Proc. I.R.E.*, Vol. 30, No. 5; May 1942, p. 213.
2 M. A. Honnell, "Single Sideband Generator," *Electronics*, Vol. 18, No. 11, November, 1945, p. 166.
3 R. B. Dome, "Wideband Phase Shift Networks," *Electronics*, Vol. 19, No. 12, December, 1946, p. 112.
4 O. G. Villard, Jr., "Single-Sideband Operating Tests," *QST*, Vol. 32, No. 1, January, 1948, p. 16.

end of a vector of fixed length as it revolves. The vector is shown at the instant where the phase angle, $\emptyset$, is 45 degrees. The distance y represents the amount of the quantity at any instant.

It can be shown that a vector of fixed length rotating at a constant angular velocity represents a sine wave. We know from long experience that any distortion of a sine wave indicates the presence of

Fig. 3. Two vectors, V_1 and V_2 may be added together to give a resultant, R, by constructing a parallelogram with V_1 and V_2 as sides.



more than one frequency, and it can also be shown that if the vector varies in length or angular velocity as it rotates, a non-sinusoidal wave is being represented.

The handiest feature of vector representation is that it allows the addition of electrical quantities which are of different amplitudes or phase angles, or both. *Figure 3* shows how this is done by constructing a parallelogram with the two vectors, V_1 and V_2 as sides. The diagonal of the parallelogram, R, is the resultant in both phase angle and amplitude, of adding the two vectors V_1 and V_2.

So much for vectors. Now to produce a single sideband with their help. *Figure 4* shows four identical r-f amplifiers with the excitation phase leading 90 degrees from one amplifier to the next, going from top to bottom. The phase of the top amplifier leads that of the bottom one by 90 degrees, completing the circle. At one particular instant the relative phases of the r-f grid voltages applied to the amplifiers might be as indicated by the vectors above the grid coils. Excitation could be applied to the link circuit between the amplifiers at any point. Assume for the moment that all the plate-supply leads to the amplifiers are tied together and connected to a common plate power supply. Each amplifier would then attempt to develop across its plate tank a voltage having the phase indicated by the vectors alongside each plate tank. The r-f output voltages which would be developed by amplifiers 1 and 3 are equal in amplitude and 180 degrees out of phase, and when added together cancel. Amplifiers 2 and 4 also develop equal and out-of-phase voltages which add up to zero. Inasmuch as all four amplifiers are excited from a common source, it is evident that the outputs from amplifiers 1 and 3 will always cancel, as will the outputs of amplifiers 2 and 4, as long as the plate voltages applied to the four amplifiers are equal.

At this point it becomes desirable to introduce an artifice commonly used in modulation analyses. The r-f output vectors of *Fig. 4* are all turning counter-clockwise one revolution each r-f cycle. This makes it difficult to watch what goes on during modulation, so we will assume that the portions of the page on which the r-f vectors are printed are turning clockwise one revolution for each cycle of the excitation frequency, so that the vectors appear to be standing still. In effect, the excitation frequency temporarily has been subtracted, and we can now watch the actions of the four output vectors under modulation without being confused by the fact that they are rotating at the excitation frequency. As we have by this trick established a condition where the output vectors appear to be standing still when only the excitation frequency is present, any rotation of a resultant of adding the output vectors after modulation will indicate that the output frequency is different than the excitation frequency.

We have seen that the net output from the four amplifiers is zero when they all have the same plate voltage. If we now remove the plate voltage entirely and apply instead four sine-wave voltages from a modulator in such a way that the audio phase differs by 90 degrees between adjacent r-f amplifiers, as shown in any of the rows labeled *A*, *B*, *C*, etc., at the bottom of *Fig. 4*, the previously analyzed situation changes radically.

At the bottom of *Fig. 4* is a chart which shows, at the left, the modulation voltage applied to each r-f

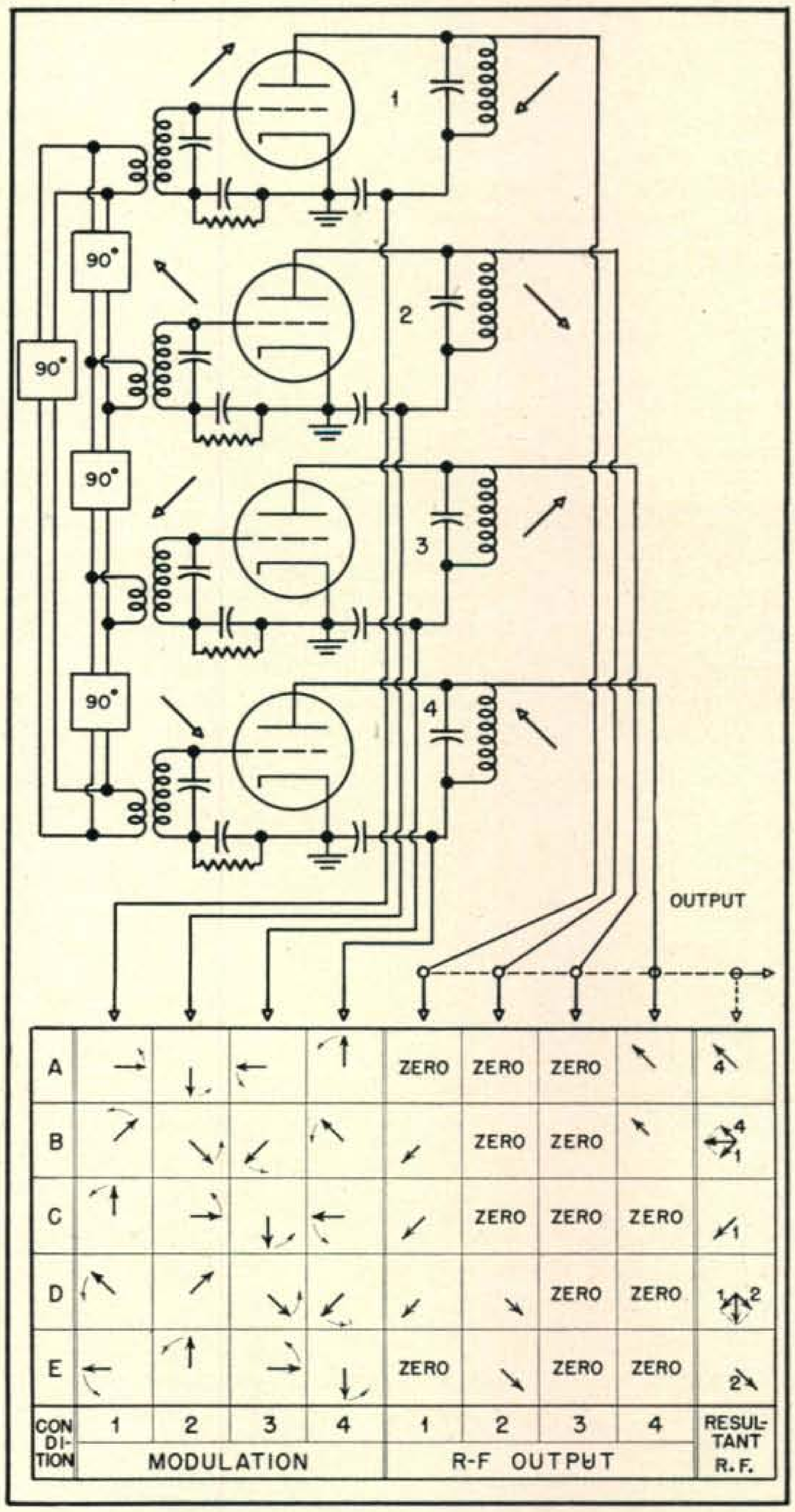


Fig. 4. Step-by-step illustration of how the four amplifiers add the audio and r-f frequencies. The operation is described in the text.

amplifier. The right-hand side of the chart shows the situation existing in each r-f amplifier when these modulation voltages are applied, and shows the phase and amplitude of the r-f voltage produced by each amplifier. In the first line, labeled condition *A*, only amplifier 4 has positive plate voltage applied. All the other amplifiers have either zero or negative plate voltage, as indicated by their modulation vectors being either horizontal or pointing downward. The r-f output section of the chart shows that only amplifier 4 is delivering output, and this output is at the phase indicated by the r-f output vector for amplifier 4 at the top of *Fig. 4*. The vector representing amplifier 4 is the only one to appear in the "resultant" column at the extreme right.

The row of vectors labeled *B* shows what happens one-eighth of an audio cycle later, when all the modulation vectors have rotated counter-clockwise through 45 degrees. Tubes 1 and 4 are now both operating, but at reduced plate voltage, because the modulation vector for tube 4 has passed the peak of the cycle, while the vector for tube 1 has not yet reached the peak. The plate voltages for tubes 1 and 4 are equal, respectively, to the sines of 45 and 135 degrees, or 0.707, times the peak value. If the output delivered by the two amplifiers is linear with respect to the plate voltage, the two r-f output vectors shown in line *B* will be 0.707 times as long as the single vector shown in line *A*. The result of adding the two vectors of length 0.707 and 90 degrees apart is a voltage vector having a length of 1 and an angle midway between the two original vectors. This is shown in the "resultant-r.f." column, where the vector is seen to be the same length as the vector shown above in line *A*, but rotated 45 degrees. Line *C* shows the situation after another one-eighth audio cycle. Amplifier 1 is now delivering full output, while the others have either zero or negative plate voltage. The resultant output vector has made another 45-degree turn in a counter-clockwise direction.

It is now obvious what is happening. The resultant r-f output vector is turning counter-clockwise and is going to make one full revolution for each full revolution of the modulation vectors. The output frequency must then be equal to the excitation frequency plus the audio frequency, because we originally assumed that a stationary vector would represent the excitation frequency.

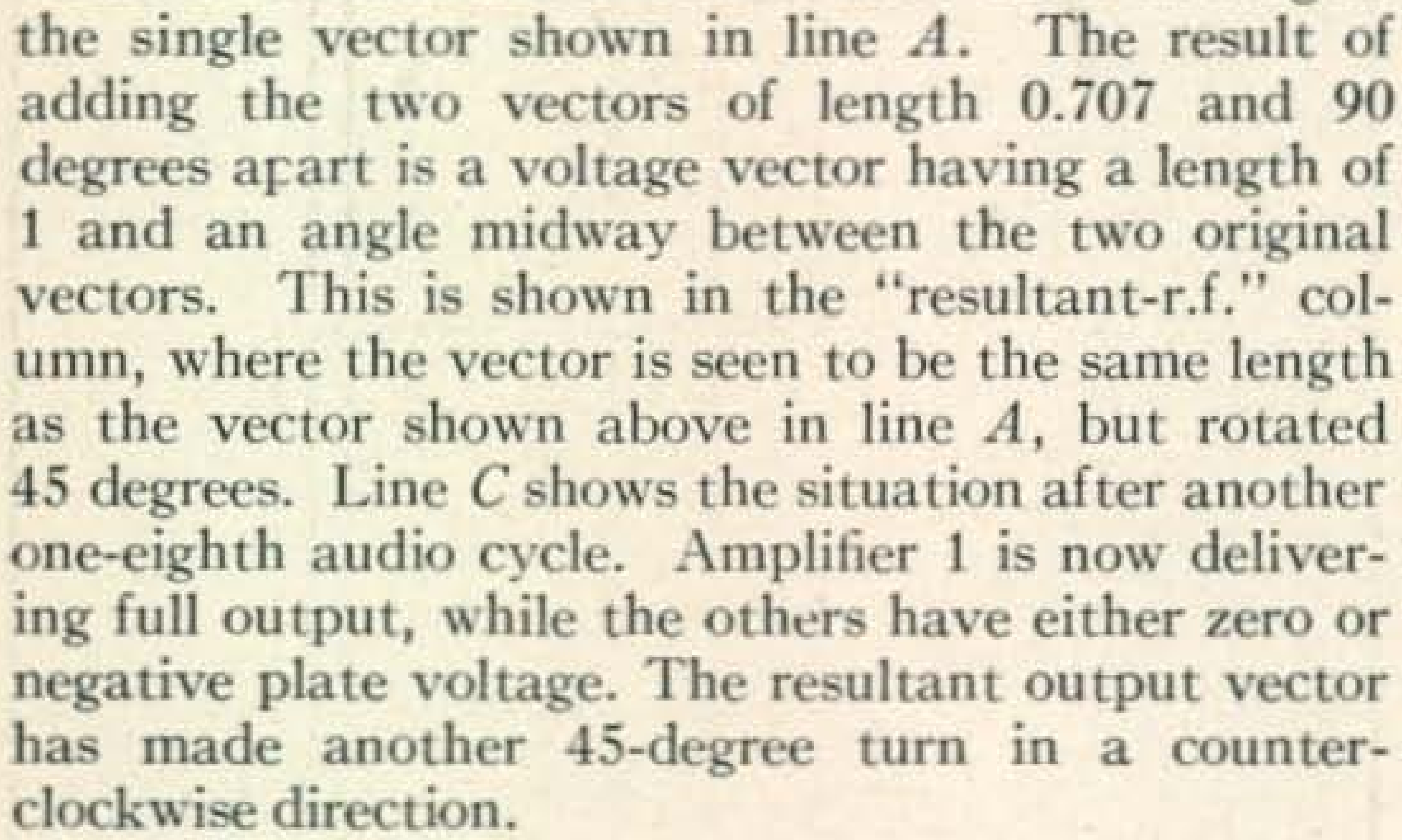


Fig. 5. Networks giving a 90-degree phase shift beween their outputs. For voice work, R_1C_1 should be 100 and R_2C_2 should be 453, where R is in ohms and C is in microfarads. R_1 and R_2 may have values of 10,000 to 100,000 ohms.

It has been shown that the length of the resultant vector is the same for all the conditions illustrated in *Fig. 4*, and it can easily be shown that, if the amplifiers are linear, the length stays fixed for all audio phase angles, and not only at the discrete points 45 degrees apart selected for purposes of illustration. It has also been shown that the resultant vector turns through 45 degrees for each 45 degree of rotation of the audio vectors, and it can be shown that the resultant r-f and the audio vectors turn through the same angle, regardless of the audio angle selected. As the length of the vector is fixed and it turns at the same rate as the audio vectors, which were specified as representing sine waves, the output must also be a sine wave. The r-f output must, therefore, be a pure single-frequency wave having a frequency equal to the excitation frequency plus the audio frequency. It is, then, a *side-frequency* produced by frequency addition. If the audio is a complex wave containing a number of frequency components, the output will be a set of side frequencies corresponding to the sum of the excitation frequency and each of the audio components. Each of the output frequencies will have an amplitude proportional to the amplitude of its corresponding audio component. This is a single sideband.

The process just described produces the "upper" sideband. If either the audio or r-f connections to two of the amplifiers which are 180 degrees out of phase are interchanged, the resultant r-f vector will revolve clockwise, indicating that the output frequency is lower than the excitation frequency, and the "lower" sideband is being produced.

How To Do It

The best part of this system is that it isn't nearly as complicated to make work as it might appear from the rather lengthy description of the operating principles. Tubes 1 and 3 are 180 degrees out of phase in both the r-f and audio circuits. Tubes 2 and 4 are likewise 180 degrees apart in their r-f and audio circuits. The necessary r-f voltages are easily obtained from split grid-tank circuits such as are used to excite any push-pull amplifier. The 180-degree audio voltages can be obtained from ordinary center-tapped audio transformers. The r-f excitation delivered to tubes 1 and 3 must, however, be 90 degrees away from that supplied to tubes 2 and 4. This requirement can be fulfilled in a number of ways, one of the simplest being to take advantage of the fact that the voltages across two tuned circuits coupled together and tuned to the same frequency are 90 degrees out of phase. Excitation is coupled into one circuit, and the second is fed by inductive coupling from the first.

The difficulty comes in the audio department. The modulation for tubes 1 and 3 must, like the r.f., be shifted 90 degrees in phase from the modulation applied to tubes 2 and 4. This is not nearly as simple to accomplish as the r-f shift, because it must be done over the whole audio range, rather than just over a relatively narrow band. A simple solution for this problem had everyone stumped for years until Dome [3] came up with the answer. Instead of

(*Continued on page 98*)

Low-Cost Audio Selectivity

TABLE I
Inductances Used in FL8A Filter

Marking	*Lead Colors*	*Approx. Inductance, mh*
AM	red, green	2700
BM	yellow, blue	3500
31M	black, brown	42
34M	red-white, green-white	200
35M	blue-white, green-white	200
37M	black, brown-white	750

RICHARD G. TALPEY, W2PUD*

Modifying the FL8A radio range filter for improved bandpass characteristics.

RECENT ARTICLES have pointed out the desirability of audio selectivity to combat present QRM conditions.[1,2] The writer feels that a band-pass filter such as described by W6WB fills the bill nicely since it is useful for both c.w. and phone. Such a filter may be made very cheaply using the inductances contained in the surplus FL8A range filter, provided you don't mind the work of extracting them.

The FL8A contains six inductances, the approximate values of which are given in *Table I*. The markings referred to are those on the sides of the coils, and the lead colors are given for convenience. These are for filters made by UTC—if yours is made by someone else you may find them different. The coils have a Q of about 12. They are mounted in the casting with an air gap in the core which is adjusted by means of Allen head screws under the direction plate inside the switch compartment. This allows the inductance to be adjusted to the correct value.

After a little trial and error with the low-pass filter formulas[3] it turns out that a constant-K section flanked by two M-derived half-end sections may be conjured up out of the 200-mh and the 750-mh coils. This type of filter structure is well known for its sharp cut-off characteristics and constant impedance over the pass-band. The filter, for a cut-off frequency of 1000 cycles, has a convenient characteristic impedance of 2500 ohms. The filter and its measured response curve are shown in *Fig. 1*. The response above 1000 cycles is comfortably down, although not as far as would be obtained with coils of somewhat better Q.

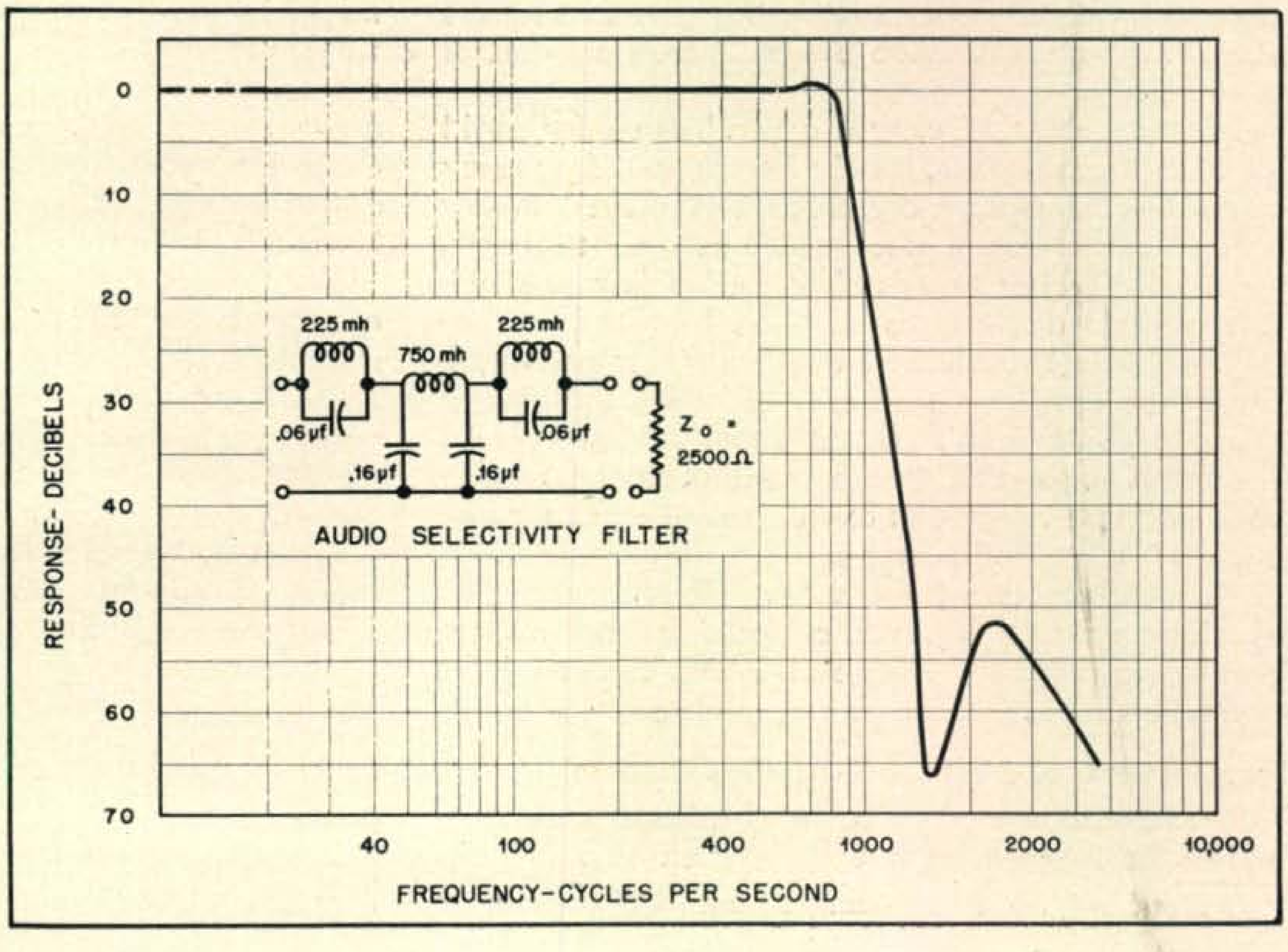
The coils may be removed from the FL8A by hacksaw methods if you are careful not to injure the coils. The following procedure has been found satisfactory, also. File off the rivets holding the side plate; remove it and also the switch in the upper compartment, leaving the leads as long as possible.

(*Continued on page 99*)

*59 Orland Rd., Rochester 9, N. Y.

1 Bane, "Bandpass Filters," *CQ*, June, 1948, p. 15.
2 Black, "Peaked Audio," *CQ*, June, 1948, p. 20.

3 Terman, "Radio Engineer's Handbook," p. 223.



Modified FL8A measured response curve. For simplicity the designation of the iron core inductances has been omitted.

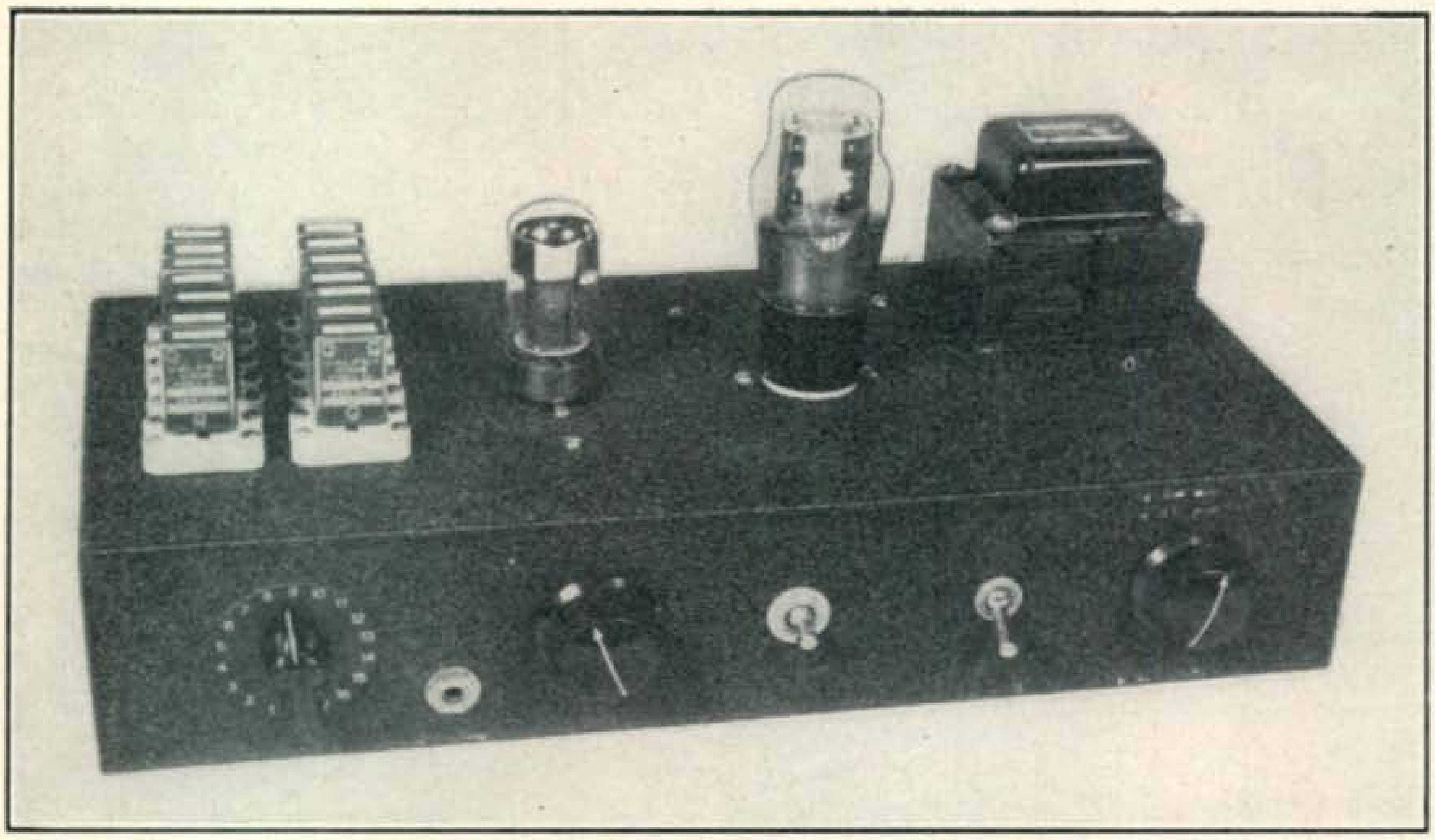


Fig. 1. Fourteen crystals are mounted on this crystal switching oscillator, but the number may be increased if the builder desires.

Variable-Frequency Crystal Oscillator

RUFUS P. TURNER, W1AY*

With no oscillator retuning, 14 crystal frequencies are available at the flip of a switch.

LOVERS OF 75-METER phone tend more definitely to be one-band operators than any of the other lower-frequency groups. In this band of enticing rag-chews, QSY means simply the ability to slide around easily and safely between 3850 and 4000 kc. What an 80-meter exciter of the shifter type will do in other bands usually is of no consequence to the rabid 75-meter enthusiast. Networks and spot contacts share equal importance on 75. For that reason the shifter must provide the maximum amount of reset ability.

Nothing short of crystal control can offer rapid stepping from one accurately known spot frequency to another. However, crystal control of the ordinary sort is rather inadequate when smooth tuning is required. Where one-band operation is concerned, the obvious advantages of crystal control can be enjoyed with considerable QSY flexibility by switching in the oscillator a number of crystals at closely spaced frequencies. To cover the 3850–4000 kc band in 10 kc steps, this arrangement does not require many crystals. The cost of a complete oscillator unit with self-contained power supply is lower than that of a good factory-built v.f.o. Furthermore, no special construction kinks, calibrations, nor adjustments are required. Any radio man can build the crystal-switching oscillator with ordinary tools.

Requirements of a Crystal-Switching Oscillator

A 75-meter crystal-switching oscillator must provide spot frequencies not more than 10 kilocycles apart throughout the phone band to be as effective as a v.f.o. For complete safety, as regards out-of-band operation, the end crystal frequencies should be not closer than 10 kc to the edges of the phone band. This limits the end frequencies to 3860 and 3990 kc. Including these two limits, 14 crystal frequencies 10 kc apart must be provided.

The crystal-switching oscillator, like a v.f.o., might be used from time to time to drive different transmitters having a variety of excitation requirements. Continuously variable r-f output control accordingly must be provided in the oscillator. This control, manually operated, will provide the smooth adjustment of grid excitation required in the following stage of the transmitter.

For maximum isolation and resulting carrier frequency stability, the crystal-switching oscillator should have its own independent power supply. Relay terminals should be included, in order that the plate-screen power of the oscillator may be switched off and on by the push-to-talk system of the transmitter.

A coaxial r-f output jack must be available at the oscillator to permit use of a completely shielded low-impedance concentric cable for connection to the transmitter. Means should be provided for keying the oscillator for c-w operation.

The foregoing are essential requirements which have been met in the design of the oscillator described in this article. An individual builder may prefer to elaborate upon these. For example, crystal frequencies might be chosen with 5 instead of 10-kc

16 Howland, So. Dartmouth, Mass.

separation, higher power output (larger tube and higher plate and screen voltages) might be employed, one or more extra crystal positions might be provided for fractional-frequency network channels, etc.

Oscillator Circuit

The complete schematic of the crystal-switching oscillator is given in *Fig. 2*. The circuit features of this unit will be discussed separately in the following paragraphs.

The builder may purchase spot-frequency crystals for the 14 channels between 3860 and 3990 kc or for other frequencies in the 80-meter band if the oscillator is to be used for all-band excitation. At first, the cost of crystals may appear rather high. However, it should be remembered that this is the largest single investment in the instrument, that the total cost of the oscillator with brand new crystals still will be less than that of a good, manufactured v.f.o., and that the stability of the crystal oscillator most likely will surpass that of any v.f.o. the reader might build.

An alternative is to buy surplus crystals on assorted frequencies in the 80-meter band (3500 to 3800 kc) and to grind them down to the 14 required phone frequency values.

A *shorting*-type crystal selector switch is employed, in order that all unused crystals will be connected together and grounded automatically. A satisfactory switch (S_1 in *Fig. 2*) is the Mallory type 31117-J which is a single-pole 17-position unit. One of the unused contacts ("X" in *Fig. 2*) is grounded. By means of this switching scheme, the shorting ring of the switch connects together and grounds all unused crystals. Note that *both* sides of each unused crystal are grounded.

The oscillator employs a beam type 7C5, tetrode-connected. The tube plate is operated at 300 volts and the total cathode current is 25 milliamperes. Other tetrode tubes which may be used successfully in this circuit, provided any necessary changes are made in resistor and capacitor values, include types 6V6, 6L6, 6AG7, and 807.

The midget closed-circuit jack, J_1, is provided for insertion of a 0–50 d-c milliammeter for tune-up purposes, or for insertion of a key for c-w transmission. When the plug is removed from this jack, the d-c cathode circuit return is restored automatically.

Fixed capacitor C_5 isolates the rotor of the plate tank tuning capacitor, C_4, from d.c. permiting mounting the tuning capacitor directly on the metal chassis without insulation. Potentiometer R_3 is the r-f output control. Adjustment of R_3 varies the screen voltage and, as a result, varies the r-f output of the oscillator.

The self-contained power supply section is entirely conventional. In this section the relay terminals are connected in series with chassis ground and

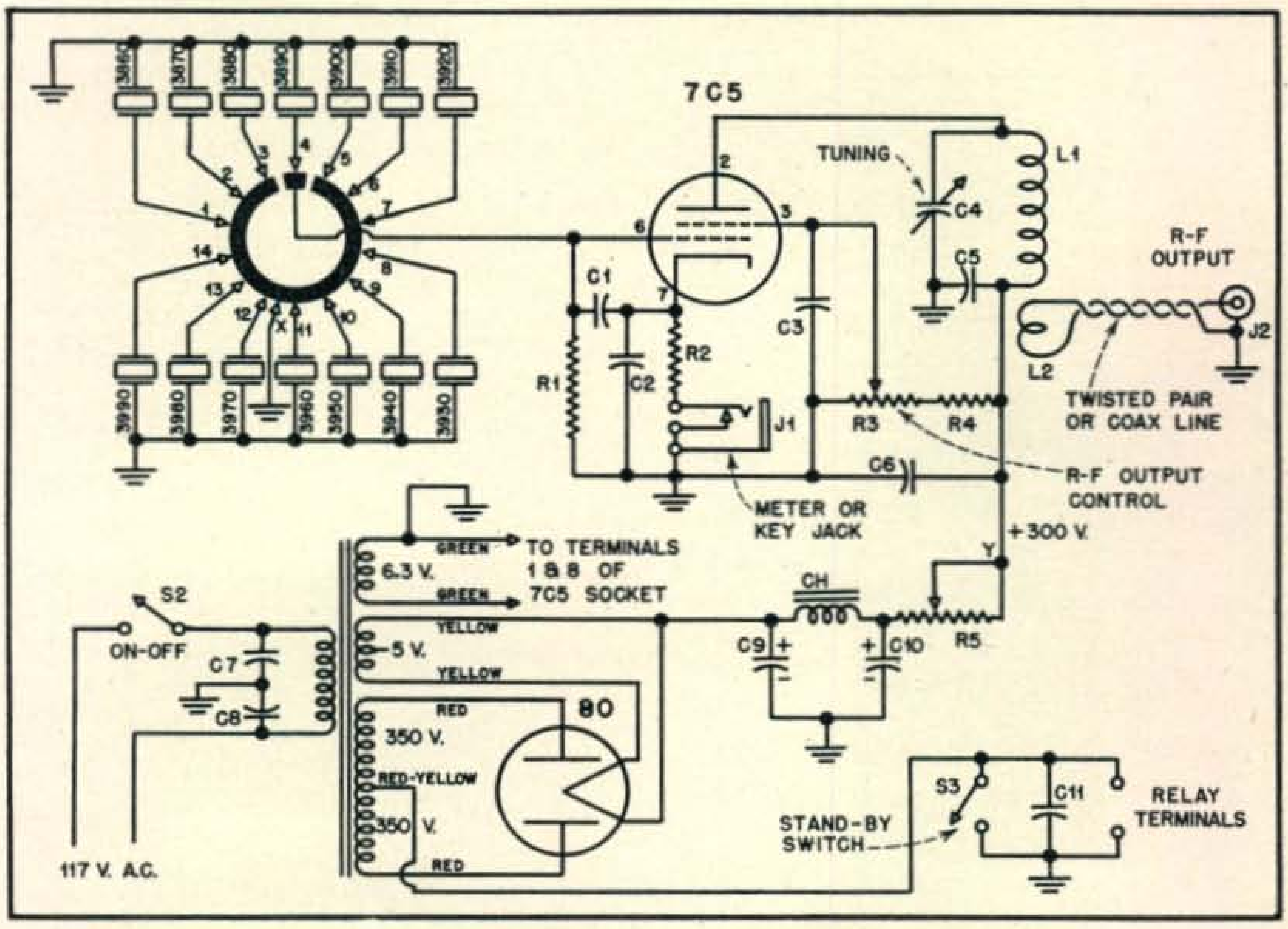


Fig. 2. Circuit of the crystal switching oscillator.

C_1—40 μμf, mica.
C_2—250 μμf, mica.
C_3—0.002 μf, mica.
C_4—50 μμf, midget variable.
C_5—0.01 μf, mica.
C_6—0.002 μf, mica (may not be needed in some layouts).
C_7, C_8—0.1 μf, 600 v. tubular.
C_9, C_{10}—20 μf, 450 d.c. w. v., midget tubular electrolytic.
C_{11}—0.25 μf, 600 v. tubular.
CH—8-henry 85-ma filter choke (Stancor C-1709).
J_1—Midget closed-circuit jack.
J_2—Female coaxial chassis-type jack (Amphenol 93-C).
L_1—52 turns No. 24 enameled wire close wound on 1-inch diameter form.
L_2—2 turns No. 22 d.c.c. wire close wound on same form as L_1 and separated from B+ end of L_1 by ⅛ inch.
R_1—100,000 ohms, ½ watt.
R_2—150 ohms, 10 watts, wire wound.
R_3—10,000 ohms, 50-watt rheostat (Ohmite Model J-0332).
R_5—2500 ohms, 25 watts, wire wound, with slider.
S_1—Single-pole, 17-position, shorting-type rotary selector switch (Mallory 31117-J).
S_2—SPST toggle switch.
S_3—SPST toggle switch.
T—Power transformer: 350-0-350 v., 70 ma.; 5 v., 3 amp; 6.3 v., 2½ amp. (Stancor P-6011).

the high-voltage center tap of the power transformer. The contacts are shunted with a 0.25-μf capacitor, C_{11}, to minimize relay sparking on the break. They are shunted also by the SPST *standby* switch, S_3, which enables the oscillator to be switched on temporarily for tune-up or beating purposes independently of the rest of the transmitter.

Resistor R_5 is set, during initial adjustment of the oscillator, to provide 300 v. d.c. Resistor R_5 acts with the series combination of R_3 and R_4 as the power supply bleeder.

Construction

The variable frequency crystal oscillator is built on a 15" x 7" x 3" chassis.

The crystal sockets (Millen type 33102) are mounted in two rows of 7 each on the left-hand end of the chassis. These sockets, spaced ½ inch on centers, occupy a total space of only 3" x 3½". The crystal switch, S_1, is mounted on the left-hand end of the front lip of the chassis so as to be as close as possible to the crystal sockets.

The threaded shank of the tank tuning capacitor, C_4, is passed directly through a tight-fitting hole in the front lip of the chassis. No insulation is required, and the nuts accordingly may be tightened against the chassis to ground the rotor. The cathode jack, J_1, is grounded in the same manner. The power transformer, *T*, is mounted in the rear right-hand corner of the chassis. The filter choke, CH, is placed under the chassis just to the left of the transformer.

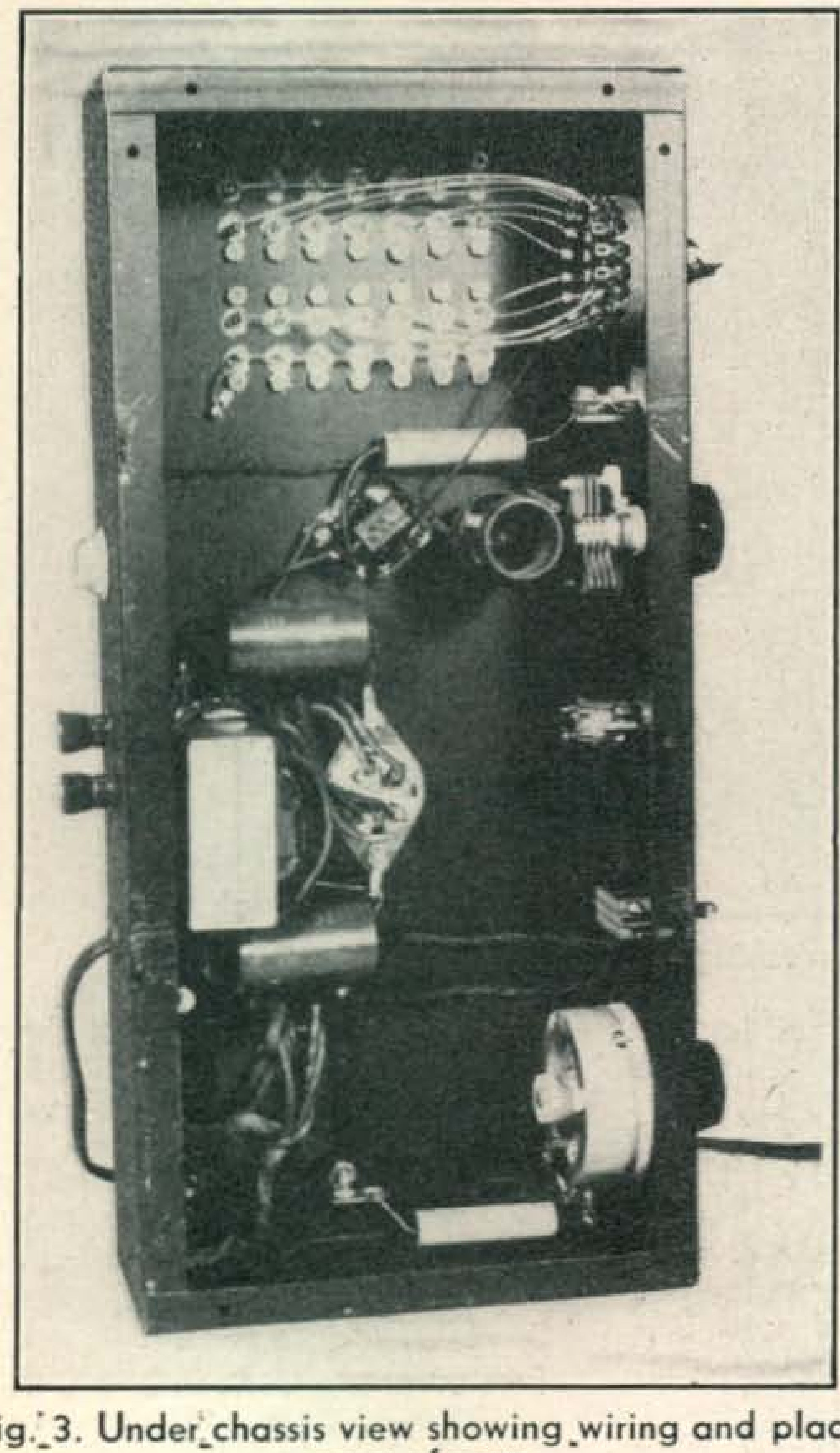


Fig. 3. Under chassis view showing wiring and placement of parts.

The relay terminals and r-f output jack (J_2) are mounted through the rear lip of the chassis. The power-line cord passes through a grommet-lined clearance hole also on the rear lip of the chassis.

The tank coil, L_1, is mounted on a long 6-32 screw and placed about ½ inch below the chassis. This coil, which may be seen in *Fig. 3*, is mounted between the tuning capacitor and the 7C5 tube socket. This position insures short leads between tube, coil, and tuning capacitor. The coil and tuning capacitor combination specified will cover the entire 80-meter band.

All wiring, except that between the crystal switch and sockets, may be done with flexible, insulated hookup wire. Use bare, solid wire in the crystal circuit and between the crystal switch and 7C5 control grid. These leads are made rigid. Ground to chassis one of the unused contacts of switch *SP*, as indicated by "X" in *Fig. 2*. Twist together each pair of a-c leads, such as the 7C5 heater leads, 117-volt transformer leads, and transformer high-voltage leads. This will reduce the likelihood of hum troubles.

Adjustment

After the construction and wiring have passed inspection, proceed with the initial adjustment of the oscillator in the following manner:

(1) Set switches S_2 and S_3 to their off position. Set R_3 to maximum resistance. Plug a 0–50 d-c milliammeter into jack J_1. Connect a 0–500 d-c voltmeter (at least 1000 ohms per volt) between point "Y" of resistor R_5 and *terminal 7* of the 7C5 socket. Place crystals in sockets and set switch S_1 to position 1.

(2) Plug-in power plug. Throw switch S_2 to on position and allow time for 7C5 heater to come up to operating temperature.

(3) Throw standby switch S_3 to on position.

(4) Adjust tuning capacitor C_4 for minimum dip of milliammeter.

(5) Set slider on resistor R_5 to bring voltmeter reading exactly to 300 volts. Tighten slider in this position.

(6) Remove voltmeter. Check operation of exciter with each crystal by setting switch S_1 successively to each position and retuning C_4, if necessary, for minimum dip of milliammeter.

(7) Connect the oscillator output to transmitter by means of coaxial cable. After tune-up operations are completed in exciter and transmitter, run rheostat R_3 from one extreme to other, noting variation of exciter output, as evidenced by variation in grid current in first transmitter stage.

(8) If exclusive 75-meter operation is not desired, the oscillator may be used as a multi-crystal 80-meter unit to drive any all-band transmitter having 40, 20, and 10-meter doublers, as well as an 80-meter "straight-through" channel. Select crystals in the 3500–4000 kc group to give desired harmonics in bands to be worked. (For example 3562.5 kc crystal for 28.5 mc 10-meter operation.) Remember that the frequency separation on 40 meters will be twice the crystal frequency separation, four times on 20 meters, and eight times on 10 meters.

LIGHTHOUSE TUBE

420-mc Transmitter

DAVID L. THOMPSON, W6VQB*

Lighthouse tubes provide high-efficiency, adequate power and the ultimate in simplicity for 420-mc operation.

WHILE THE disc-seal, or as it is more familiarly known, the Lighthouse tube, was originally designed for use in coaxial tank circuits, the extremely low inter-electrode capacity of these tubes indicates that they could be successfully used in linear-tank or parallel-rod circuits at ultra-high frequencies. The use of conventional tubes poses a problem from the standpoint of coupling and frequency control, since the inter-electrode capacity is much greater and the external tank must be that much smaller.

This transmitter is a self-excited oscillator for the 420-mc band using 2C40 tubes. These are the so-called receiving-type Lighthouse tubes and are rated at 500 volts on the plate, and in this circuit the pair will draw about 35 ma. A somewhat lower plate voltage is necessary as the circuit is a modulated oscillator and 350 volts seems to fit this requirement. The 2C43 series may be used at a higher plate voltage, but the small increase in power output does not merit the additional cost. 2C40 tubes are available from most supply houses and many are still on the surplus market. The earlier model of the 2C40 known as the 446A may be employed, but these suffer from internal arcing failures quite easily.

The design and construction of the transmitter is quite simple. For the obvious reason that it is not desirable to have stray r.f. find its way into the modulator, the oscillator was constructed on a separate chassis. The plate tank circuit consists of two solid brass rods, shorted at one end by the adjustable shorting bar and shunted at the other end by the capacity of the tubes. Any non-ferrous metal might be used for the plate rods, or even tubing, as long as a good electrical and mechanical contact between the tube anode cap and the rod is insured.

The grid circuit is formed by the small loop of wire that connects the two grids. The d-c return to ground is provided by a 5000-ohm resistor. The cathodes of the two tubes are grounded directly by clamping the base shells together with a specially prepared clamp and bolting to the chassis. Tube pins 3, 5, and 8 are grounded to the chassis.

The added refinement of silver plating the tank rods does have the advantage of reducing the losses due to skin effect. However, laboratory tests have shown that with a transmitter of this type the absence of silver plate does not materially affect or reduce the power output. The same tests did show that rods of a diameter of at least ½″ should be used. The greater diameter permits more rapid heat dissipation (and less frequency drift) and adds to the *Q* of the tank.

*c/o Philco Corp., 6509 N. Broad St., Philadelphia, Pa.

Construction

The recommended chassis layout is shown in *Fig. 1* and the wiring schematic in *Fig. 2*. A detailed

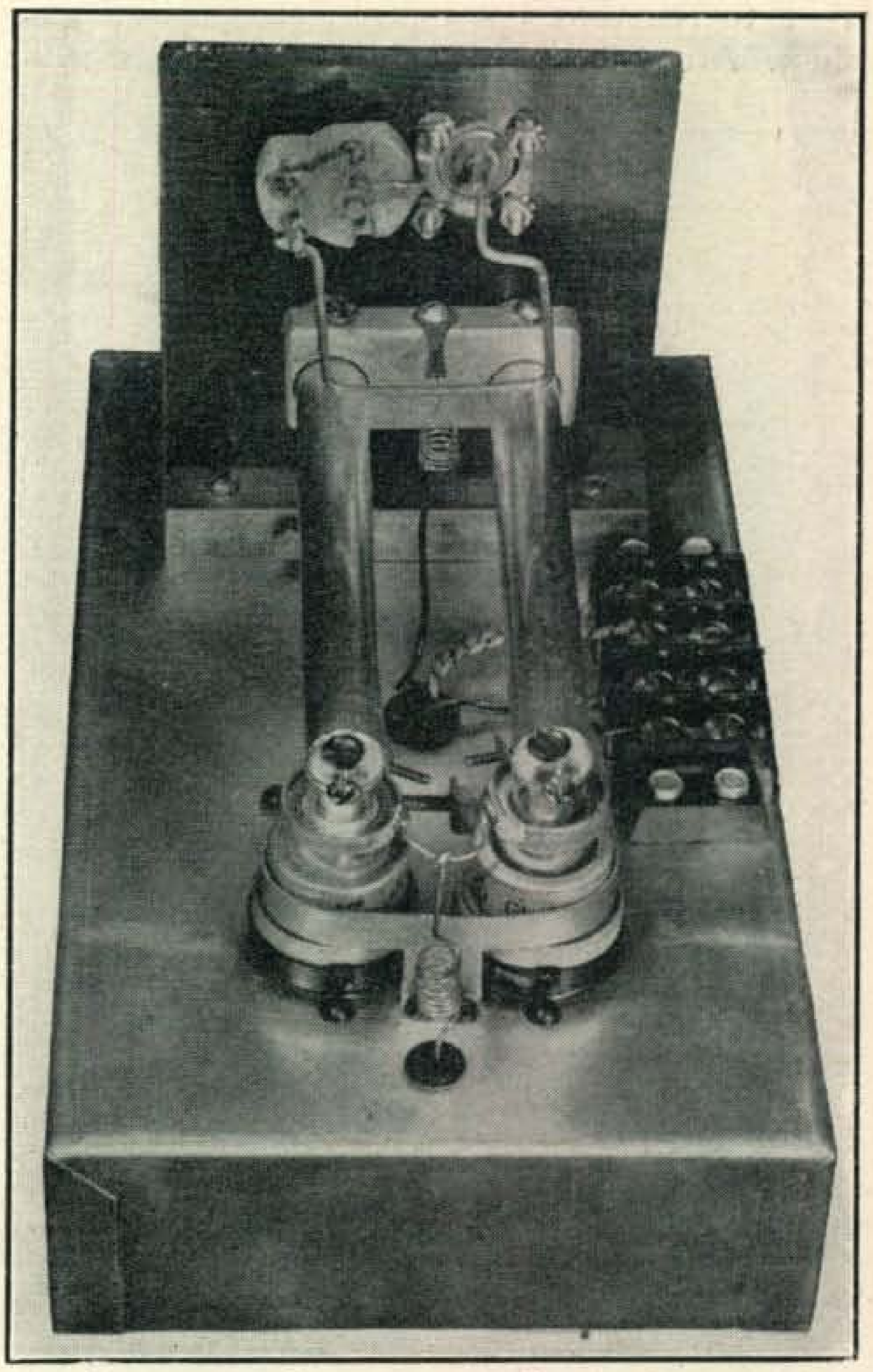


Fig. 1. Top view of 420-mc oscillator showing details of chassis layout and grid loop. The tubes are separated one and one-half inches center-to-center.

sketch of the plate rods is shown in *Fig. 3.* Both plate rods are identical.

The first step is to lay out the tube socket holes. The distance between centers should be 1½". This dimension corresponds to the center-to-center distance of the shorting bar. This bar must also have provisions for securely clamping to the plate rods once the optimum setting has been found. The plate rods are supported at one end by the tubes and at the other end by a bracket of lucite or similar material. A coax fitting is mounted on the panel and serves to support the antenna coupling loop. This loop is formed by a U-shaped wire 2" long and 1½" wide. The optimum spacing between the loop and the plate rods was found to be about 1¼". The antenna trimmer condenser in series with the loop is a small air padding condenser with all but one rotor and one stator plate removed.

The plate voltage is applied to the tubes through the center tap on the shorting bar. A small choke is in series with this lead and an air-wound coil about ¼" in diameter consisting of 6 turns of No. 18 wire has been found most effective. The r-f return to ground is provided by the 50-μμf condenser.

Two grid disc clamps should be formed from a piece of copper or brass strip about 3/16" wide and 3-3/16" long. Each clamp is formed on the tube grid disc itself until a circle is made and then the ends are bent and drilled out for a 3-48 nut and bolt. *Fig. 3* includes a sketch of one of the clamps. Some care must be exercised during the bending process and especially during the removal or installing of the clamps to see that the metal-glass grid seal is not broken. A small drop of solder is sufficient to fasten

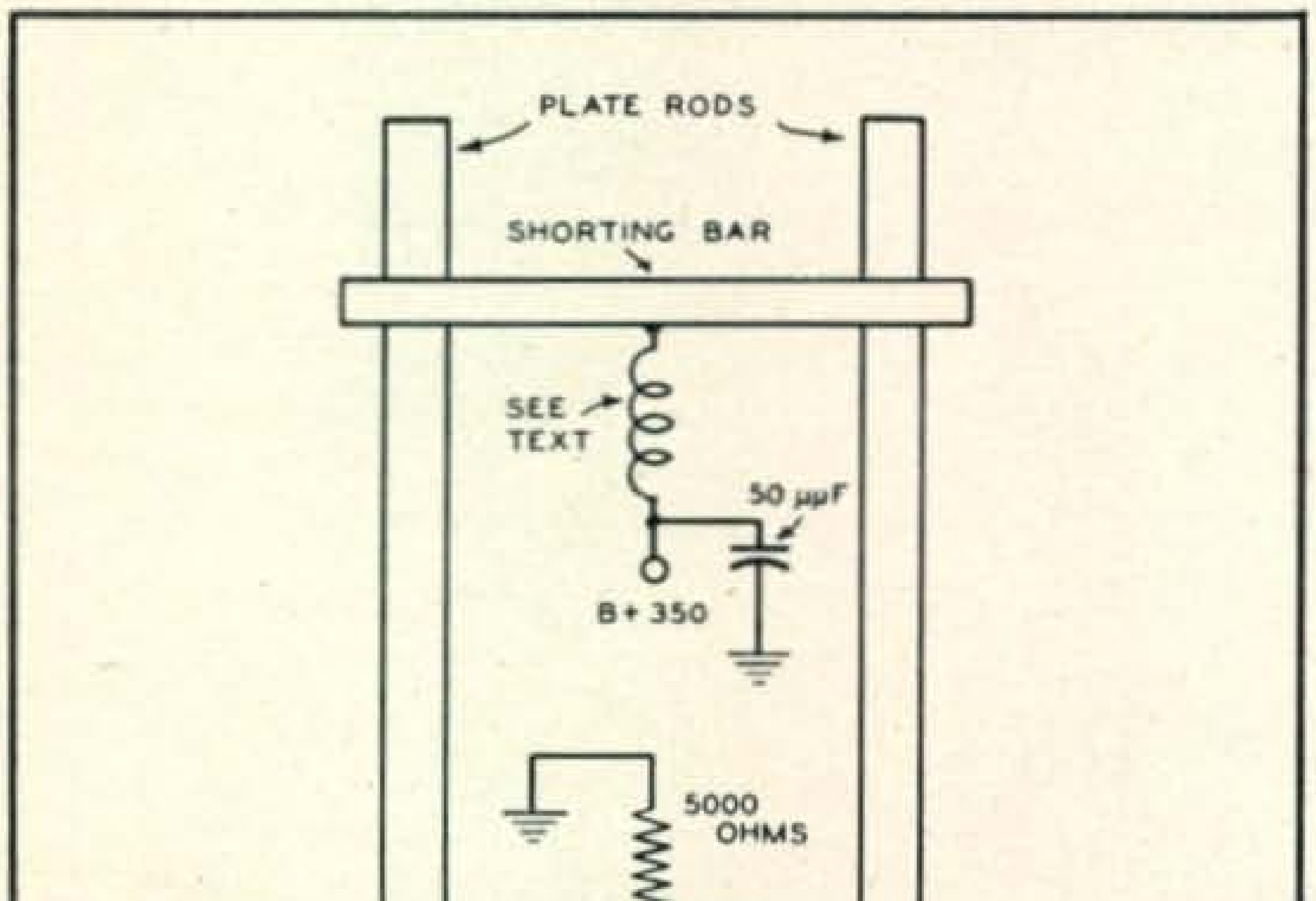


Fig. 2. Wiring schematic of the parallel rod oscillator. The antenna loop is not shown. Antenna coupling is described in the text.

the grid loop to the grid clamps. The grid return resistor is center tapped on the grid loop through an r-f choke similar to the one in the plate circuit. The grid clamp and grid coil may be seen in the closeup view, *Fig. 1.*

Tuning Up

Some patience is needed in waiting for Lighthouse tubes to warm up. At least one minute should elapse before the plate voltage is applied. Check for oscillation by observing the plate current when a metallic screwdriver is touched on the plate lines. If there is a considerable increase in current at the moment the screwdriver touches, it may be taken as a sure sign that the tubes are oscillating.

For proper evaluation of the tuning adjustments two external instruments should be available. The first and most important is a frequency indicating device. This may be a commercial unit,[1] or the pair of Lecher lines especially constructed for 420 mc as described in the Appendix.

The other instrument is some sort of field strength indicating meter. A simple and effective device may be constructed for this purpose by shunting a 1N21 or similar crystal with an 0-1 milliammeter, and connecting the combination to the center of a dipole that is 13 inches long. If the meter should fail to read when the transmitter is known to be oscillating the connections to the crystal should be reversed. If no reading is still obtained the trouble may be in the crystal. This may be checked by measuring the d-c resistance of the crystal and then reversing the leads and again noting the resistance. If the ratio of the two readings is less than 20 to 1 the crystal should be discarded.

Tuning up must take place while the antenna is connected. However, if the antenna loop is placed too near the rods the oscillator will be loaded too heavily and will become unstable. If the loop is too far away the energy transfer will be insufficient and the strength of the radiated signal will decrease accordingly. For the initial adjustments couple the loop to a distance of about 1½ inches. Apply the plate voltage and check the frequency. If it is higher than 437 mc increase the length of the plate tank very slightly. Conversely, for mid-band operation shorten the tank length if the frequency is lower than 433 mc.

Now adjust the antenna trimmer while noting the reading on the field strength meter. The meter should be placed about eight feet from the antenna. As the trimmer is adjusted there should be some point of sharp rise in the field strength. When this has been found, again measure the frequency. If the frequency has not changed more than a megacycle it means that the reactance of the antenna has been tuned out and the transmitter is working into a resistive load. Note that the frequency will change if the antenna is not resonant to the same frequency as the plate tank. The antenna should be trimmed until both are resonant at the same frequency. This *pulling* effect can be minimized by careful adjustment of the antenna trimmer while keeping the loading light. Don't worry, plenty of energy is still being coupled into the antenna.

1 McMurdo-Silver #903.

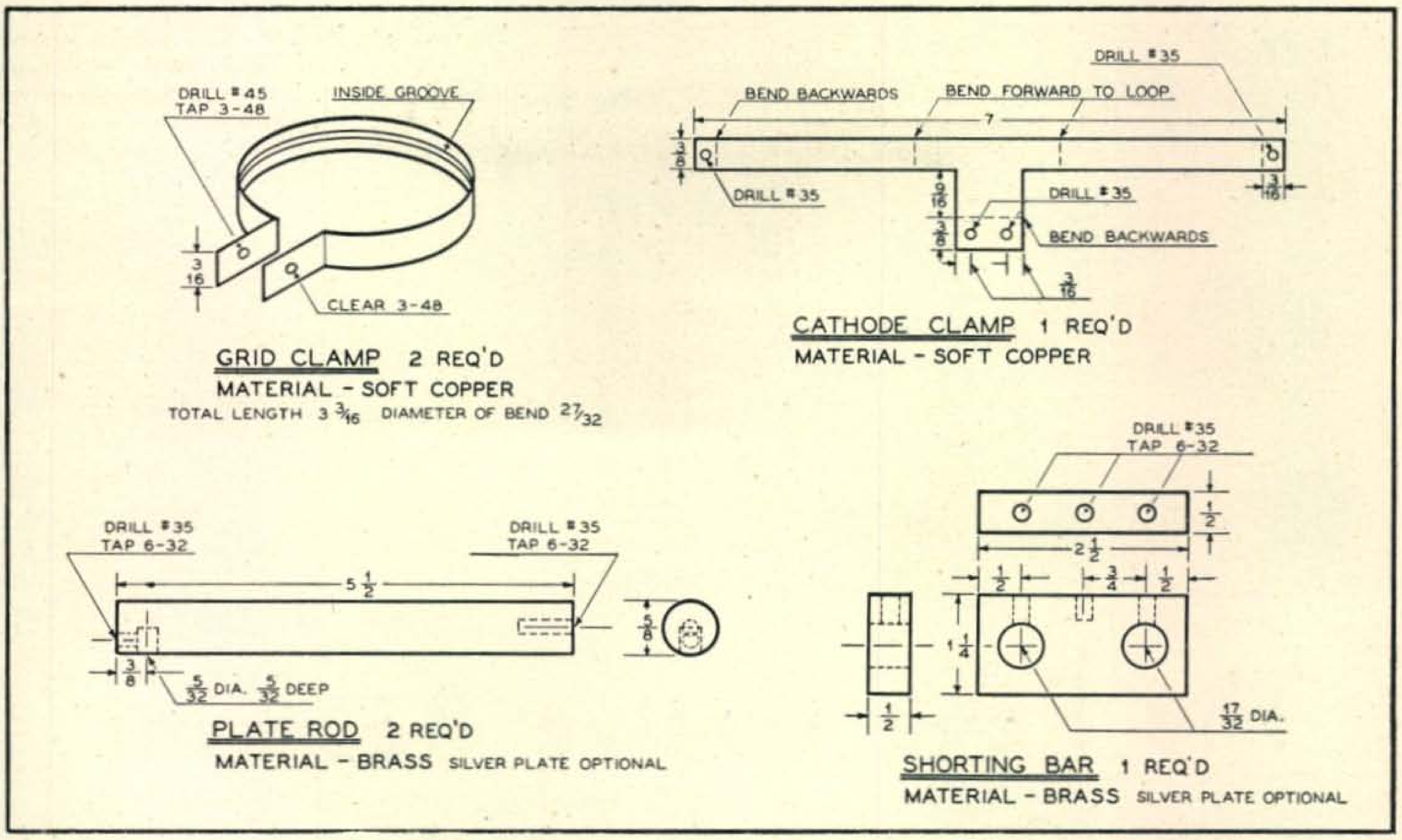


Fig. 3. Detail drawing of plate rod and grid assembly.

Of course, the preceding material assumes that there is a respectable match between the antenna and the antenna lead, etc. Probably the best lead is the 72-ohm Twin-Lead. Coax cable may be used, but unless a re-entrant transformer is used the pattern of the antenna will be distorted due to the unbalanced line, a problem on the higher frequencies. The optimum loading with this type transmitter has been found to be a 30% increase in plate current when the antenna is connected. This will give a good husky signal and sharp stable note.

With a working input of 14 watts about 5 watts of audio are needed. Almost any two-tube audio combination will work. The writer uses the familiar 6J5-6F6. To determine the percentage of modulation, a loop and bulb should be used. The variation of the bulb should be noticeable, but not pronounced for optimum modulation.

This transmitter has performed very well and with a little care in choosing the site and path some real DX may be easily worked. A similar transmitter loaned to W6PSQ has worked in excess of 140 miles.

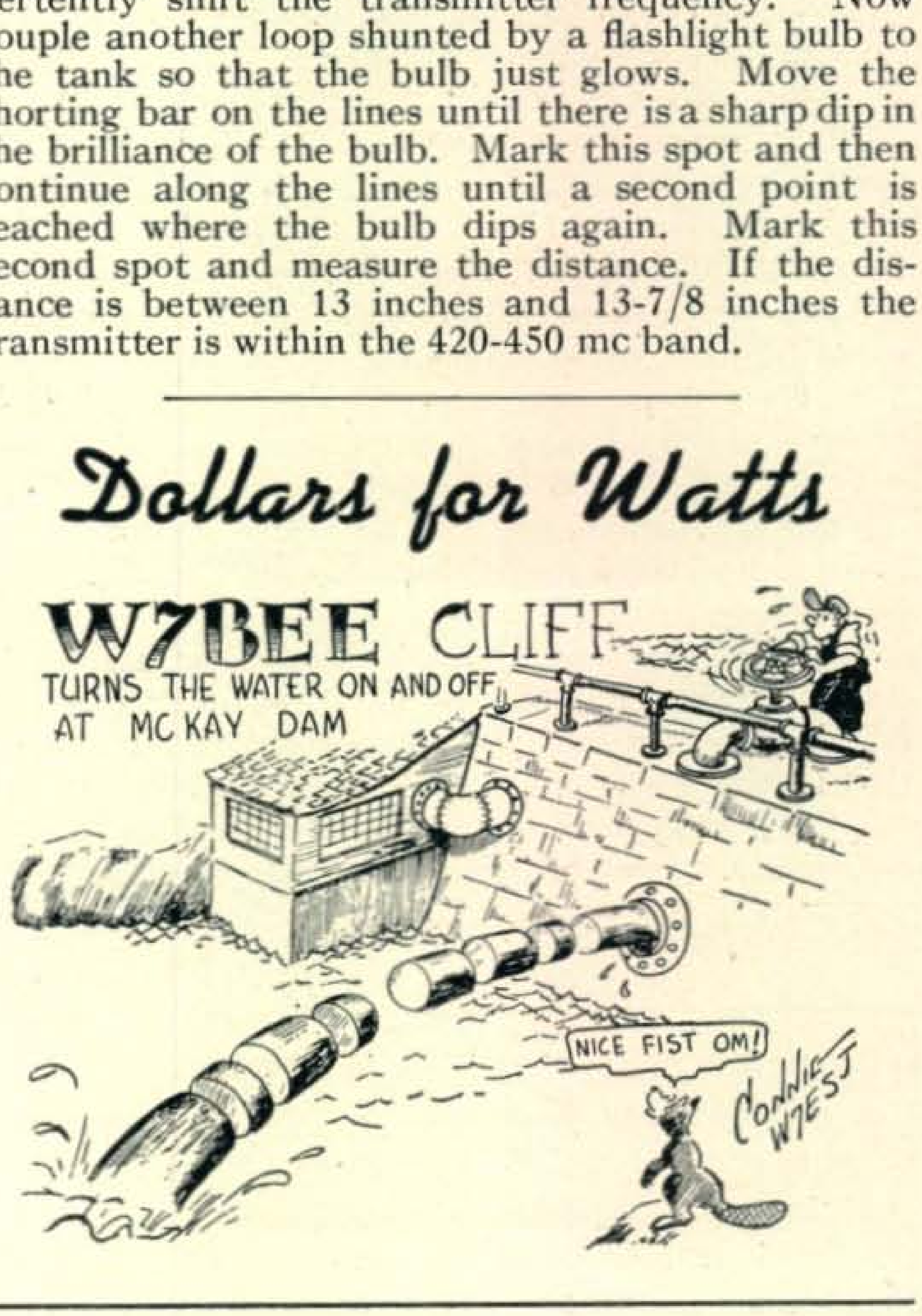
Appendix: 420-mc Lecher Lines

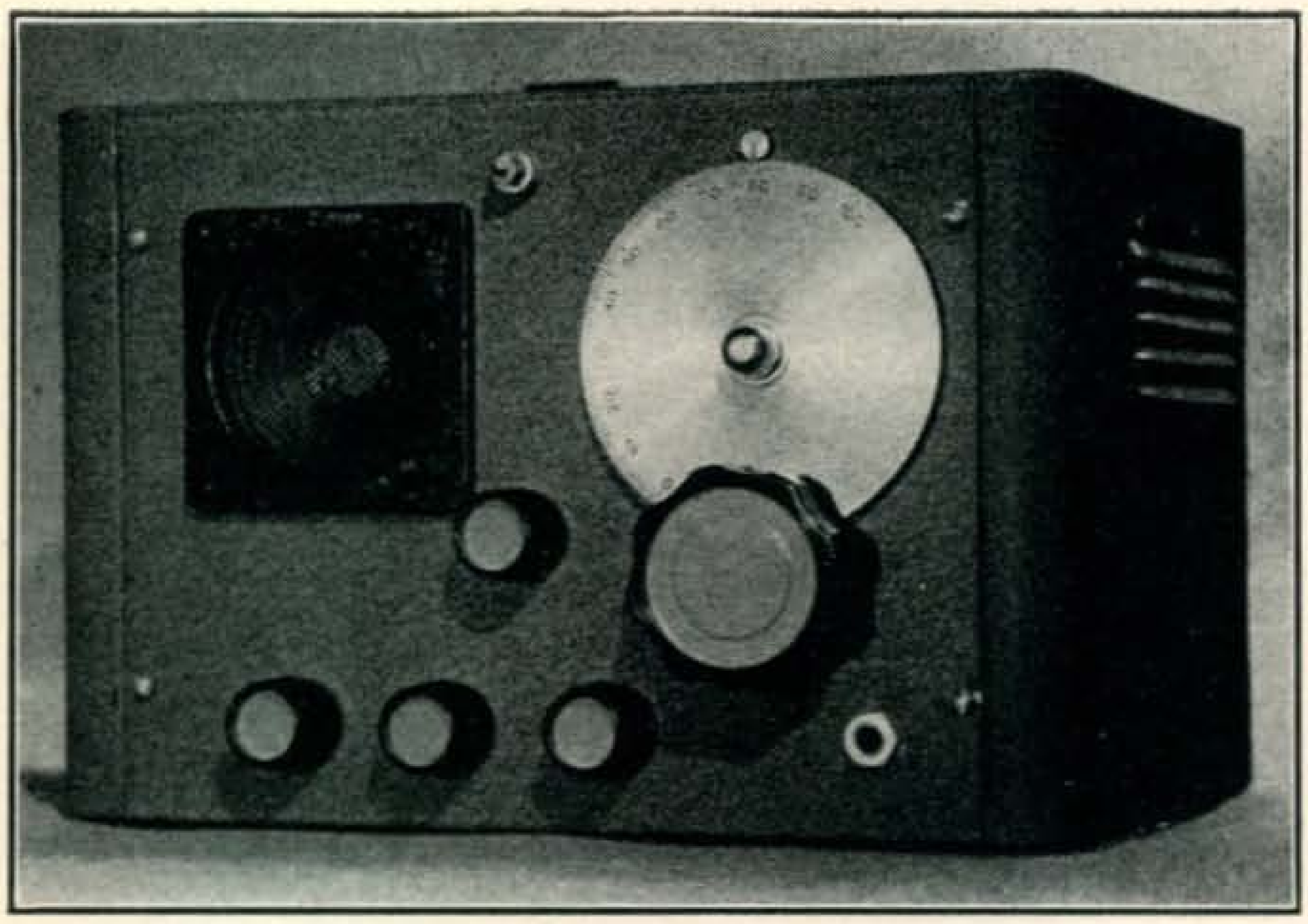
To obtain mechanical stability and rigidity metal rods rather than wire should be used in building the Lecher lines. Copper, brass or aluminum will work satisfactorily. Two 3-foot length rods will be required. The diameter is not important, although probably ¼" would be most useful. The rods are fastened to standoff insulators (three for each rod) and the insulators are mounted on a board about four feet long and six inches wide. The distance center-to-center between rods need only be about three inches.

One end of the rods is connected to the open end of a U-shaped loop of No. 12 wire. A shorting bar similar to the one used in the transmitter will be needed. Fasten a wooden dowel to the shorting bar center tap. This isolates the r-f circuit from the operator.

The lines are loosely coupled to the tank circuit of the transmitter. The minimum allowable distance between the tank and the coupling loop is 2½". Too great a degree of coupling will inadvertently shift the transmitter frequency. Now couple another loop shunted by a flashlight bulb to the tank so that the bulb just glows. Move the shorting bar on the lines until there is a sharp dip in the brilliance of the bulb. Mark this spot and then continue along the lines until a second point is reached where the bulb dips again. Mark this second spot and measure the distance. If the distance is between 13 inches and 13-7/8 inches the transmitter is within the 420-450 mc band.

Dollars for Watts





Impressive to look at, this five-tube regenerative receiver employing miniature tubes in the r.f. is even more impressive to operate. At low cost and with little complicated circuitry, it gives big-set performance.

MAURICE P. JOHNSON*

The Regenerative Receiver
Comes Into Its Own

SINCE THE EARLY days of radio, the regenerative receiver has been popular with beginning hams and other short-wave enthusiasts. Such popularity the circuit justly deserves, since when properly designed and constructed, a regenerative receiver will provide a maximum of performance with a minimum of tubes, and is relatively easy to build and adjust.

Many constructors have undertaken to assemble such a receiver, and have begun with high hopes, yet have been dissatisfied with the results obtained from the finished set. Examination of a typical receiver illustrates some factors responsible for such unsatisfactory performance.

In a surprising majority of cases, the receiver is constructed as cheaply as possible, more often than not utilizing ancient "junk-box" or other poor quality parts. An average receiver consists of a regenerative detector followed by a stage of audio. The power supply is on a separate chassis. The speaker and power amplifier make still another assembly. Any r-f stages are generally added as afterthoughts. All these stages must be interconnected as well as tied to the power supply, with the final result that the receiver grows to be a maze of wire and small assemblies. Small wonder then, that there is interaction, operation is dishearteningly poor, and in a short time the mess finds its way back into the junk box.

*502 Newland Ave., Jamestown, N. Y.

The design and construction of a de luxe regenerative five-tube receiver which features sub-assembly construction of the radio frequency stages to permit inclusion of power supply, speaker and audio stages in a single compact unit.

The point to be made is simply this: A poorly designed, carelessly constructed regenerative receiver cannot be expected to give anything but poor performance. To gain optimum results, a regenerative set should be as carefully designed and constructed with as high quality components as would be lavished on a multi-tube superhet.

It was with this goal in mind that the design and construction of the receiver illustrated here was initiated.

Design Considerations

In commencing the design of this receiver, several general requirements were considered, such as the desire for a logical layout together with neat appearance; simplicity of circuit and construction to enable easy duplication of the set; and the integration of sections into a compact self-contained unit, without introducing undesirable coupling or interaction.

The nucleus of the set, of course, is the detector. This is of the pentode type for high gain, and for low tube capacities. For the latter reason, a 6AU6 miniature tube was selected for this stage. This type has very low inter-electrode capacity, its small size facilitates compact construction, and the glass-seal base avoids many of the losses common to other tube bases.

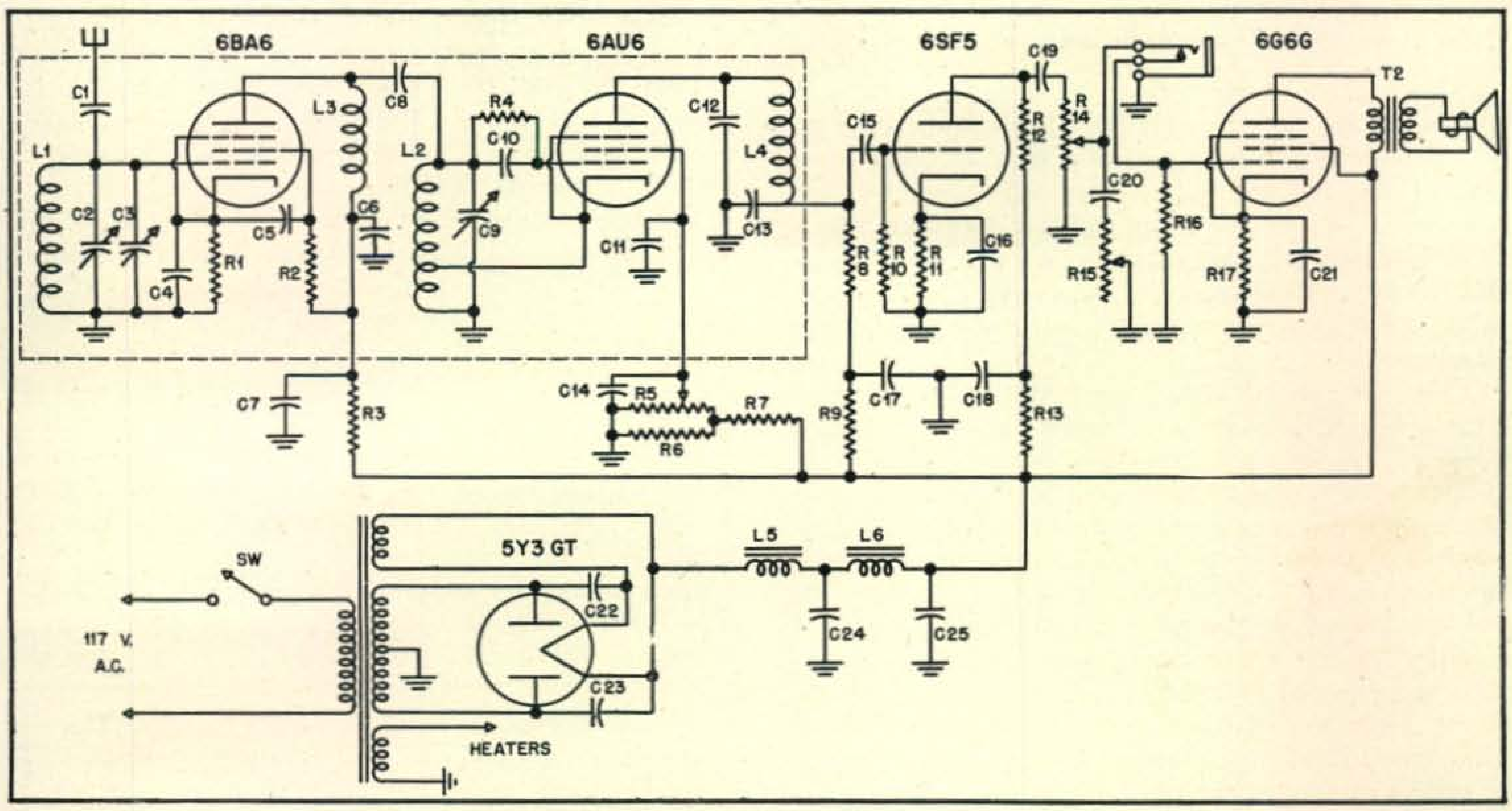
The time-tested electron coupled circuit was adopted for the regenerative detector, because it is reliable, requires little feedback winding for oscillation, is very stable, and coil winding is simplified due to the use of a single winding. With such a coil, there is no need for concern over proper phasing of the "tickler."

The tuned circuit was given special attention. Since the set was intended for use over the narrow tuning ranges of the amateur bands, it became feasible to use a very high *L/C* ratio, which would not have been possible had the circuit been designed for general coverage. Series bandspread was considered, and admittedly has some desirable features. However, there is a tendency toward crowding at the high frequency end of a band, the initial circuit alignment, particularly for more than one stage, is somewhat difficult, and the condensers must be reset for each band. For these reasons, and especially since it was intended that the receiver be simple enough to be duplicated by beginners, series bandspread was rejected. In fact, no bandspread whatsoever is used, which actually works no hardships. Because of the small maximum to minimum tuning capacity ratio, the ham bands are spread over the major portion of the dial, which results in ease of tuning, plus the advantage that there are no bandset condensers to adjust.

An r-f amplifier is needed ahead of the detector to minimize the effects of antenna loading, as well as to reduce radiation from the oscillating detector. This stage also has a high *L/C* tuned grid circuit, thus giving additional gain and selectivity. A 6BA6 miniature pentode was chosen for this stage, this time a remote cutoff type to prevent undesirable effects of signal overloading. An r-f trimmer allows peaking of the stage on any particular signal, which assures perfect alignment of the two tuned circuits. No other control is located in the r-f stage, which eliminates interaction often found between an r-f gain control and the regeneration control.

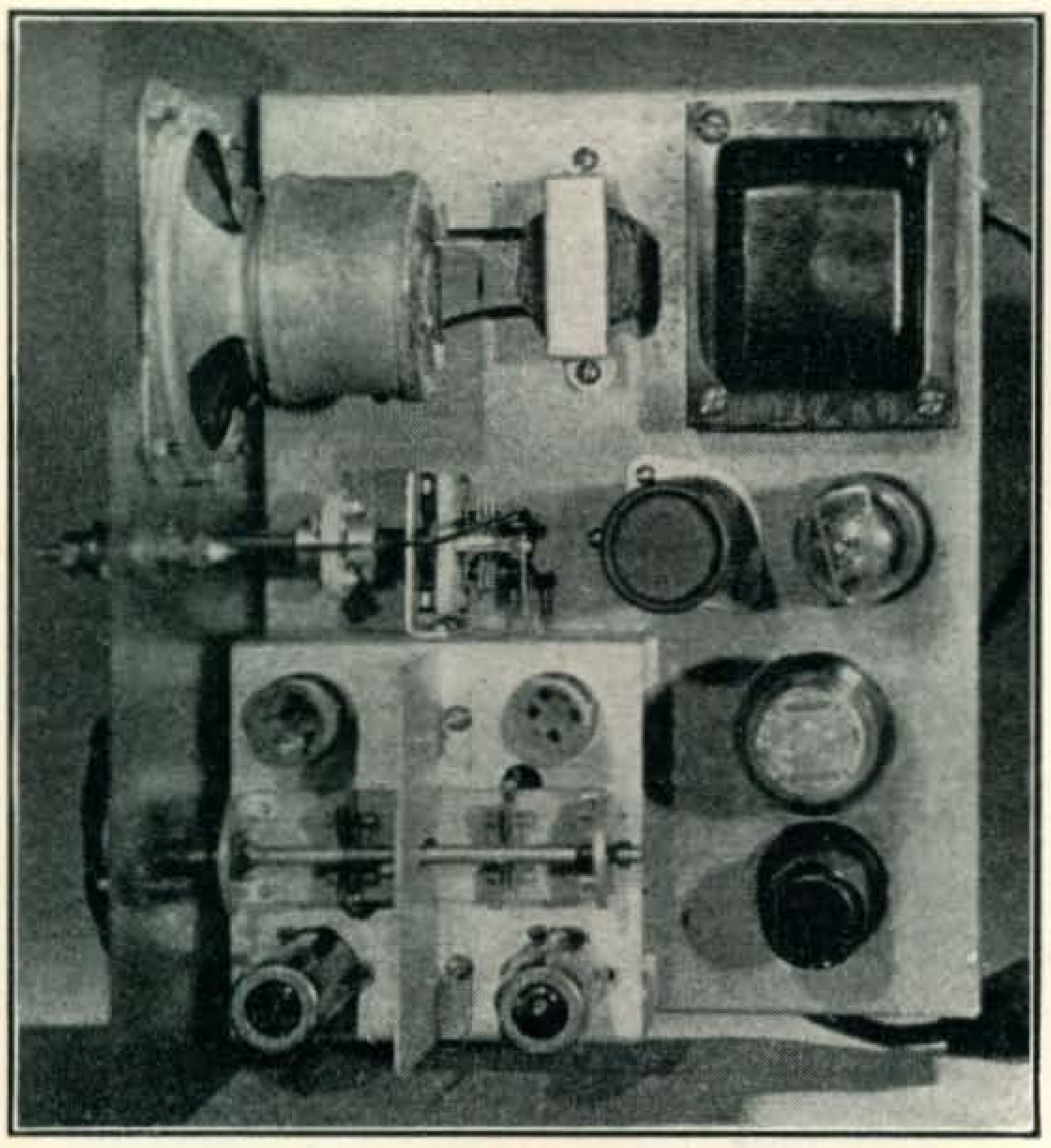
The sub-assembly construction of the r.f. and detector is of considerable importance in the isolation of the stages from each other, as well as from the audio and power supply circuits. Such constructional practice has long been used for v-h-f equipment where short leads and minimum interaction are most essential. Its use in this lower frequency receiver results in superior operation and stability not usually found in simple regenerative sets.

In order to provide a maximum of usefulness, the receiver includes both headphone and speaker output. The first audio tube is a high-gain metal 6SF5 which provides more than ample signal to drive the



Circuit diagram of the de luxe regenerative receiver.

C1—3-30 μμf, compression mica, semi-variable antenna coupling condenser.
C2, C9—3-15 μμf, miniature variable, two-gang cut down to 5 plates per section.
C3—3-15 μμf, miniature trimmer.
C4, C5, C6, C11—.01 μf, 200 v., mica.
C7—.1 μf, 400 v., paper.
C8—500 μμf, silver mica.
C10, C12, C13—250 μμf, silver mica.
C14—.25 μf, 200 v., paper.
C15, C16, C19, C20—.01 μf, 400 v., paper.
C17—8 μf, 450 v., electrolytic.
C18, C24, C25—Triple 8 μf, 450 v., electrolytic.
C21—10 μf, 25 v., electrolytic.
C22, C23—.002 μf, 600 v., paper.
R1—68 ohms, ½ w.
R2—30K, 1 w.
R3—10K, 1 w.
R4—1 meg., ¼ w.
R5—50K pot.
R6—5K, 1 w.
R7—25K, 2 w.
R8, R12—250K, ½ w.
R9—50K, ½ w.
R10, R16—500K, ½ w.
R11—2K, ½ w.
R13—20K, ½ w.
R14, R15—500K pot.
R17—500 ohms, 1 w.
L1, L2—See text.
L3, L4—2.5-mh r-f choke, pi-wound.
L5, L6—30-henry 50-ma open frame filter chokes.
T1—Power transformer: 50 ma, 650 v., center tapped; 5 v. at 2 amps; 6.3 v. at 2 amps.
T2—Output transformer: 10K plate-to-speaker voice coil.
SW—SPST switch back on R14.
J—Close circuit type phone jack.



The small sub-assembly houses the r-f stages and antenna trimmer (mounted outboard). Power supply and audio stages occupy balance of large chassis.

phones or following stage. A volume control is inserted ahead of the phone jack so that the output can be adjusted without the use of the regeneration control. The power output tube is a 6G6G, which supplies over one watt of audio with unusually low current drain. This permits the use of a low current supply, consequently reducing magnetic fields and coupling.

There is no need for a high fidelity audio system for communication work, instead this amplifier was designed for voice frequencies, which further reduces troubles from hum and noise. A small 3″ PM speaker provides sufficient volume for normal purposes, and is compact enough to be included in the receiver itself. The circuit resembling a tone control, connected in the second audio grid circuit, is actually intended for noise reduction. Although noise is generally of random frequency, suppression of the highs will often reduce the background noise sufficiently to permit copying a signal which would be otherwise lost in the hash.

It is possible to include the power supply on the main chassis without interaction because of the separate sub-assembly construction of the r-f stages, and the selection of a shielded metal tube for the high gain audio stage. The low current drain of the set also contributes to the reduction of power supply troubles, as mentioned previously. Small condensers are connected from plate to cathode of each diode of the rectifier to prevent tunable hum. Otherwise the power supply is conventional.

Construction

Construction of the receiver should not be difficult, provided a logical sequence is followed for mounting components and wiring. Since the parts layout on the main chassis is determined by the location of the sub-assembly, it is best to begin construction of the set with the r-f unit.

The small chassis for the detector and r-f stage should be made of aluminum for good shielding and low-loss ground connections, as well as ease of fabrication. Sheet aluminum of approximately No. 16 gauge makes a suitable material. The sub-assembly shown in the photograph was made from an old 16″ transcription base, which is soft enough to be readily bent and cut, yet results in a rigid unit.

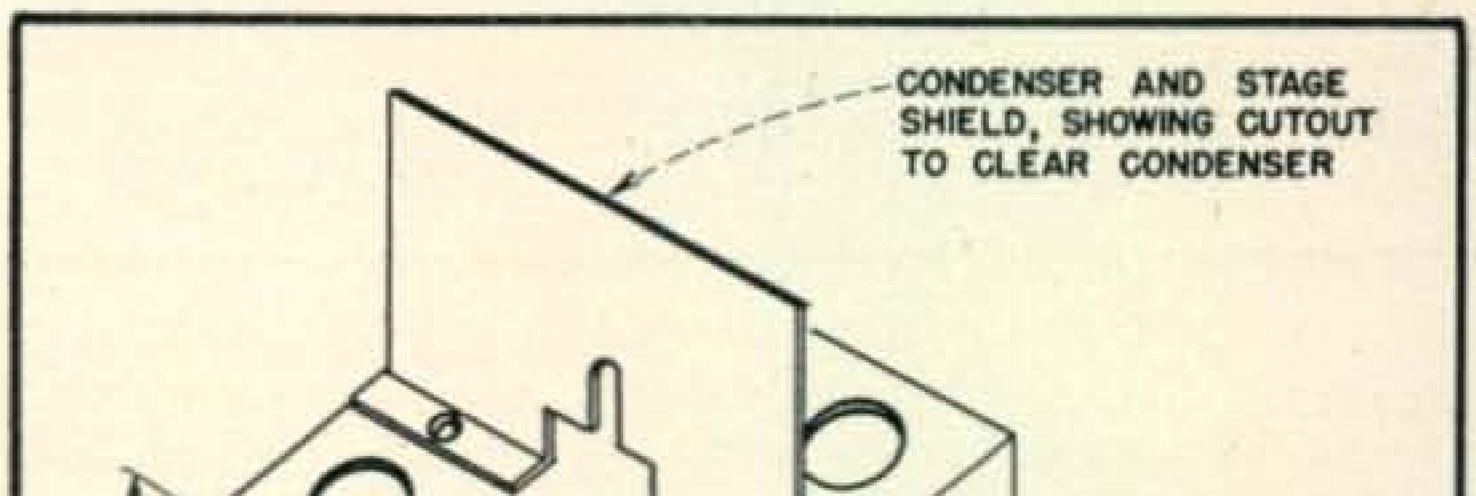
A piece of sheet aluminum 8½″ x 3¾″ will be needed for the chassis itself. A half-inch mounting lip is folded at each end of the longer dimension. The sides are then formed by bending each side again, these bends spaced 2″ from the lips. This will produce a "U" shaped chassis which is 3½″ x 3¾″ on top, 2″ high, with two ½″ mounting flanges across the bottom.

When the chassis has been bent into shape, the various holes should be cut. Two holes to pass the chassis mounting screws are drilled in each mounting lip, approximately ¼″ from each edge. These holes should be oversize to permit the sub-assembly to be mounted to the main chassis without difficulty.

The main condenser is a two-gang Hammarlund HFD or similar type, and is mounted so that it is centered on the top of the chassis with the shaft extending as much beyond the edge as possible. Holes to pass the leads from each stator section should be drilled directly below the solder lugs. These holes should be about 3/8″ in diameter to reduce capacity between the leads and the chassis.

The two tube sockets are mounted along the right side of the chassis, with the filament pins closest to the outside chassis edge, and positioned so that the sockets are equidistant from the edge of the tuning condenser and the chassis edge. The coil sockets are positioned in a similar manner along the left side of the chassis. Glove type shields are necessary for the tubes, and should be mounted at the same time as the sockets. When mounting parts, bear in mind that the r-f section is to the rear, and the detector is at the front.

The r-f trimmer condenser is mounted against the left edge of the chassis by means of a small aluminum



Rear view of r-f sub-assembly, showing positioning of brackets.

bracket approximately 1½" square, with a 3/8" mounting flange. The condenser should be spaced away from the bracket by small bushings, with a ¾" hole cut in the bracket to give plenty of clearance around the shaft. The lead from the condenser to the coil is brought through a 3/8" hole in the chassis. The condenser shaft is cut short and fitted with an insulated shaft coupling to isolate the condenser from the front panel.

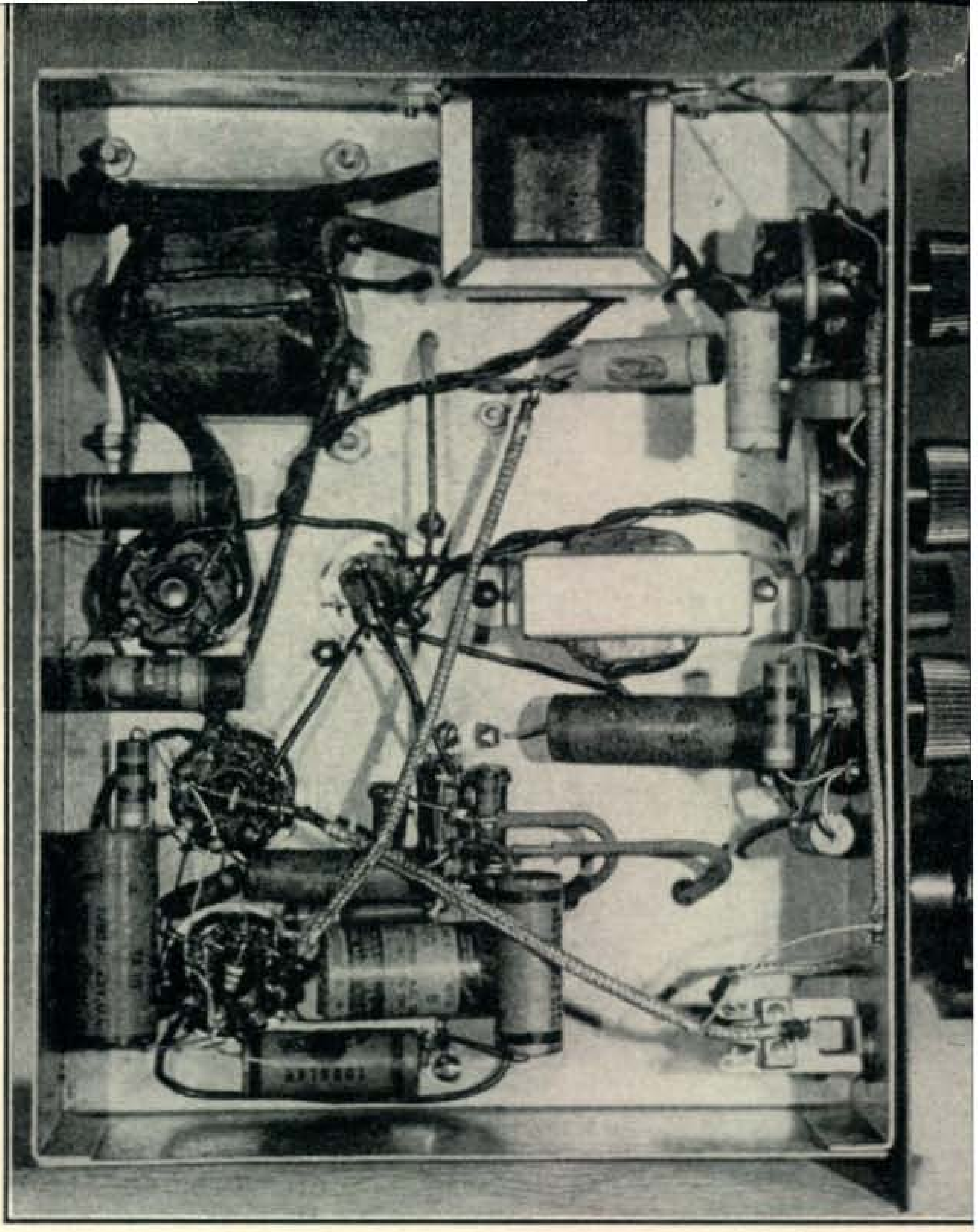
A shield to mount between the main condenser gangs is made by folding a ¼" lip along the wider dimension of a 2½" by 3½" piece of aluminum. A cutout must be made to clear the condenser shaft and base. A shield is also fitted beneath the chassis to isolate the two stages. The shield is approximately 3" long and 1" high, with a ¼" mounting flange. A 3/8" hole is drilled at the end near the tubes, to pass the lead from the interstage coupling condenser. This shield is then mounted directly below the tuning condenser shield, using the same two screws to fasten both shields to the chassis.

Small insulated tie-downs are fastened between the sockets of each stage, below the chassis, to anchor leads which go through the main chassis, thus avoiding any strain on sockets and components.

The sub-assembly is now ready for wiring. Light bus wire is used for all ground connections, and this is tied to the chassis itself at one point in each stage. One side of the heaters is grounded, and tied together with the other grounded tube elements right at the socket, including the metal ring shield located in the center of the socket. The other heater connections are wired in parallel and a length of wire attached to one socket which connects the remaining heaters on the main chassis. All by-pass condensers are mica or of the molded type to conserve space, and are wired with as short leads as possible, with connections directly to the sockets. To avoid stray capacities, all r-f leads are spaced from each other and from the chassis. The components within the dotted line section of the schematic are wired into the r-f assembly. Be sure to attach lengths of wire at the points where leads go to the circuits below the chassis.

The sub-assembly r-f section is one of the prime factors responsible for the high standards of performance obtained from this receiver. Short, direct leads in this section are used to obtain stable, trouble-free operation. Too much emphasis cannot be placed on the need for this method of wiring. It should also be pointed out that all components carrying r-f should be insulated with polystyrene or ceramic if circuit losses are to be kept to a minimum.

With the r-f section completed, work on the main chassis and panel is started. The chassis is a standard 7" x 9" x 2" unit, to fit a standard cabinet with 8" x 10" front panel. The chassis is of plated steel that provides magnetic conduction to help confine the magnetic fields from the power supply. The r-f assembly mounts at the front right corner, fastening to the main chassis with four small screws. Holes are cut in the main chassis to pass the leads which feed through from the sub-assembly. Once the r-f section is positioned, the remaining stages are laid out. Reference to the photographs shows that the audio stages are to the rear of the sub-assembly, with the first audio tube directly behind the r-f tube.



Efficient layout permits neat wiring. Simplicity of the receiver is underscored by the absence of clutter below the chassis. R-F assembly is above the chassis.

The power transformer is located at the rear left corner, as far from the r-f unit as possible. The filter condenser can and the rectifier tube are between the transformer and the output tube. A 3" PM speaker is mounted directly to the front panel, and the associated output transformer is directly behind on the chassis. The filter chokes are below the chassis, one mounting in front of the filter can, the other on the chassis side near the power transformer. These locations position the magnetic fields of each inductance at right angles to all others, thus reducing coupling and hum pickup.

The potentiometer controls are arranged along the front edge of the chassis, with the phone jack at the right corner. These control nuts are used to secure the panel to the chassis. The control below the speaker is the gain control combined with the a-c line switch. The center control is the noise reduction potentiometer, and the regeneration control is nearest the phone jack. The speaker is fitted with a panel grill to prevent damage to the cone. A smooth action vernier drive dial with oversize tuning knob fastens to the main tuning condenser. The r-f trimmer is between the speaker and the tuning dial. A polystyrene feed-through bushing brings the antenna through to the front panel, to avoid bringing the antenna near the rear chassis components.

Wiring of the main chassis is straightforward. Reference to the under chassis view shows that point-to-point wiring is used, with loose ends of components tied to terminal lugs. The leads from the first audio plate to the output grid are shielded and bonded to the chassis. No special precautions

(Continued on page 100)

What Makes the DX Man Tick?

Here are the results of a recent poll of DX men made to determine just what sets the DXer apart from his brother hams.

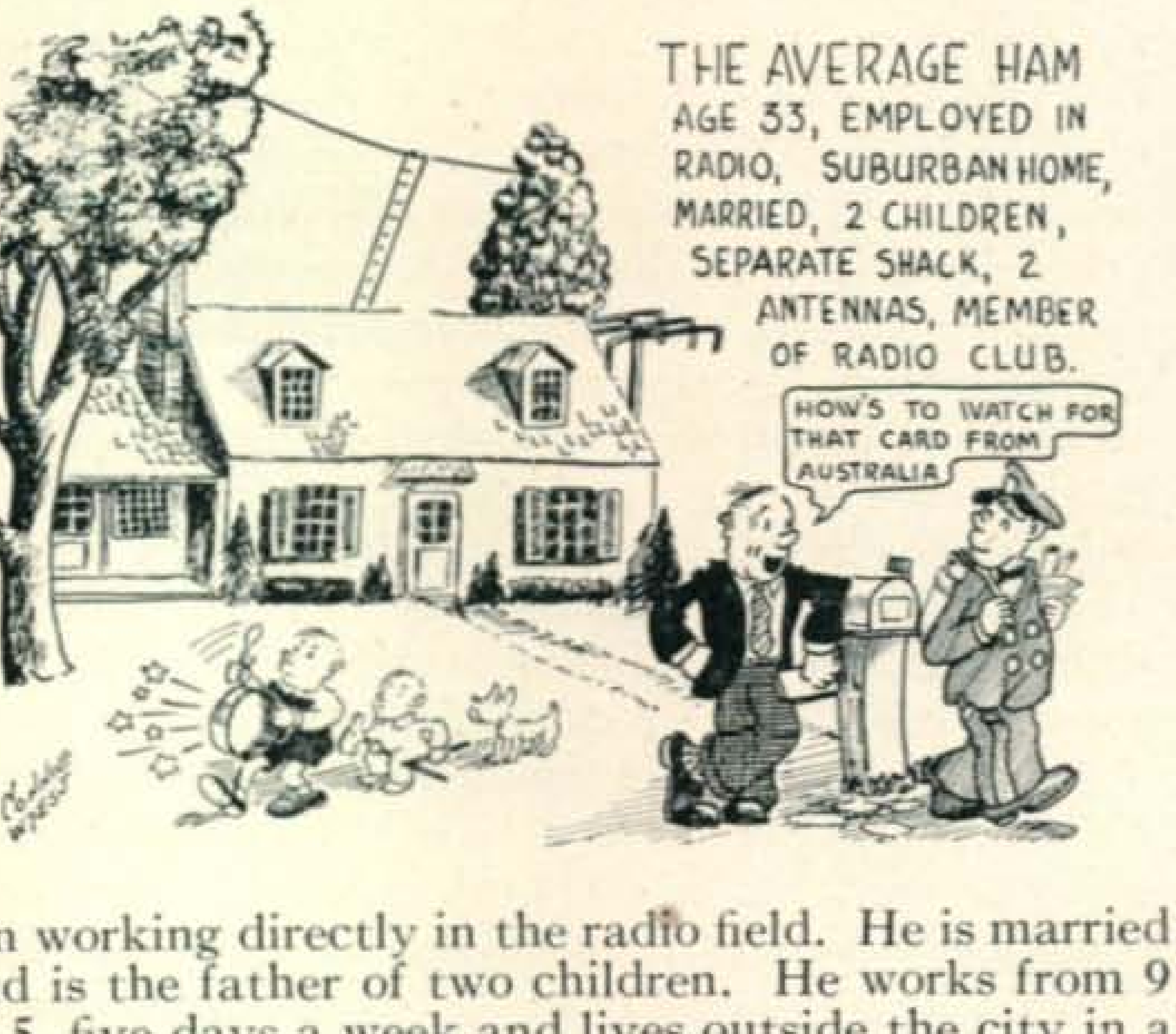
IF A POLLSTER were to sample the radio amateur hobby he would soon find that the field is divided into three distinct categories. One is the rag-chewer, who finds that his interests lie in discussing the affairs of the time, as well as those of yesteryear, with fellow hams down the block, or in the next hemisphere. The second is the experimenter who always feels that his rig could work a little better or he can build up something a little better than the next man. The last, but not least, is the DXer. He is the one who symbolizes the spirit of the first days of amateur radio—the working of DX from the farthest corners of the globe.

A few months ago Bob Chapman, W1QV, sent out a questionnaire to a group of well-known DX men. The purpose was to obtain some cross-sectioning of what the DXing amateur thought, who he was, and what equipment he used. Naturally, the entire body of DX men was not polled, but rather a sampling was taken in the method common to the better-known polls of public opinion. In this way an estimate in percentages and the probability figures for the whole group could be worked out.

Some of the results of this poll are given here. They show interesting things that heretofore had only been surmised about this group. However, all in all, it is doubtful that these opinions and figures differ too widely from those of the entire fraternity at large. As an example of this, let's look at the average amateur who is primarily interested in working DX. Average out a group of your amateur friends and see how close they come to this tabulated average ham.

The Average DXing Ham

The poll shows that the average ham may be described as follows: Age, 33 years; employed in a better-than-average position with six out of every



ten working directly in the radio field. He is married and is the father of two children. He works from 9 to 5, five days a week and lives outside the city in a suburban area. He has been interested in working DX for at least 15 years and is a member of an active ham club and attends as many meetings as possible. His equipment is generally located either in a room built especially for radio, or in the spare bedroom. He has at least two antennas, one of which is a rotating beam. He generally trys to rebuild certain sections of his transmitter each year, although five to ten years may elapse before a major change will be made.

Functional Transmitter Design

Ten questions in the poll related to the transmitters that were used to work so much DX. Our first thought was to determine whether separate transmitters, or if separate final amplifiers were used on the different bands. If not, how then did the operator shift from one band to another.

	YES	NO	Partially
Question 1. Do you use separate transmitters on each DX band?	19%	81%	....
Question 2. Do you use a separate final amplifier and the same v.f.o. on different bands?	6%	94%	....
Question 3. Does your transmitter have complete bandswitching, or just partial bandswitching?	21%	30%	49%

It was apparent from the returns to *Question 1* that few amateurs could afford the time and expense involved in using separate transmitters on the DX bands (i.e., 10-20-40 meters). Undoubtedly, the gap between the 19% who had separate units and the 81% who did not would widen considerably when the fraternity was grouped at large. As an alternative, the use of a separate final amplifier apparently was not as attractive as it might at first appear. Of those polled only 6% had designed their transmitters to feed into separate finals on each DX band. Bandswitching also posed a constructional problem and the returns tell us that only 21% of those who regularly participate in the Sweepstakes were using direct complete bandswitching arrangements. 30% of the amateurs had no provisions at all for bandswitching, while about 49% had partial switching.

The tabulations show that the average DX man uses the same transmitter on all the principal DX bands. Bandswitching in the v.f.o. or the crystal oscillator stages is quite common, while plug-in coils rather than bandswitching are used in the buffer and final amplifier stages. The poll also told us that a few amateurs had designed broad bandpass buffer stages for ease in v-f-o operation and a very low percentage (less than 3%) used shorted turns to drop down from the lower to the higher frequency bands.

The data on power input was indirectly obtained in the questionnaire by noting the tubes used in the final amplifier. Making allowances for the general inaccuracies of this method it was found that of those polled about 9% were operating near the

1000-watt input limit. The returns showed that 100% of the DX men were using more than 100 watts and 93% used more than 250-watts input. The greatest number (68%) used between 500 and 600-watts input.

Receiving Arrangements

The next group of questions dealt with the receiving equipment and its operation. 89% of the DX men were using standard communications receivers, of which 10% were obtained as war surplus. Only

THE POWER AND CW-PHONE BAND QUESTIONS

9% found it necessary to make any modifications in the standard models, although 58% were using additional r-f stages on either 10 or 20 meters. 44% of those polled were using converters for 10-meter band coverage. Several additional questions were included.

	YES	NO
Question 1. Do you operate break-in?	58%	42%
Question 2. Do you use a separate receiving antenna?	12%	88%
Question 3. Do you use headphones a large percentage of the time for c-w work?	70%	30%
Question 4. Do you use a keying monitor?	63%	37%

The answers to this group of questions gave some indication of the flexibility of the receiving setups. Definite provisions for break-in operation was made by 58% of those tabulated. With regard to *Question 2* the 12% who use separate receiving antennas is slightly greater than normal, since a partial inclusion has been made of those requiring separate antennas for break-in operation. It was found that approximately 96% of the DX men use the transmitting antenna for reception. Nearly three-quarters of the group use headphones for c-w work, while two-thirds have keying monitors.

The Location and Station QTH

There has always been some speculation whether a basic requirement in working DX was an extra-good location, or at least, one above the average of John Q. Ham. Actually, it is difficult to assay a good location and the poll was carefully rephrased to enable the questionee to make his own decision. Then to further ascertain the type of location we added two more questions concerning possible interference problems.

	YES	NO	SOME
Question 1. Do you consider location above the average?	38%	62%	....
Question 2. Do you have much interference from automobile ignition?	46%	34%	20%
Question 3. Have you any more hams in your immediate vicinity to cause you local QRM?	64%	36%	....

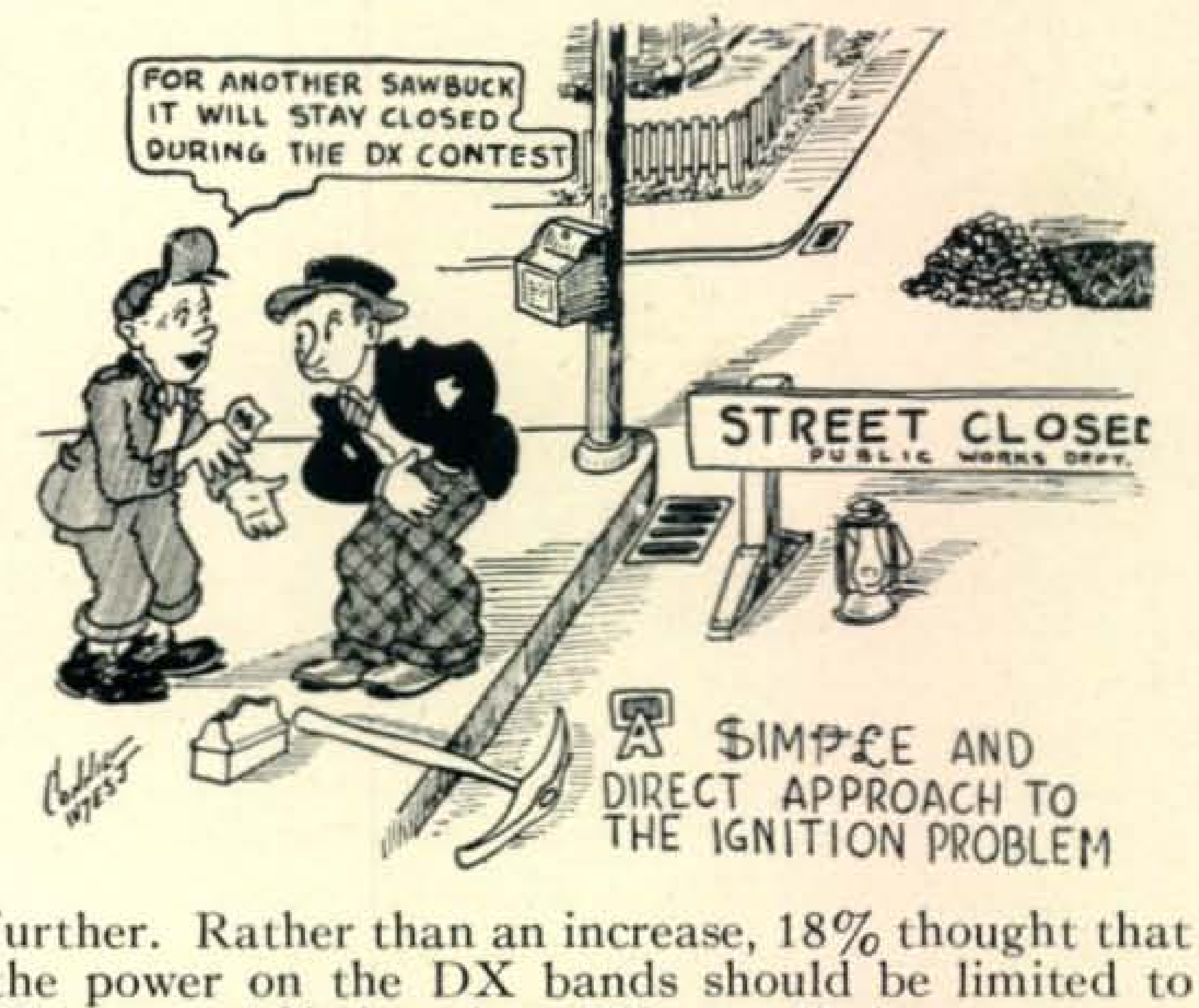
The answers to these questions shed some interesting sidelights on what the DXing ham thought of his station QTH. Of those polled 62% stated specifically that their location was *below average*. If considered alone it would have been thought that many amateurs were prone to under-rate their locations. However, an interesting correlation was developed between the below average location (62%) and the local QRM from fellow hams (64%). Only one amateur thought that his location was near his ideal, while 7% of those volunteered the information that their QTH was extremely poor—based on any amateur standards. Ignition QRN is experienced to some degree by 66% of the hams, although 20% stated that it was only noticed on the 10-meter band. Additional comments showed that one location was troubled with QRN from oil well drilling machinery, while another could count 18 other 20-meter band operators within a ½-mile radius of his station.

Operating Procedures

The last group of questions was designed to deal entirely with opinion subjects. The returns gave a fair impression of what the DXing ham thought of certain vital issues that concerned his activities as a whole.

	YES	NO	SOMETIMES
Question 1. Are you in favor of more power?	13%	87%	....
Question 2. Do you think calling CQ DX is poor procedure?	50%	36%	14%
Question 3. Do you favor answering and calling DX stations on the same frequency to keep the QSO in one channel?	30%	60%	10%
Question 4. Do you think certified logs sworn to under oath should be accepted in lieu of QSLs for awards?	26%	68%	6% (no opinion)

The question of maximum power for amateur transmitters showed an overwhelming response that the 1000-watt input limit should not be raised any



A SIMPLE AND DIRECT APPROACH TO THE IGNITION PROBLEM

further. Rather than an increase, 18% thought that the power on the DX bands should be limited to 250 watts, 4% thought a 100-watt limit was reasonable under the present congested conditions. Oper-

(*Continued on page 95*)

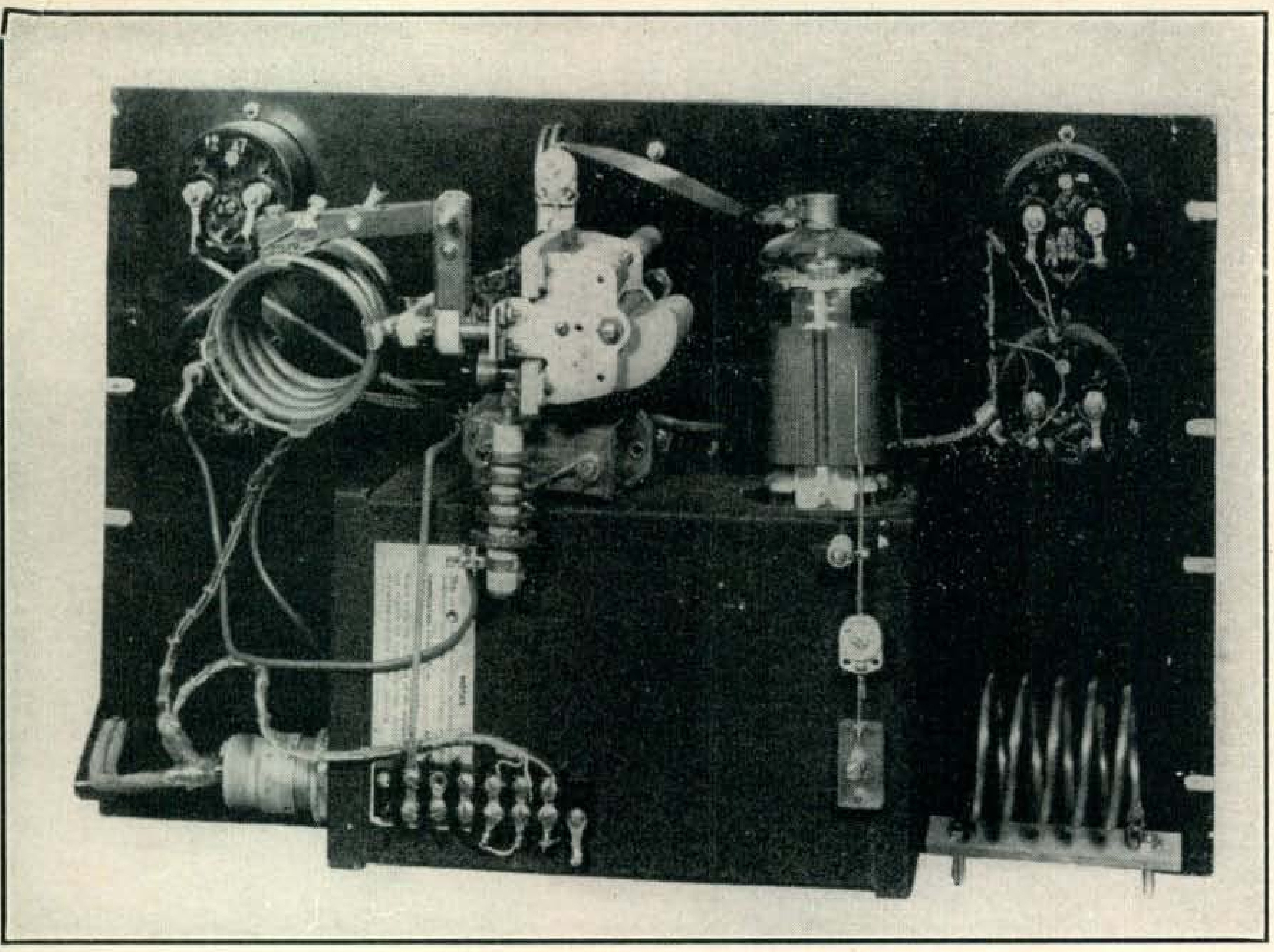


Fig. 1. Rear view of the transmitter. The neutralizing condenser is a short wire running parallel to the plate of the 813 final amplifier. A spare coil for 11 is in the right foreground.

10 Is The Band!

FRANK LESTER, W2AMJ *

Tops in popularity with the phone man, DX and local rag-chews make 28 mc ideal for the one-band operator. W2AMJ's auxiliary transmitter is designed specifically for 10 and 11.

THIS TRANSMITTER is used as a supplement to our 6-meter rig. Since it uses the same power supplies and modulator as the 50-mc outfit, and as it is only intended for radiophone operation in the 10-11 meter band, the physical size was reduced to a near minimum. In spite of a lot of reports to the contrary, we found it relatively simple to build up an 813 final amplifier which worked smoothly.

The challenge of taming the 813 final weakened considerably when the stage was fully and properly shielded. The principal working components are all contained in an aluminum box measuring 9¼ x 5¾ x 4½ inches. Only one plug-in coil is used and that in the final amplifier. B. & W. Miniductors were soldered directly into the circuit in all low power stages.

Transmitter Circuit

The circuit employed is as fool-proof as one could desire. The only unusual part of it is the Les-Tet oscillator frequency multiplier circuit utilizing a 6C4-6AQ5 tube combination. The circuit was developed by the writer and will be recognized as an inverted or cathode tuned oscillator directly coupled to the frequency multiplier. The circuit offers all the advantages of the usual Tri-Tet, but is much richer in harmonic content, free from self-oscillation and parasitic oscillation, and is very easy on the crystal. A particular feature is that with the Les-Tet circuit when the crystal is not oscillating, or if the cathode circuit is not properly tuned, the plate and screen current of the 6AQ5 keep well within plate dissipation ratings. This is primarily due to the rather large cathode resistor, *R2*. The combination is followed by a single 2E26 employed as a frequency doubler. The 2E26 was chosen because it was felt that this tube would be more than capable of driving the 813 regardless of any circuit losses. After the transmitter was constructed it was found that the 2E26 does actually over-drive the 813 even with the cathode potentiometer, *R5*, set at maximum resistance.

With 300 volts applied to the 2E26 plate the combined plate and screen current is of the order of 40 ma. This develops 8 ma of grid current through the 25,000-ohm resistor, *R8*, of the 813 final. Actually the 300 volts could be reduced to lower this grid current to the recommended value of 6 ma. The plate efficiency that is obtained is from all indications between 75% and 80%. With an input of 400 watts (2000 volts at 200 ma) a dummy load of three 100-watt lamps exceeded full brilliancy.

The grid neutralization system eliminates the need for a split-stator condenser in both the grid and the plate tank circuits. It also simplifies the plate tank coil neutralizing and lowers initial cost. In order to maintain a balanced circuit the unloaded side of the grid coil from which we obtain the neutralization voltage has a 20-$\mu\mu$f condenser (*C14*)

*240 W. Main St., Bergenfield, N. J.

connected from this point to ground. This capacity approximates the input capacity of the 813 and the output capacity of the 2E26 shunting the other half of the coil (center tap is grounded for r.f.) and therefore tends to balance the circuit. This also eliminates the need for neutralizing when changing frequency.

The 813 Final Amplifier

The 813 final did not require any taming, due primarily to the excellent shielding and the absence of parasitics in the preceding stages. Using the normal grid dip method of visual indication for neutralization indicated that the 813 did not require any neutralization. With the bottom lead from the split coil disconnected, no grid current flicker in the grid meter could be observed as the plate circuit was tuned through resonance.

Sometimes this indication is not sufficiently sensitive and an r-f galvanometer or some r-f indicator should be used to determine whether or not neutralization is necessary. In our case, we used two turns approximately the same diameter as the plate coil shunted with an r-f galvanometer. The two-turn coil was tightly coupled to the plate tank at its low potential end. It was found that without neutralization a reading of from 80 to 100 ma (current squared) could be obtained at plate circuit resonance (plate and screen voltages *disconnected* and grid drive applied to the 813), although no grid current flicker was observed with the former system.

The homemade neutralizing condenser may be seen in *Fig. 1.* It consists of a short piece of No. 12 wire and a small ceramic trimmer, *C16*. A lead is brought out from the grid coil through the wall of the aluminum box to the ceramic trimmer which is supported at the upper portion of the box by a standoff insulator. The wire then bends in slightly toward the 813 glass envelope, and is about 3/8 inch from the envelope for a distance of about 1½ inches. Rather than bend the wire closer or farther away from the tube to neutralize, the ceramic trimmer is the adjustment.

The proper procedure for neutralization is to completely disconnect the B supply returns from the 813 plate and screen circuits. Do not merely open the primary circuits of the high voltage supply leaving the plate and screen returns to ground through the supply proper. This gives a false reading and is often the cause of many headaches in transmitters that cannot be neutralized. With the supply returns disconnected and with 10 ma of grid drive to the 813, the ceramic trimmer was adjusted until no reading could be obtained. If the minimum reading is obtained near the minimum setting of *C16*, a short piece (about one-half inch) should be clipped from the end of the wire lead near the glass envelope.

Fig. 3 shows the bottom view of the chassis when

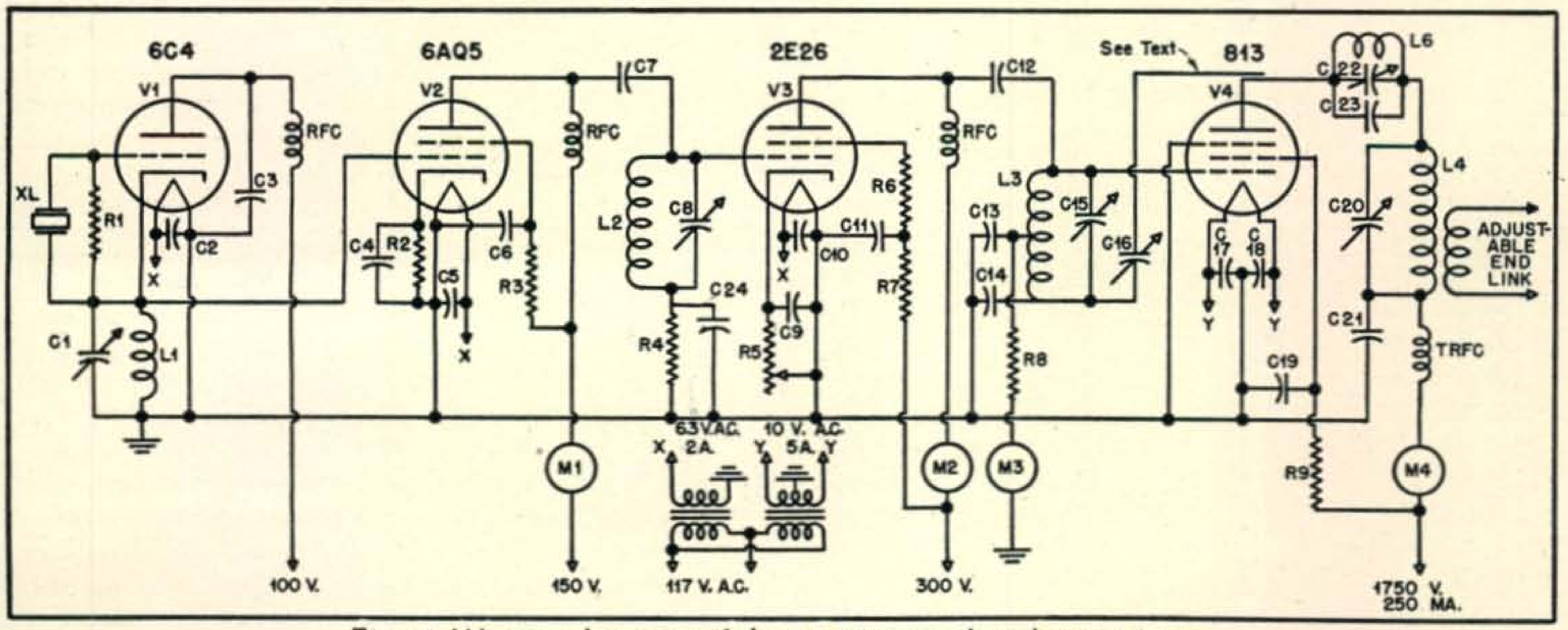


Fig. 2. Wiring schematic of the 10-11 meter band transmitter.

C1—140 μμf, midget variable.
C2, C3, C5, C6, C10, C13, C17, C18—400 μμf, button type.
C4, C12—150 μμf, mica, 500 volts.
C7—.001 μf, mica, 500 volts.
C8—25 μμf, midget variable.
C9—.01 μf, mica, 500 volts.
C11—680 μμf, GP1 Erie Ceramicon.
C14—20 μμf, GP1K Erie Ceramicon.
C15—50 μμf, variable.
C16—3-12 μμf, Erie Ceramicon trimmer.
C19—.001 μf, mica, 2500 volts.
C20—25 μμf, variable, 4000 volts peak.
C21—.001 μf, 5000 volts.
C22, C24—7-45 μμf, Erie Ceramicon trimmer.
C23, C25—50 μμf, silver mica.
R1—100,000 ohms, ½ w.
R2—2500 ohms, 10 w., wire-wound.
R3—56,000 ohms, 2 w.
R4—27,000 ohms, 1 w.
R5—1000-ohm potentiometer, 25 w., wire-wound.
R6—50,000 ohms, ½ w.
R7—15,000 ohms, 2 w.
R8—25,000 ohms, 5 w., wire-wound.
R9—60,000 ohms, 75 w., wire-wound.
RFC—2.5-mh. choke.
TRFC—500-ma transmitting choke, National R154.
L1—20 turn. ¾" dia., B.&W. No. 3011.
L2—18 turns ¾" dia., B.&W. No. 3011.
L3—12 turns at 9 turns per inch, ⅝" dia., No. 14 wire.
L4—4 turns ¼" copper tubing, 2¼" O.D., spaced to 3" for 10 meters.
L5—Same as L4 but made with 5 turns.
L6—2 turns, No. 10 wire, ⅝" I.D.
V1—6C4
V2—6AQ5
V3—2E26
V4—813
M1, M3—0-20 ma meter.
M2, M4—0-300 ma meter.

it is removed from the shield can. The oscillator tuning condenser and coil can be seen in the lower left. In approximately the center is the plate cap of the 2E26, while in the lower right are the center-tapped grid coil and tuning condenser of the 813 grid circuit. A split-stator is used here with the rotor floating. Any sufficiently insulated 25 to 35-$\mu\mu$f variable might be used, but keep in mind that all parts of the condenser are above ground.

The top view is shown in *Fig. 4*. The 6C4 and 6AQ5 are seen in the upper left-hand corner of the compartment. In the center is the 2E26 socket. This socket is constructed from an Amphenol socket intended for above chassis mounting which is taken apart and reversed. The shell is then supported from the chassis with three one-inch long brass spacers. The shell now shields the lower portion of the 2E26 tube and provides a substantial mounting platform. On the extreme right is the socket for the 813 final amplifier. The 1000-ohm 25-watt potentiometer, *R5*, that adjusts the grid drive to the 813 is visible just below the oscillator-multiplier tubes.

The power supply requirements for the crystal oscillator and frequency multiplier as well as the 2E26 doubler can readily be taken care of by almost any small receiver-type power supply. These stages require about 300 volts at 75 to 100 ma. A single section filter with condenser input of 4.0 to 6.0 μf either side of a 20-henry choke is recommended. A 25,000-ohm 50 to 80-watt, wire-wound resistor should be used as a bleeder. Two sliders may then be adjusted to obtain the 100 volts for the 6C4 plate and the 150 volts for the 6AQ5 plate. It is suggested that a low voltage electrolytic of about 8 to 10 μf be connected from the 100-volt tap to ground and a 0.1-μf tubular from the 150-volt tap to ground.

Under normal operating conditions the crystal oscillator plate will draw between 4 and 5 ma, the 6AQ5 will draw between 7 and 8 ma combined plate and screen current. The 2E26 doubler should draw about 40 ma of combined plate and screen current. These readings were taken with the transmitter completely tuned up. A meter is not incorporated in the crystal oscillator since proper adjustment of this stage will result in the plate and screen current of the 6AQ5 rising from approximately 5 ma when the crystal is not oscillating to about 10 ma when it is oscillating and tuned up.

Protection for the 813 against overload is desirable. Plate protection can be an overload relay in series with the center tap of the high voltage transformer. Grid excitation failure can be protected against by placing a sensitive relay in series with *R8* and the grid milliammeter. This relay is closed by the flow of grid current and has its contacts in series with plate primary transformer relay. If excitation fails it will open removing the h.v. We used a 2000-ohm coil SPDT Sigma relay. An alternate method is to use the sensitive relay with *R8* substituted by a 12,500-ohm 5-watt resistor, the relay coil and an 8000-ohm 5-watt resistor connected in series in this order. The moving contact is grounded. The top contact is connected to the junction of the 8000-ohm resistor and the bottom of the relay coil. The bottom contact is connected to the filament c.t. with a 1500-ohm 50-watt resistor connected from the filament c.t. to ground. With grid drive the relay closes shorting the 1500-ohm resistor. Without grid excitation the 1500-ohm resistor will limit the plate current and short out the 8000-ohm series grid resistor to help overcome the additional bias provided by itself. This second version is entirely automatic and self-cycling and eliminates any need for a plate primary relay.

A short time after this transmitter was put into operation a complaint was received from a television receiver owner, located approximately 300 feet from the writer. Since the 6-meter transmitter did not bother this same receiver it was apparent that the cause of the interference was most likely the second harmonic output of the new 10-11 meter transmitter.

A field strength meter capable of tuning to the frequency of the harmonic is a necessity in determining the amount of power being radiated. A sensitive meter using a tuned circuit, crystal diode and microammeter was built for this purpose. It uses a small adjustable antenna which when collapsed is about 12 inches long. The field strength meter should be placed on a table, step ladder, or any other convenient rigid support enabling a fixed reading to be obtained. Depending on the power output of the transmitter the small antenna is brought near to the antenna feeders until a suitable indication is obtained and a definite peak observed when tuning to the second harmonic. Placing the meter approximately one foot from the 300-ohm Twin-Lead gave an indication of about 150 μa. This

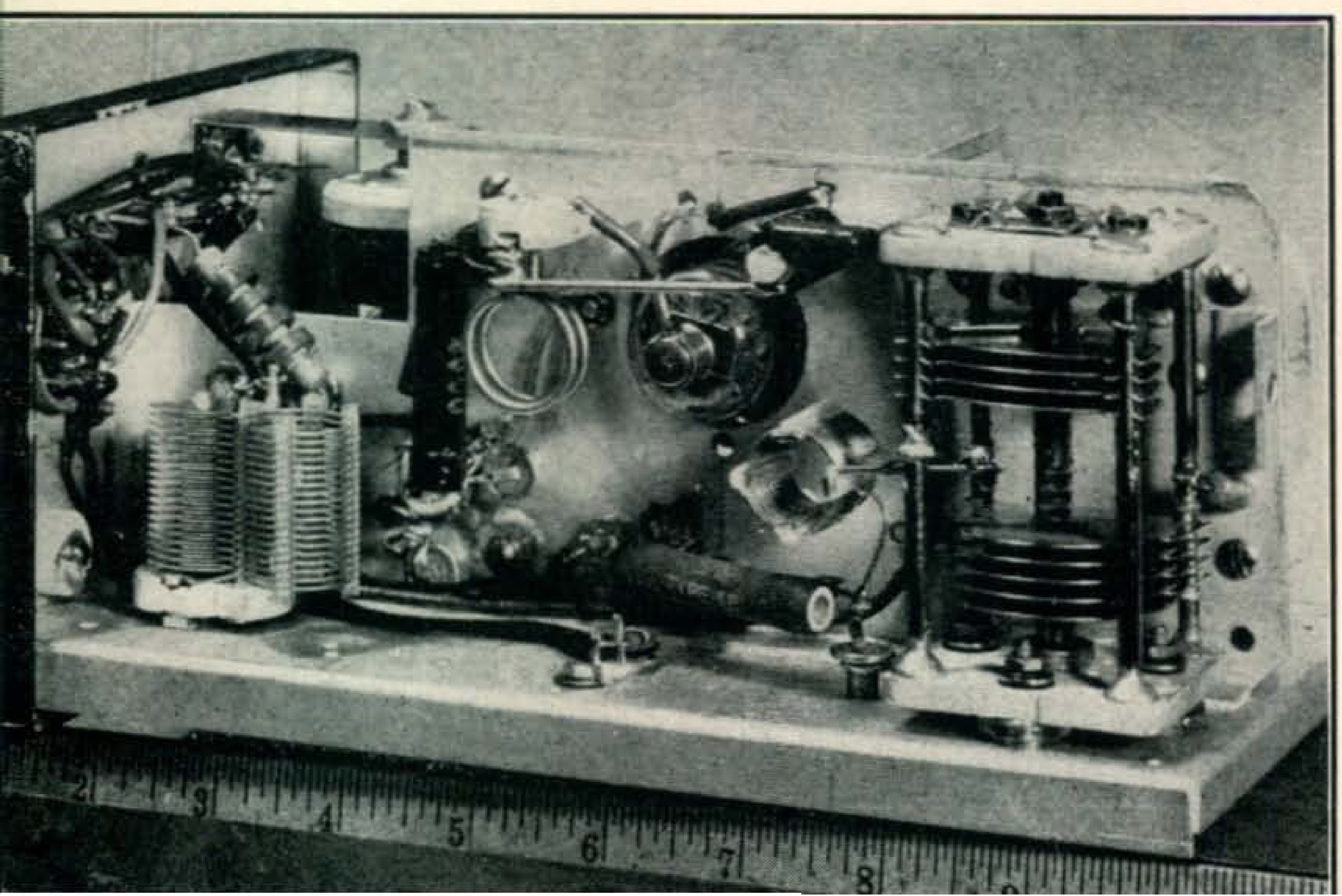


Fig. 3. Because the transmitter is only to be used on 10-11 meters the coils may be soldered directly into the circuit. The 2E26 doubler protrudes through the wall. The second harmonic trap at the left center was removed. The split-stator is not required and was used only to obtain the desired tuning capacity.

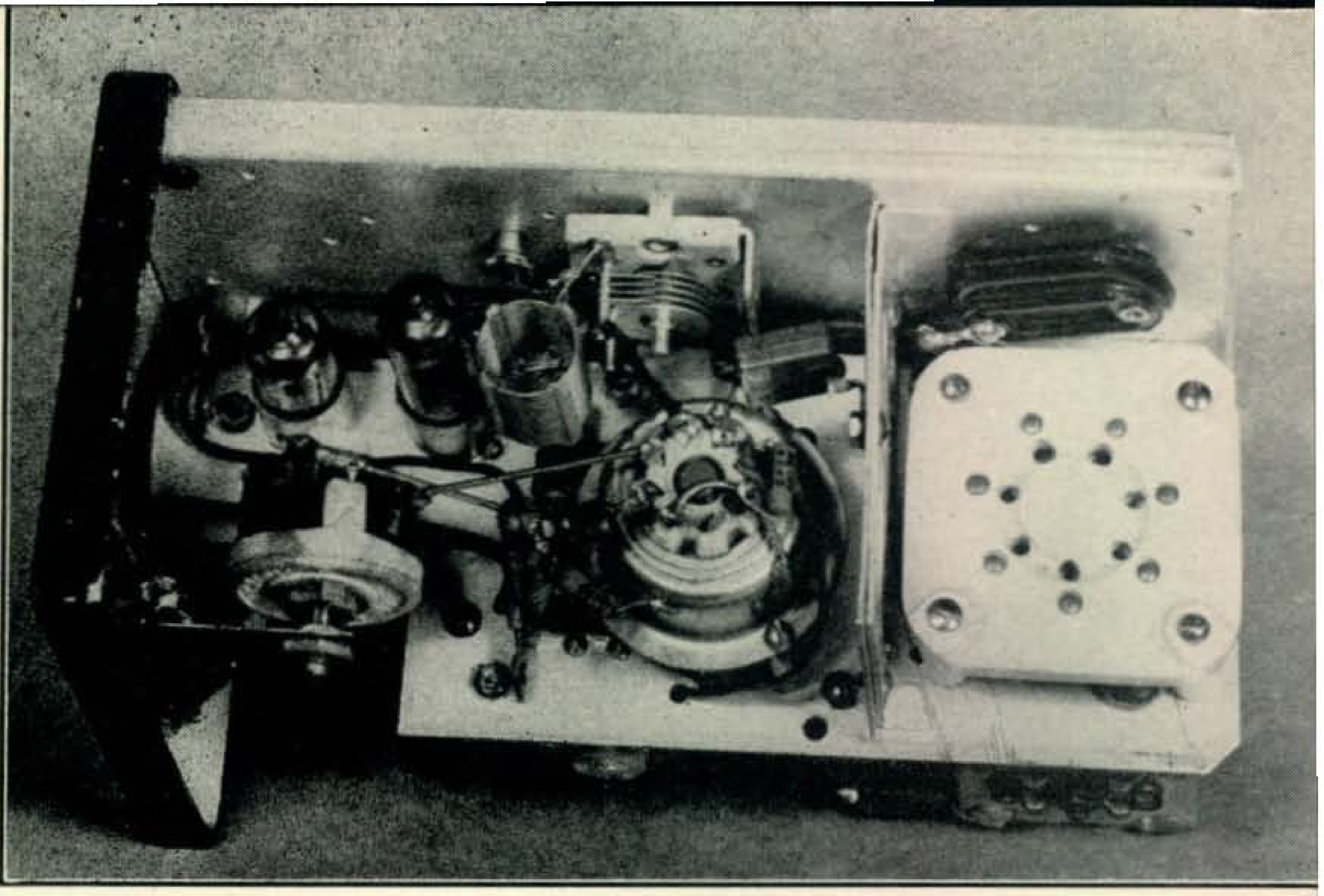


Fig. 4. Top view showing the locations of the tubes. The 6C4 oscillator, 6AQ5 multiplier, inverted 2E26 and 813 socket in the usual order. Potentiometer at the lower left regulates the 813 grid drive.

reading at this distance from the line indicates a comparatively low harmonic content being radiated. However, even this reasonable amount is often too much for television receivers in the immediate vicinity.

Curing this case of TVI consisted of putting a small wave trap tuned to the harmonic in series with the plate lead of the 813. This trap must have a very high *C*, since while we desire it to tune to the harmonic, we also want this extra tuned circuit to have as little effect on the 10-11 meter tank as possible. The actual trap consists of two turns of No. 10 wire, ¾ inch O.D. soldered across an Erie Ceramicon trimmer, *C22*. The trimmer has a range of 7 to 45 $\mu\mu$f and is paralleled with a 50-$\mu\mu$f silver mica, *C23*. Tuning the trap brought the field strength reading down to about 30 μa. However, quite likely the actual harmonic content was considerably lower as the meter was nearly driven to this value by shock excitation from the r-f field.

This one trap in the lead to the plate of the 813 resulted in elimination of this instance of TVI. It is well to remember that it does not require much power to create TVI. An example of this is the 6C4 oscillator in our 6-meter converter that runs with only 50 volts on its plate, but is still capable of messing up the picture on a television receiver in the same house.

Match the Beam to Any Line

NORMAN JERVIS, ZS2F*

THIS IS A HINT for those brother hams who must make do with low power. The purpose is to show a method of matching the driven element of a parasitic beam to any given impedance of feed line. The system has been employed at ZS2F for quite some time with results that should speak for themselves.

It is known that the impedance of a solenoid type coil is zero at its exact center. If we take a pair of feeders and attach them at the appropriate points either side of center we can make the feed line look into any desired impedance. By moving the connections various distances from true center we can increase or decrease this impedance accordingly. Thus, an antenna whose radiation resistance varies because of the spacing and number of parasitic elements may be effectively matched to the more common types of coax and twin-leads. *Fig. 1* shows the electrical connections of such a system.

The size and the number of turns for the coil at the center of the driven element will vary for each installation. Naturally, do not use more turns than are actually necessary for a 100% match. Also, it will be appreciated that the radiator will be shortened by, roughly, the length of the wire used in the coil. This is no objection as its slight effect is compensated for many times over in the better match and consequent higher efficiency of the radiator.

In our particular case a coil of nine turns of No. 14 wire one inch in diameter is used. The feeder is rubber covered twisted pair with a characteristic impedance of about 80 ohms. The line is attached one half turn from each end of the coil or four turns

(*Continued on page 101*)

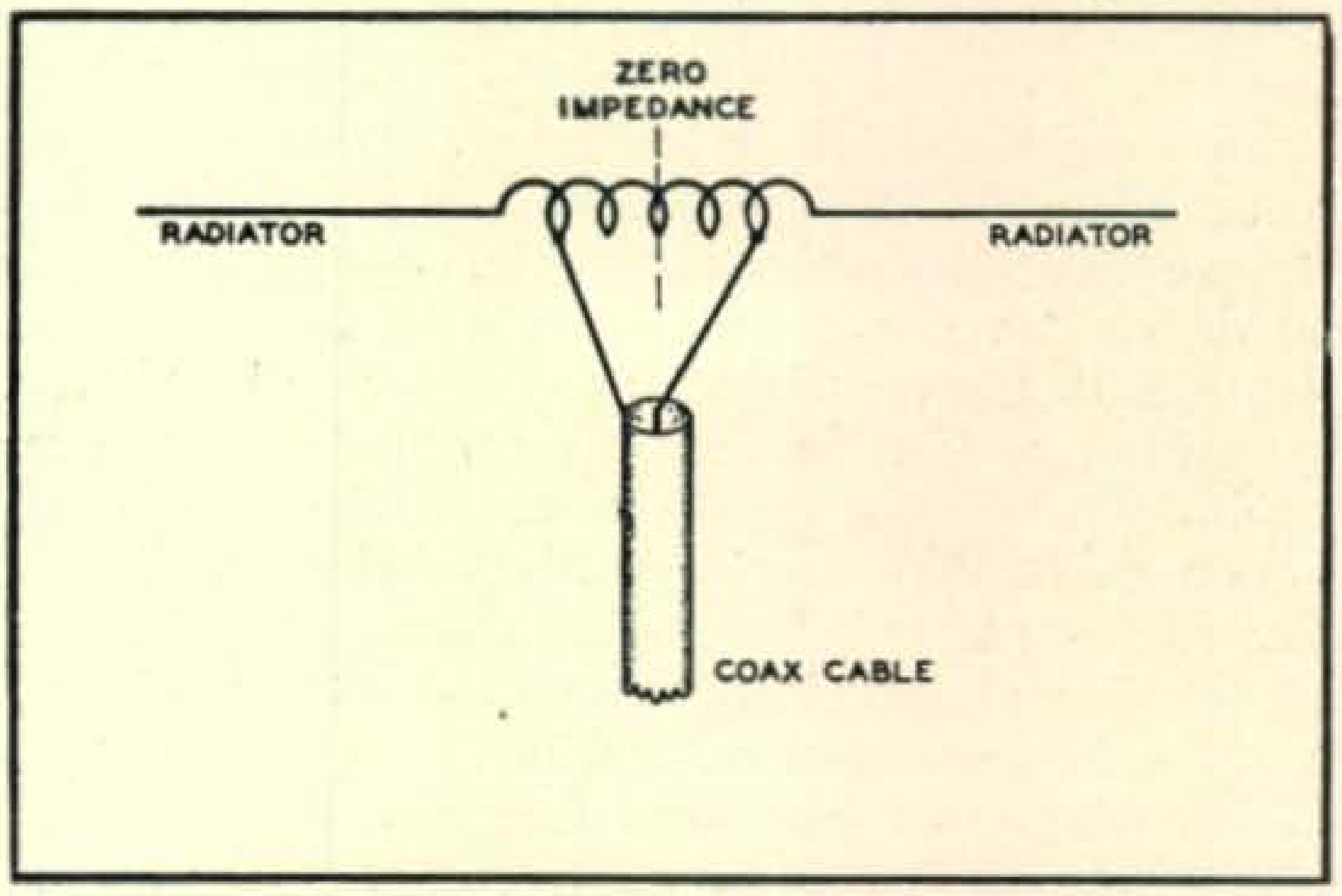


Fig. 1. Method employed by ZS2F for impedance matching.

22 Salisbury Ave., Port Elizabeth, South Africa.

Putting the BC-455 on 10

EVERETT J. GILBERT, W9MSP*

A simple conversion for the phone man of a popular surplus receiver.

Many articles have been written on the conversion for amateur use of war surplus receivers and transmitters. To them should certainly be added the conversion of the BC-455B receiver for 27 to 30-mc operation. Very few additional components are needed and the antenna input may be adapted for either single-wire or doublet lead-in.

The parts required are a power supply furnishing either 6.3, 12.6, or 28 volts for the filaments and 250 volts for the plates. Also, a phone jack, plate switch, midget 25,000-ohm potentiometer, a five-prong socket with male plug to match power connections at the rear of the chassis, and several small resistors and condensers.

The first step is to take out the small can insert at the bottom front of the panel. This can contains male and female plugs which are clipped free of all wires close to the plug terminals. This will allow room for the controls which are mounted on the front plate. The midget potentiometer which is to serve as an r-f gain control is mounted in the center with the B− control switch on one side and the phone jack mounted on the other side.

The filament circuit is then rewired to match the new power supply. The BC-455B is initially designed for a 24–28 volt supply using 12.6-volt tubes. With a 12.6-volt supply the filaments will need to be rewired for parallel connections. 6-volt equivalents may be substituted while again rewiring for parallel operation.[1]

At this point the biggest job in the conversion is to reduce the capacity of the tuning condensers. This will be a much easier task if the condenser section is completely removed temporarily from the chassis. By heating the point of mounting of the plates, they can be readily removed. Care should be exercised to avoid bending or misaligning those plates which are to be left in the gang. Leave only one rotor plate and this one should be the middle one. Leave only two stator plates—the ones on either side of the single rotor plate. Also remove the front rotor sections of the trimmers on the mixer and oscillator variables, and all but three rotor plates of the remaining trimmers on the three sections. Do not touch the oscillator series padder condenser. Center the tuning plates by adjusting the centering screws on the sides of the condensers, remount the condenser and resolder the connecting wires.

The next step is to rewind the coils. The oscillator grid coil is changed to a double-spaced five-turn winding using the same wire and the same spacing for coupling to the adjacent winding. Take the mixer coil and remove the large winding of fine wire at the top of the form and replace it with four turns of No. 24 enamel wire. Change the grid winding to a double-spaced six-turn coil leaving a space of approximately one-eighth inch from the smaller one, being sure that both windings are in the same direction. Rewind the r-f form to duplicate the mixer grid winding and wind the two-turn antenna coupling coil of covered buss wire (No. 18) on top of the six-turn coil at its center. If a single-wire antenna is to be used, ground one end of this winding at the plug on the chassis, connect the other terminal to the antenna post, first removing the small condenser in series with the former antenna lead-in. Another antenna binding post may be mounted and both leads brought out for use with a doublet antenna.

Prior to starting the realignment process it is best to drill out the rivets in the coil shield cans. Enlarge the holes to one-quarter inch in both the can and the mounting bracket. This provides access to the slugs for alignment. (*Continued on page 96*)

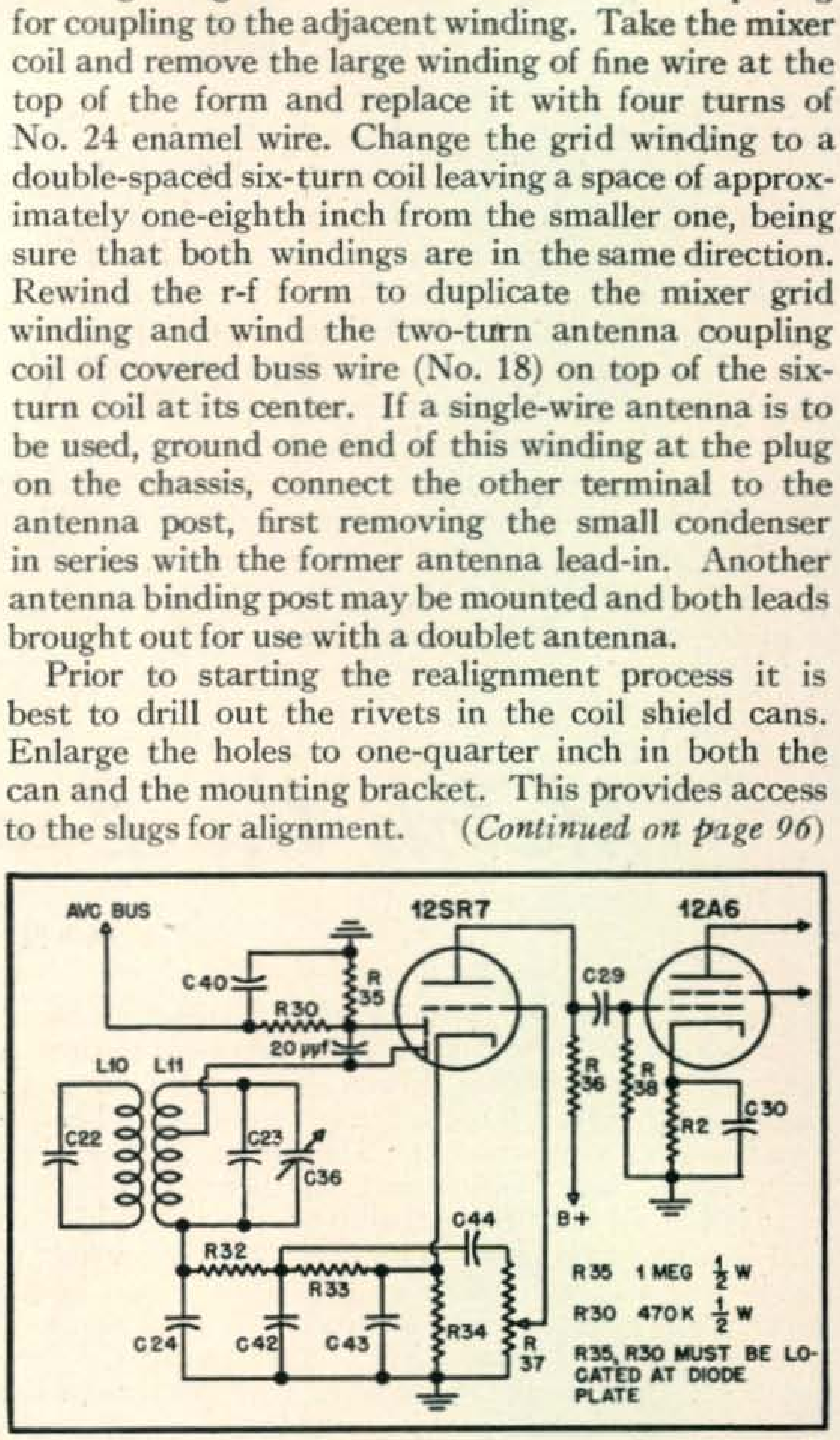


Fig. 1. Necessary changes for rewiring the BC-455B circuit for an additional audio stage and a.v.c.

C40, C42—100 µµf, midget mica.
C41—20 µµf midget mica or ceramic.
C43—25.0 µf, electrolytic.
C44—0.1 µf, paper.
R30, R38—470,000 ohms, ½ w.
R31, R32—100,000 ohms, ½ w.
R33—510,000 ohms (was R18 in original circuit).
R34—2200 ohms, 1 w.
R35—1.0 megohm, ½ w.
R36—220,000 ohm, ½ w.
R37—500,000 ohm, pot.

* *235-34 St. Dr., S. E. Cedar Rapids Iowa.*
1 Sievert, "Converting the SCR-274N Receiver," *CQ*, Nov., 1947.

The Megacycle Marker

L. P. NEAL, W1OKQ*

1000-kc markers up to 300 mc provide accurate band locations.

THIS DESCRIBES a device we have constructed to provide us with megacycle markers throughout the spectrum from one megacycle to two hundred megacycles. When employed with a sensitive receiver it is not unusual to find usable megacycle markers as high as three hundred megacycles. The use of such an instrument is obvious since it provides accurately calibrated band edges for 6, 2 and 1¼ meters, as well as the low-frequency bands.

The circuit consists of a 6AK5 triode connected as an oscillator followed by two 6AK5s employed as harmonic amplifiers or multipliers. Parts have been kept to a minimum and the unit is constructed on a small chassis. The power input requirement is relatively small and may be taken from any convenient supply or a separate supply may be built into the unit by using a larger chassis.

The Design

A 6AK5 is used as a triode crystal oscillator in a standard tuned-plate circuit with a one megacycle quartz plate as the frequency controlling element. This insures that the grid of the first 6AK5 multiplier will be well saturated and also provides a means of pulling the crystal slightly so that it can be made to zero beat with WWV.[1] Any one megacycle crystal may be used; the one used in our model came from a BC-221 frequency meter.

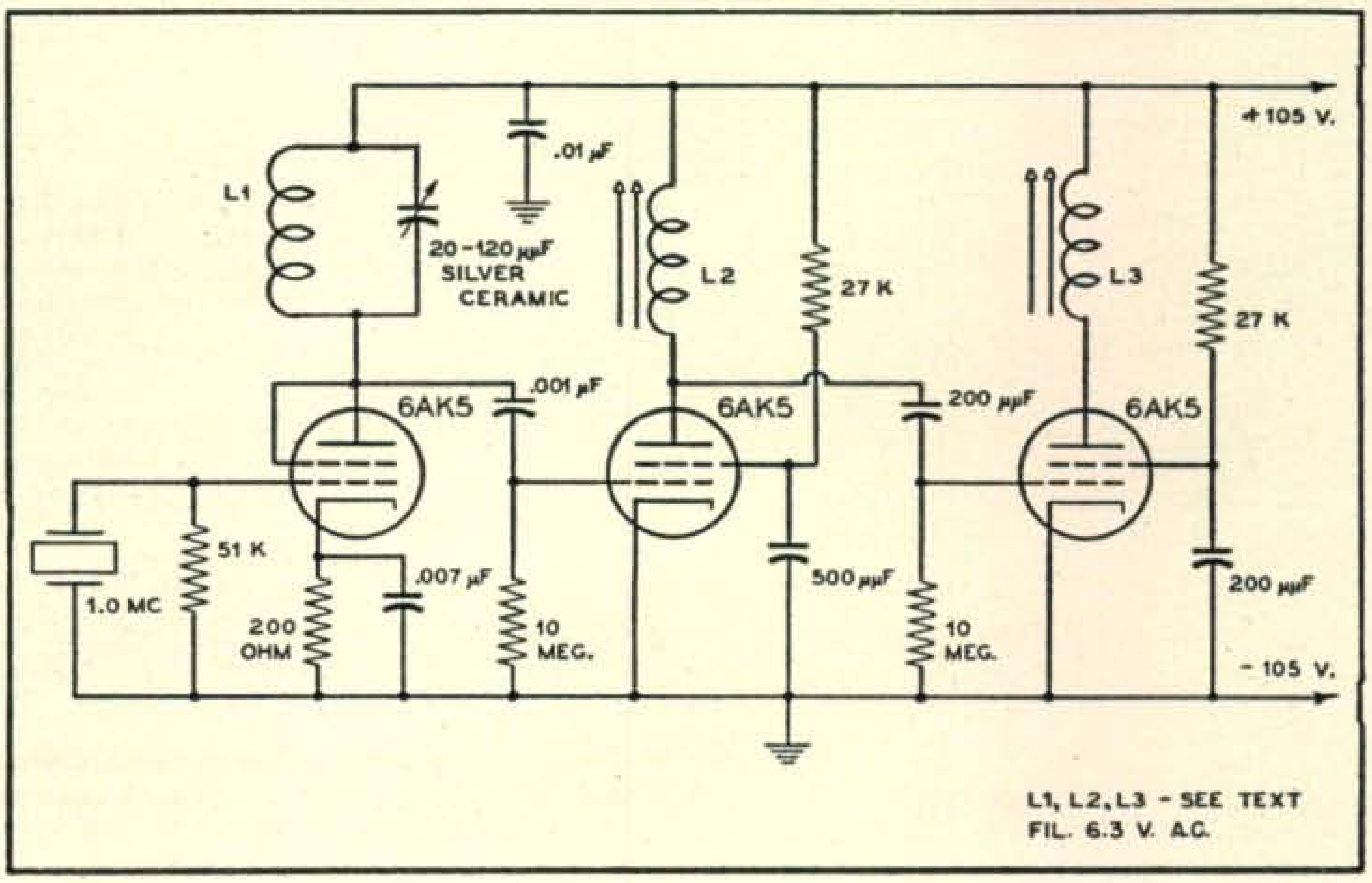
*35 *Edison Green, Dorchester* 25, *Mass.*

1 A small variable trimmer condenser of about 20-μμf maximum capacity can be shunted across the crystal for frequency adjustment. The resonant frequency of the plate tank should be adjusted to provide maximum oscillator grid current, or may be detuned on the high frequency side of the adjustment that provides maximum oscillator grid current. Greatest stability is achieved in the region from maximum oscillator grid current to one-half maximum oscillator grid current on the high frequency (lower capacity) side.

The multipliers or harmonic amplifiers are of particular interest in the manner in which they do their job. Each stage consists of a broadly tuned plate, a very high value of grid resistor, and no cathode biasing resistor. This places these stages in the category of a distorting amplifier. The signal from the oscillator is fed to the grid of the following stage by a very large condenser to furnish a voltage far above the limits of a Class A amplifier. As a result there is a small flow of grid current which builds up a high bias voltage across the 10-megohm bias resistor. This produces considerable harmonic content in the output waveform. The plate tank of the first multiplier is a low-*Q* slug-tuned coil. The *Q* is just high enough to form a decaying wave train (damped wave) that lasts until the grid of this stage is again kicked by the oscillator. This tank circuit is broadly tuned to about 20 mc, thus multiplying the crystal frequency by a factor of 20.

The second multiplier is almost identical to the first stage, however, it is tuned to about 160 mc and the component values are so altered to meet this change in frequency. No provision for coupling to the receiver is made. Enough marker energy is radiated to block the rush in a 144-mc super-regen receiver and so no direct coupling has appeared to be necessary. Should it be found desirable to have additional coupling to the receiver it may be accomplished by running a coax line to each of two tie points about ¼″ from the two tank coils *L2* and *L3* (selecting the desired output with an ordinary DPST toggle switch) and feeding this signal to the receiver through a low capacity coupling condenser. The coupling condenser may be made by twisting two pieces of wire together. The inner conductor of

Circuit diagram of the complete megacycle marker.



the coax at the receiver end should be terminated to ground through a 70-ohm ½-watt resistor. The coax shield should be grounded also.

The electrical wiring schematic is shown in *Fig. 1*. The model described was built on a 3 x 4 x 1½-inch chassis and while these dimensions need not be followed exactly it is to be recommended since it proved free from any bugs. Locate the four socket holes, the two slug-tuned coil mounting holes, and the plate tank condenser. Wire in the filaments first, cathodes second, and follow with the grids, screens, and plates.

The coil of the oscillator plate tank is a 1-mh r-f choke with about 10 per cent of its total number of turns removed. The tank tuning condenser is a 20-120 $\mu\mu$f silver ceramic adjustable type. A conventional 100-$\mu\mu$f variable air-spaced condenser would serve just as well, but physically is much larger than necessary. *L2* is a Sickles Co. ceramic coil form with a copper slug. It is wound with 26 turns of number 36 enameled wire. *L3* is a somewhat smaller form with a copper slug wound with only 3 turns of number 24 enameled wire. *L3* may be the same type and size as *L2*, in which case the coil needs only 2 turns because of the larger diameter.

The remainder of the circuit is relatively straightforward. The 27K resistors in the screen leads of the two multiplier stages protect the 6AK5 tubes in case the crystal should fail to oscillate.

Tuning Up

When the wiring is completed and checked, plug in the crystal and oscillator tube, but leave out the two 6AK5 multiplier tubes. Turn on the communications receiver and tune to WWV at 5 mc. Turn on the filament and plate power of the calibrator and rotate the oscillator plate tank tuning condenser slowly until a beat note with WWV is obtained. Carefully zero beat the calibrator with WWV. If no beat note is heard, there is either a wiring error, a bad crystal, or *L1* may need a few more turns removed. Remove any extra turns carefully, since it will be much easier to take turns off this coil than to try and put them back on. When the oscillator is zero beat plug in the first 6AK5 multiplier and tune the receiver to 20 mc.[2] Begin tuning *L2* with the copper slug clear out, and slowly screw it in until the loudest note is obtained. Remember that in the case of the copper slug the resonant frequency increases as the slug enters the coil—the reverse of what happens with powdered iron slugs. It is helpful to tune for this 20-mc peak with the aid of the receiver S-meter.

The next step will require a 144-mc receiver of any type or a sensitive wavemeter with an indicating device. Put in the 6AK5 of the second multiplier and tune *L3* for greatest signal strength at the eighth multiple of the resonant frequency of *L2*.

This completes the tuning up procedure and provides you with a calibrator or band marker that is good up to at least 200 mc. With some 6AK5 tubes usable 1000-kc markers can be found in the 300-mc region with a sensitive receiver.

2 *Exact* zero beat adjustment must be made with the 6AK5 plugged in. Its input capacity will change the resonant frequency of the crystal oscillator to a slightly lower frequency.

If your receiver tunes only to 18 mc the calibrator may be et up on that frequency with *L2* and 144 mc with *L3*. *Ed.*

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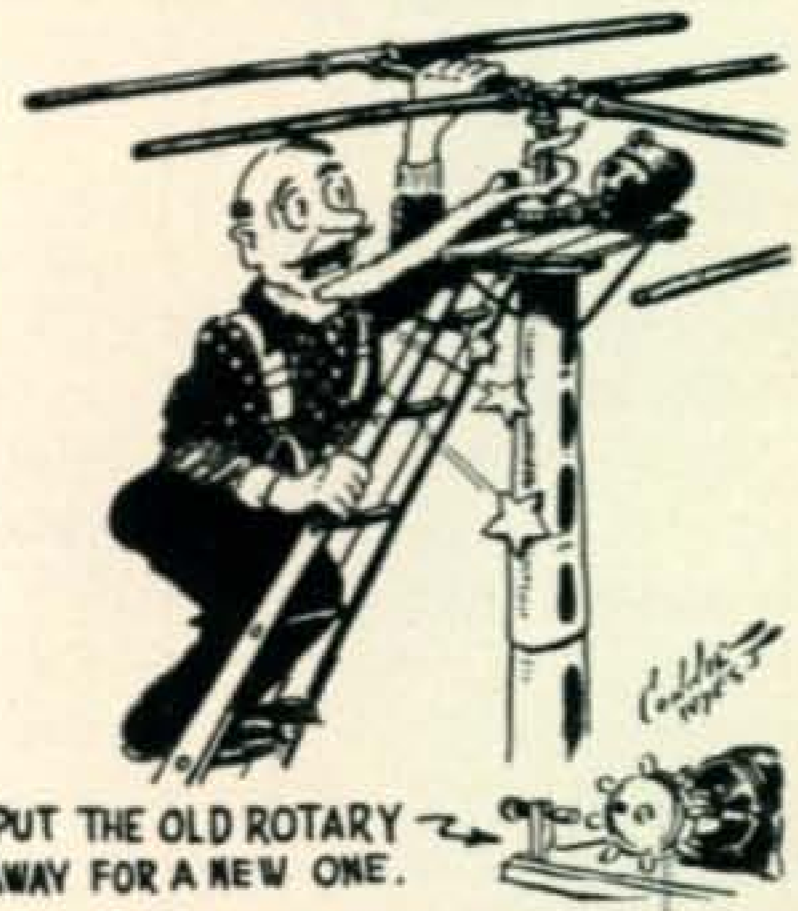
Quarter Century Wireless Assn.

Started last winter following a random conversation on 10 meters, the Quarter Century Wireless Association is now a full-grown organization with a paid-up membership of 85. The club's second semi-annual dinner and get-together was held on June 4, 1948, in historic Fraunces Tavern in downtown New York City, and was attended by 49 members and four guests. To say that everyone had a wonderful time is putting it mildly. Men who hadn't seen each other in ten and twenty years compared bald spots, exhibited pictures of their grandchildren, and in general enjoyed nostaglic recollections.



The purpose of the association is purely social and entirely unserious, and the members intend to keep it that way. Membership, which costs the sum of one dollar per year, is open to all present holders of valid amateur licenses who were active hams not less than twenty-five years ago. If you qualify and are interested, drop a line to W2FX, W2PF or W2FIT. Hams in any district or country are eligible. The next dinner meeting will be held Friday, December 3, 1948.

John DiBlasi, W2FX, who is largely responsible for getting the organization rolling, is president. George Droste, W2IN, is vice-president; David Talley, W2PF, is treasurer; and Leon Hansen, W2FIT, is secretary. The membership includes prominent engineers and executives, professional men, and former high ranking officers of the Army and the Navy.

A feature of the June 4th dinner was the presentation by Bill Harrison, W2AVA, of individually drawn QSL cards made up by member Otto Eppers, W2EA. Eventually all members of the association will sport these custom-built cards, which are veritable works of art. Bill was present as a guest, since he is shy a couple of years of being eligible for full membership.

Following is a list of the men who were present June 4th:

W2FX, John DiBlasi, president; W2IN, George Droste, vice-pres.; W2AMW, Arturo Meskus; W2EC, Ferd Thiede; W2DJJ, Robert Hertzberg; W2CVF, Ralph Hasslinger; W2BKY, Harold Wetterholm; W2WZ, John Stobbe; W2DZA, Alex Knights; W2ILO, William Wheeler; W2GKB, Nat Burnett; W2ZM, Ralph Barber; W2JA, Dave Carruthers; W2BNY, Moe Joffe; W2CN, Adolph Schwartz; W2GX, Russ Valentine; W2GN, Ed Madan; W2ARW, Morris Brody; W2QZ, Ray Morehouse; W2JN, Charles Atwater; W2FL, Dal Akers; W2AMJ, Frank Lester; W2WX, Richard Eglof; W2DX, Irv Groves; W2PFL, Harry Fendt; W2PF, Dave Talley, treasurer; W2FIT, Leon Hansen, secretary; W2VH, Paul Haus; W2MM, Earl Thomas; W2AFB, Tom McCann; W2KU, Oscar Oehman; W2BJ, Ray Farwell; W2KR, Morton Kahn; W2BW, A. L. Walsh; W2YEB, Charles Hauff; W2EA, Otto Eppers; W2AMB, Fred Huff; W2BR, Lester Reiss; W2UD, Uda Ross; W2IXE, Perce Collison; W2GA, F. Miller; W2BT, Kurt Schoenfeld; W2FO, Henry Hayden; W2CO, Walter Cobb; W2VQ, Gil Mears; W2FZ, Frank Frimerman; W2AOM, Jack Garretson; W2AMI, Sid Weinberg; W2LFR, Harold Perry. Non-member guests: W2AVA, Bill Harrison; W2JWM, Richard Lawrence; W2GDG, Jack Babkes, and Ben Snyder.

Inside the SHACK AND WORKSHOP

Conducted by A. DAVID MIDDELTON, W1CA*

Low-Cost Neutralizing Condensers for 304TL

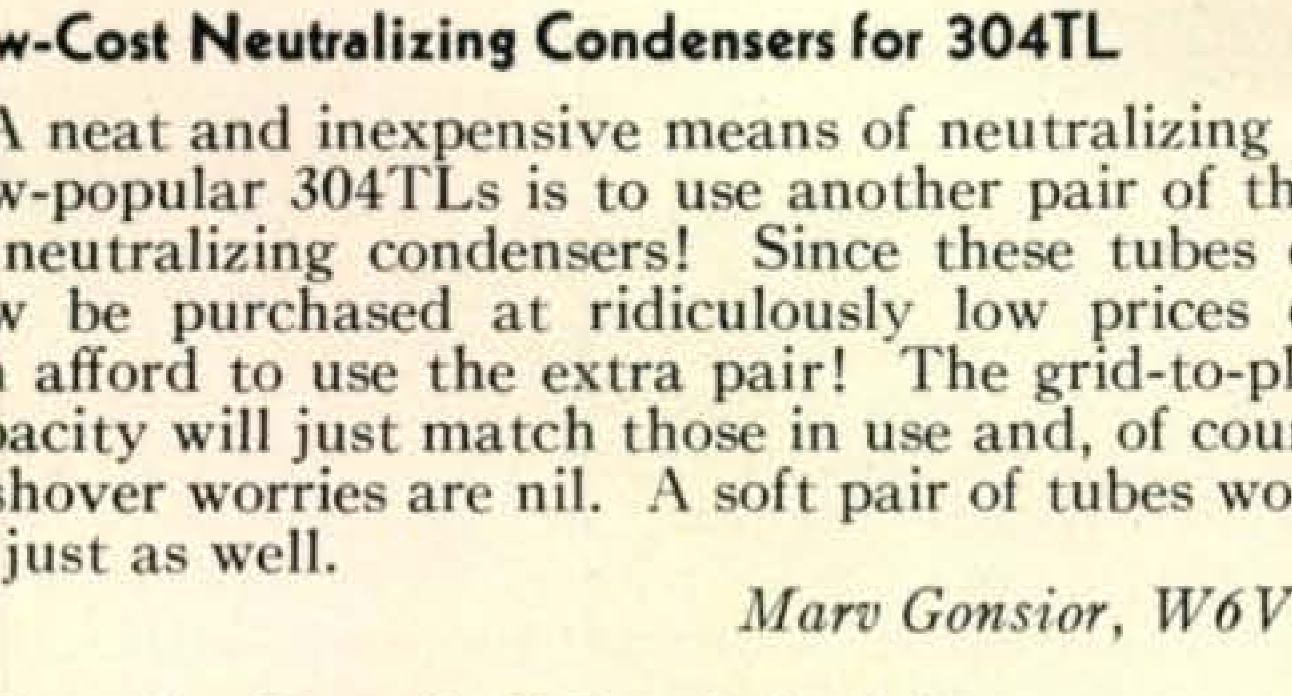
A neat and inexpensive means of neutralizing the now-popular 304TLs is to use another pair of them as neutralizing condensers! Since these tubes can now be purchased at ridiculously low prices one can afford to use the extra pair! The grid-to-plate capacity will just match those in use and, of course, flashover worries are nil. A soft pair of tubes would do just as well.

Marv Gonsior, W6VFR

Making the "Standby" Switch Useful

Instead of merely cutting off the receiver during transmission periods, the standby switch on a receiver can be used to good advantage as a control for the transmitter when changing from "receive" to "send."

The switch in most communications receivers is a SPST affair which breaks the lead from the h-v centertap to ground. In addition, this switch is often connected in parallel with a terminal strip on the rear apron of the receiver, through which an external switch or relay can control the receiver in "standby" periods.



Replace the front panel switch with a SPDT toggle with a neutral central position, so that you can silence the receiver without turning on the transmitter if desired. Disconnect the rear terminal strip from the receiver h-v circuit. Run a lead from the ungrounded side of the filament supply to one terminal and the lead from the other terminal to the "send" connection on the new switch. The lead from the h-v centertap connects to the "receive" connection on the switch, and the movable arm is grounded. If there is no terminal strip on the rear apron of the receiver it is not difficult to add one.

This provides 6-volt a.c. at the terminal strip during transmission periods. This may be used to activate one or more 6-volt relays (such as power-on, antenna relays, etc.) providing the additional drain on the receiver power transformer is not too great. The usual transformer will stand a couple of relays, if their current is not too high.

Julian N. Jablin, W2QPQ

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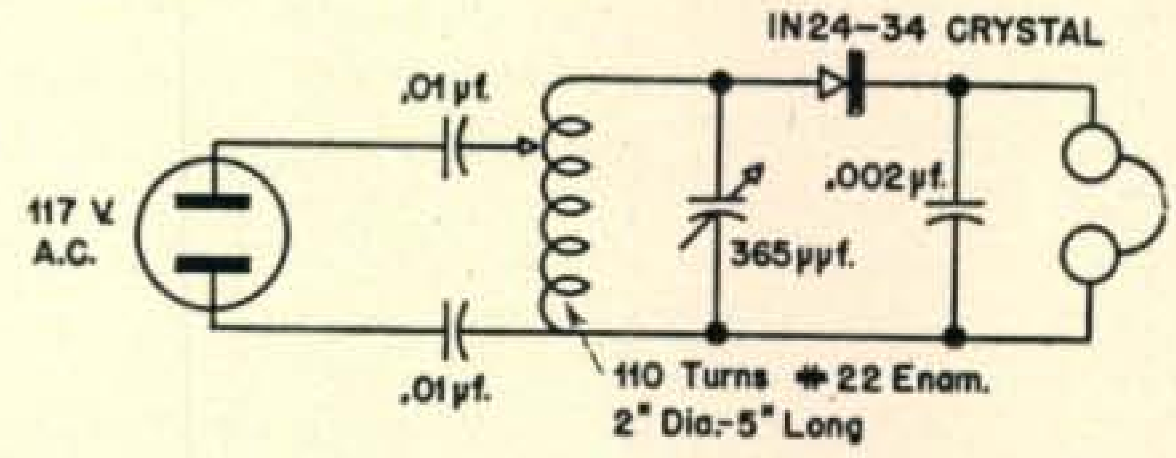
* *Address all contributions to S & W Department c/o CQ, 342 Madison Ave., N. Y. 17, New York.*

Crystal Receiver—Portable Type

The only thing new about this receiver is the antenna coupling, which is merely an old device so long forgotten!

Use the a-c lines as an antenna, with a pair of mica condensers for safety's sake, and obtain signals that will be as good or better than those ob-



tained with the usual 100-foot antenna. The a-c plug should be reversed to obtain maximum signal pickup. This receiver can be packed from room to room, and plugged in anywhere.

I mounted one of these receivers in a small box and found it a handy gadget for use around the house, either as a toy for the kids, or for regular daily usage when other listeners objected to the station being changed on the BC set.

Joseph A. Stauhs, W2BCN

Flashlight Holder for Converter Mount

A flashlight holder (made for clamping a flashlight onto the steering column of a car) makes a very neat and effective mounting for a small converter in the car.

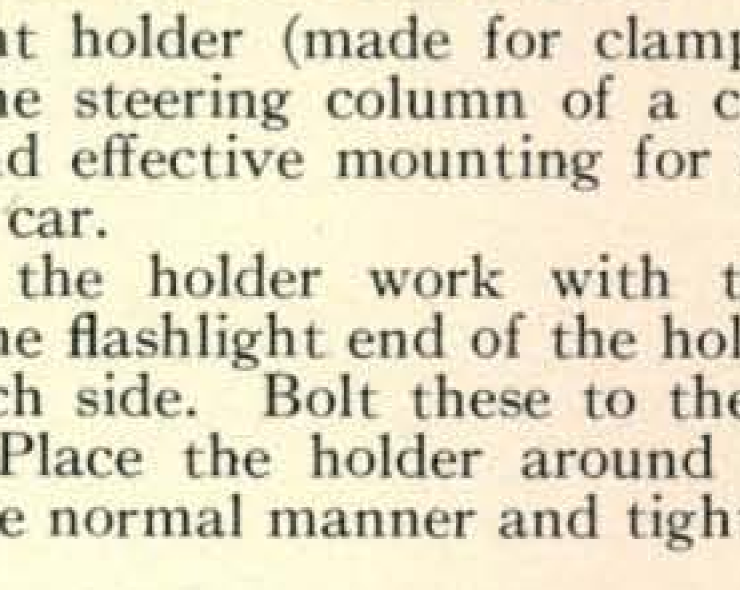
To make the holder work with the coverter, flatten out the flashlight end of the holder and drill a hole in each side. Bolt these to the case of the converter. Place the holder around the steering column in the normal manner and tighten the holding screw.

Due to the slight spring action of the holder, some shock mounting is obtained for the converter.

Alva H. Clark, W4DCG

Fool-proof Socket for FT-243

Many hams using the FT-243 type holders use an octal socket with which to make the connections



to the oscillator circuit. The drawing shows a method of cross-connecting the socket so that no matter which way you plug in the crystal it makes the *right* connections!

Felix W. Mullins, W5BVF

Monthly DX Predictions-September

OLIVER PERRY FERRELL *

OUR THANKS ARE due for the suggestions recently received in answer to our direct inquiries and to those who volunteered constructive criticism as a result of our published intention to improve the presentation of the *Predictions*. Considerable thought is still being expended in this direction with the hope that the new system will be perfected in time for inclusion in the October issue.

The great strides that have been made within the past 18 months in improving the accuracy of F2-layer predictions calls for a greater and more expanded use of the CRPL prediction services. New data permits accurate determination of limiting background noise levels, various types of absorption and MUF values in the out-of-reach corners of the world. Actually, the problem is far more complex than it may be first envisioned. To predict amateur band openings, the MUF as well as the LUHF must be ascertained. Because of the constant horizontal variation in the F2-layer the problem becomes three-dimensional, since the factor of time must always be included. However, it is evident to the experienced DX man that a presentation of the MUF and the LUHF alone does not tell the whole story. This is because the LUHF must be calculated from an arbitrary set of conditions that are not too often realized in practice. Thus, a presentation such as we are now using does not show peak times of band openings, only the extent.

A possible solution appears to be a compromise graph wherein the parameters are the paths in question. The ordinates may then be the time and relative signal strengths. The ordinate may be graded as "excellent phone," "poor phone," "good c.w.," etc. Peak times will be indicated by peaks in the excursions of the parameters. Band closing times are shown by dropping through the zero value level. The main drawback is that this presentation works best on only one band. One or two possible alternatives which hold considerable promise in permitting more paths to be shown much clearer than hithertofore are being worked out.

Graph 1 shows the predicted median conditions over the path from the W1, W2 and W3 call areas to Korea and the eastern China coastline. The shaded area in each graph bounded by the heavy black line is the region of unusable frequencies. This condition is calculated on the basis of 1000 watts of effective radiated power. It assumes that a good communication receiver is being used with c-w operation. For phone operation the LUHF generally averages about 2 mc higher in frequency at any given interval. The remaining parameter is the predicted MUF.

This path has been corrected for approximate normal auroral zone absorption, thus due to the season of the year, the LUHF will exceed 10.0 mc over 85% of the total time and no 40-meter openings are predicted. On 20 meters the MUF rises abruptly after 0500 hours EST and this band should open around 0530 EST. Signals will peak around 0630 EST and then gradually become weaker until band closing at about 0820 hours EST. No 10-meter opening is forecast for September.

Graph 2 illustrates the conditions expected over the path from W6 and W7 to central and southern Europe. Contrasted with the openings during August, the September 20-meter band openings will be materially shorter. This is due to a deterioration of the night MUF over the eastern end of the path. 20 meters will probably open shortly after 1430 hours PST and close approximately one hour later at 1530 PST. On very quiet days, ionospherically speaking, the band may open before 1400 hours and possibly during the first early stages of an ionosphere storm it may not close until after 1700 hours. A few scattered signals ranging from poor to fair may be expected around 2200 hours PST. It is reasonable to forecast towards the end of the month a few 40-meter signals breaking through between 1930 and 2100 hours PST. No 10-meter openings are directly predicted, although some scattered signals may be heard on this band during the last week of September between 0930 and 1030 hours PST.

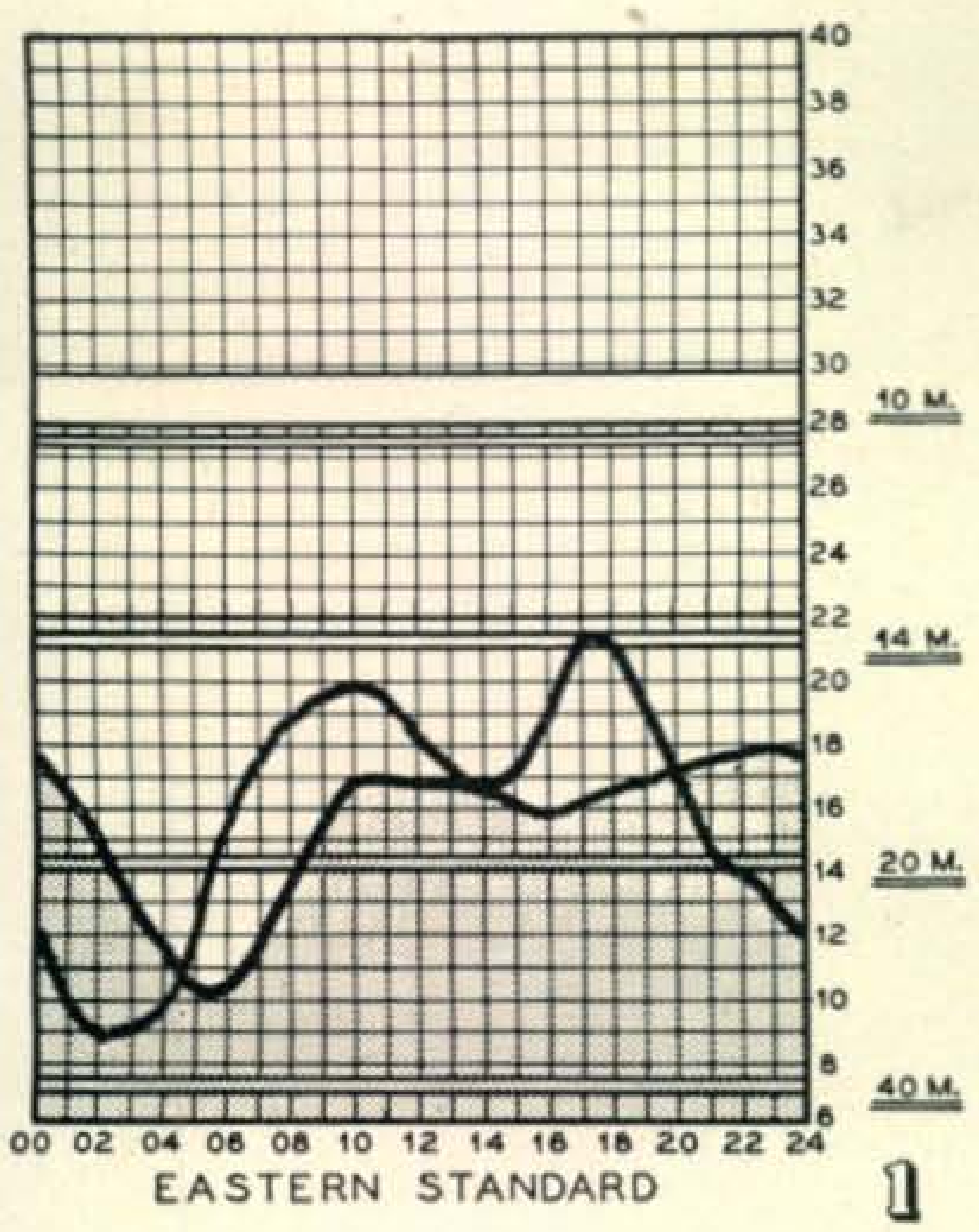
It is possible to see the sizable increase in the MUF and the corresponding decrease in the LUHF over the path in *Graph 3*. This chart shows the conditions to be expected over the path from the W9 and WØ call areas to South Africa. Weak 10-meter signals may be heard after 0600 hours, although because of absorption they may be unreadable. The band should really open after 1030 hours CST. It is interesting to note that during the early period it might be possible to use the high end of the band while the lower end is dead. The 10-meter band will close about 1445 hours CST. Peak signals between 1100 and 1330 CST. The 20-meter band should open with weak signals shortly before 1400 hours. The band should remain open until approximately midnight or possibly 0100 hours the following day. Signals during this latter period should not be too strong. Best 20-meter signals may be expected from 1530 until 1830 hours CST. The atmospheric noise level is still high during September, but a few scattered and erratic 40-meter signals should be heard and worked.

Graph 4 depicts the predicted conditions for the path across the Pacific Ocean between southeastern Australia and the central United States. A 10-meter band opening is predicted to start around 1845 hours CST. The band probably will remain open with fair signals until 1945 hours CST. An earlier opening may be expected on some days from 1745 CST. The 20-meter band should open nightly about 2230 CST. Fair signals should be heard until 0100 hours CST the following day. From 0100 until 0530 hours the band should vary from day-to-day and poor to fair signals depending upon deviative absorption will be heard. The morning opening is weak, although here too scattered signals should be heard from 0700 until 0900 hours CST. The static level will be the determining factor in 40-meter reception with a slight chance of some work between 0200 and 0500 hours CST.

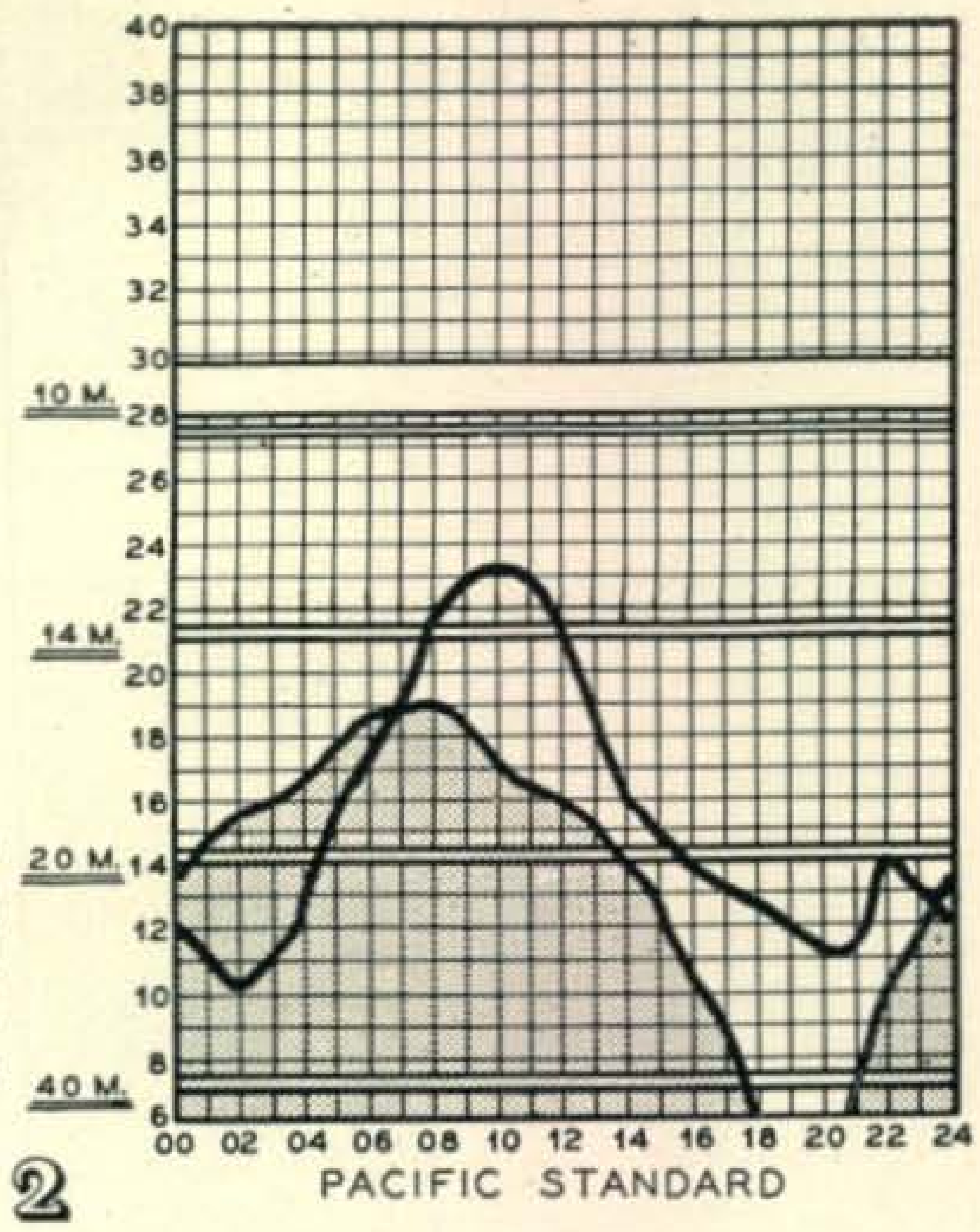
The data for the preparation of the MUF curves is derived from the booklets issued by the CRPL of the National Bureau of Standards entitled "Basic Radio Predictions Three Months in Advance." These are available on a subscription basis from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

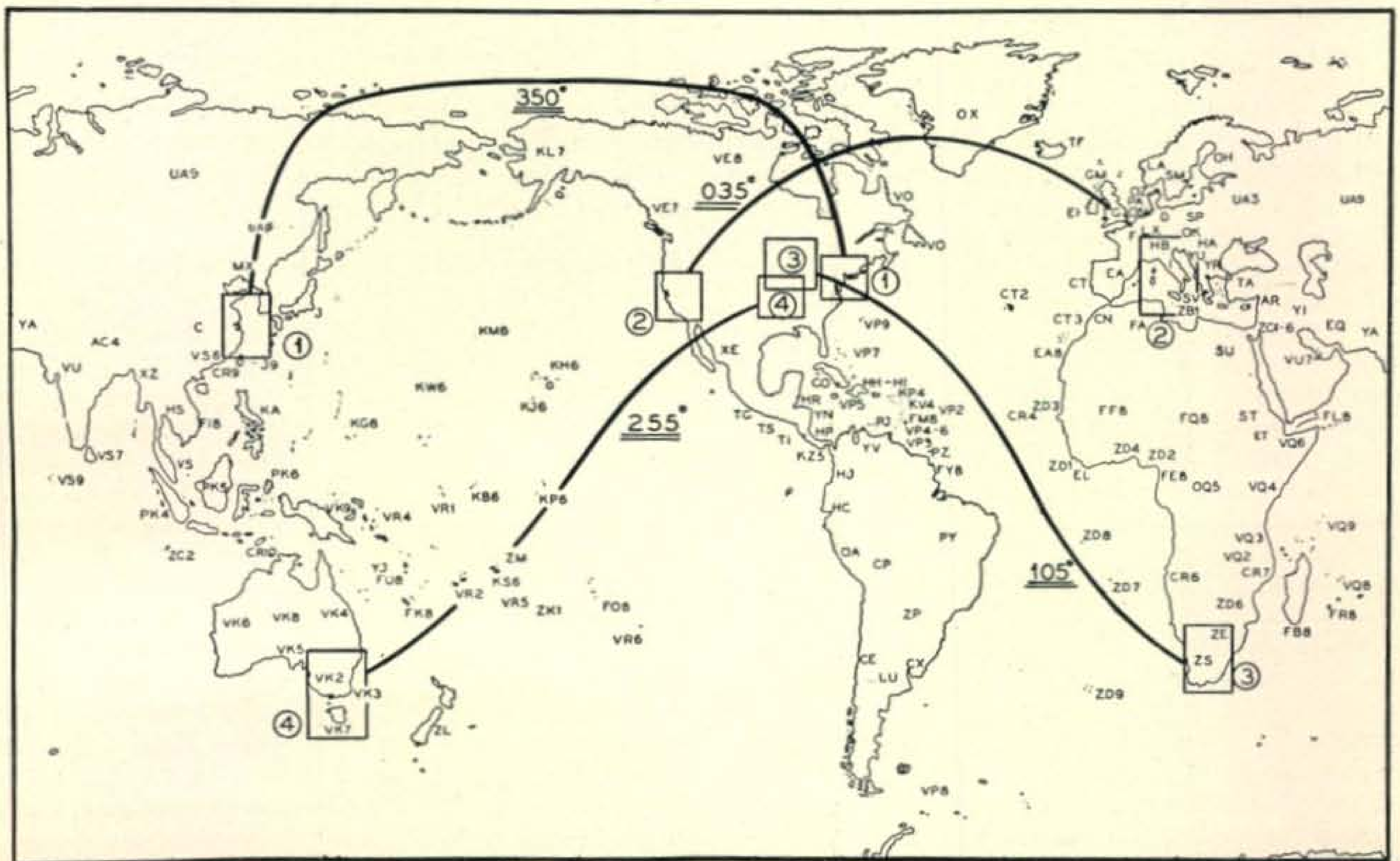
**Assistant Editor, CQ.*

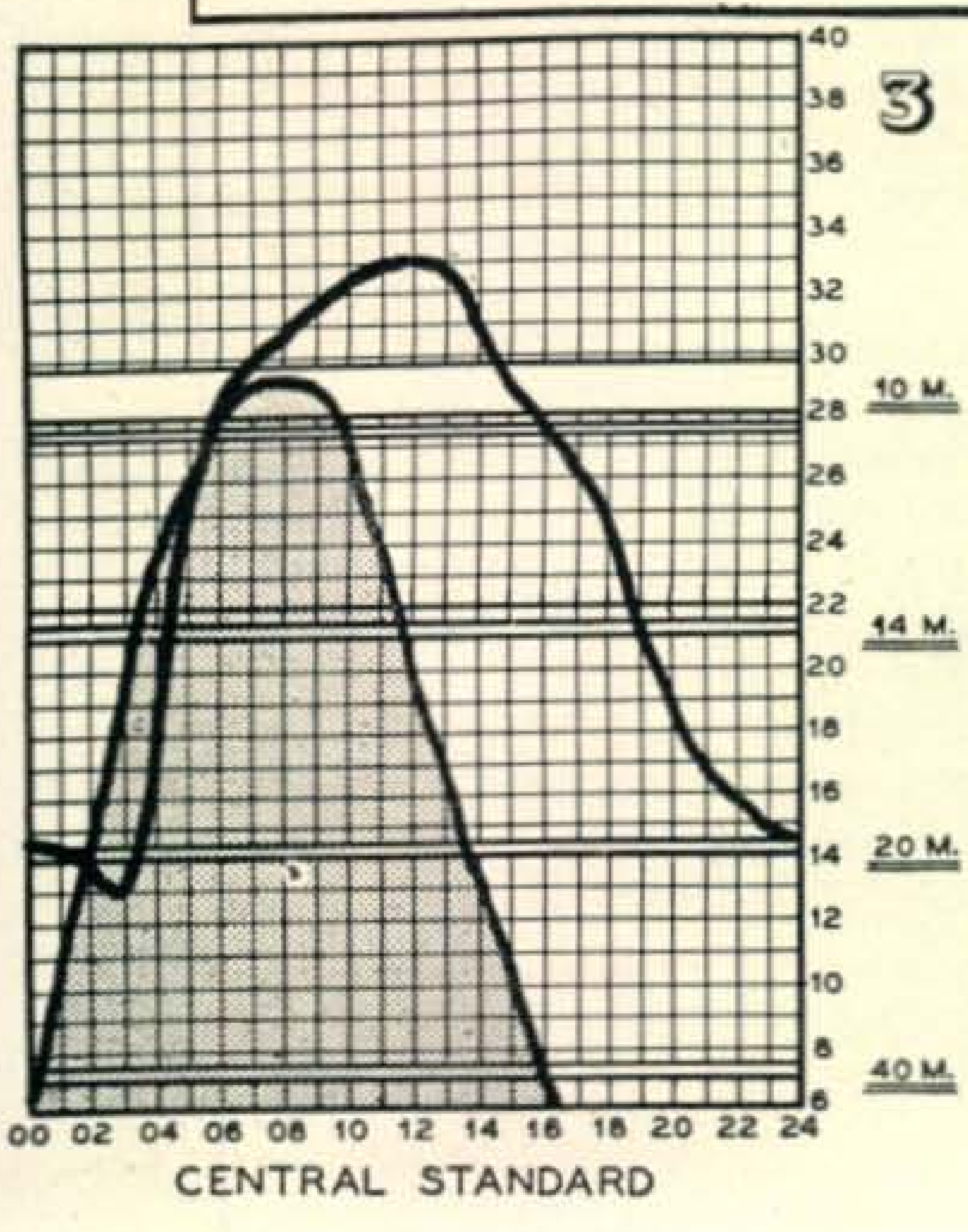
Monthly DX Predictions



Maximum Usable Radio Frequencies—Charts show the maximum usable frequencies propagated by the F2-layer over the paths indicated in the world map. The abscissa shows the local standard time at the point of origin of the path. The ordinate shows the frequency in megacycles. Amateur frequencies fall within the two heavy parallel lines that indicate the upper and lower limits of the principal bands.



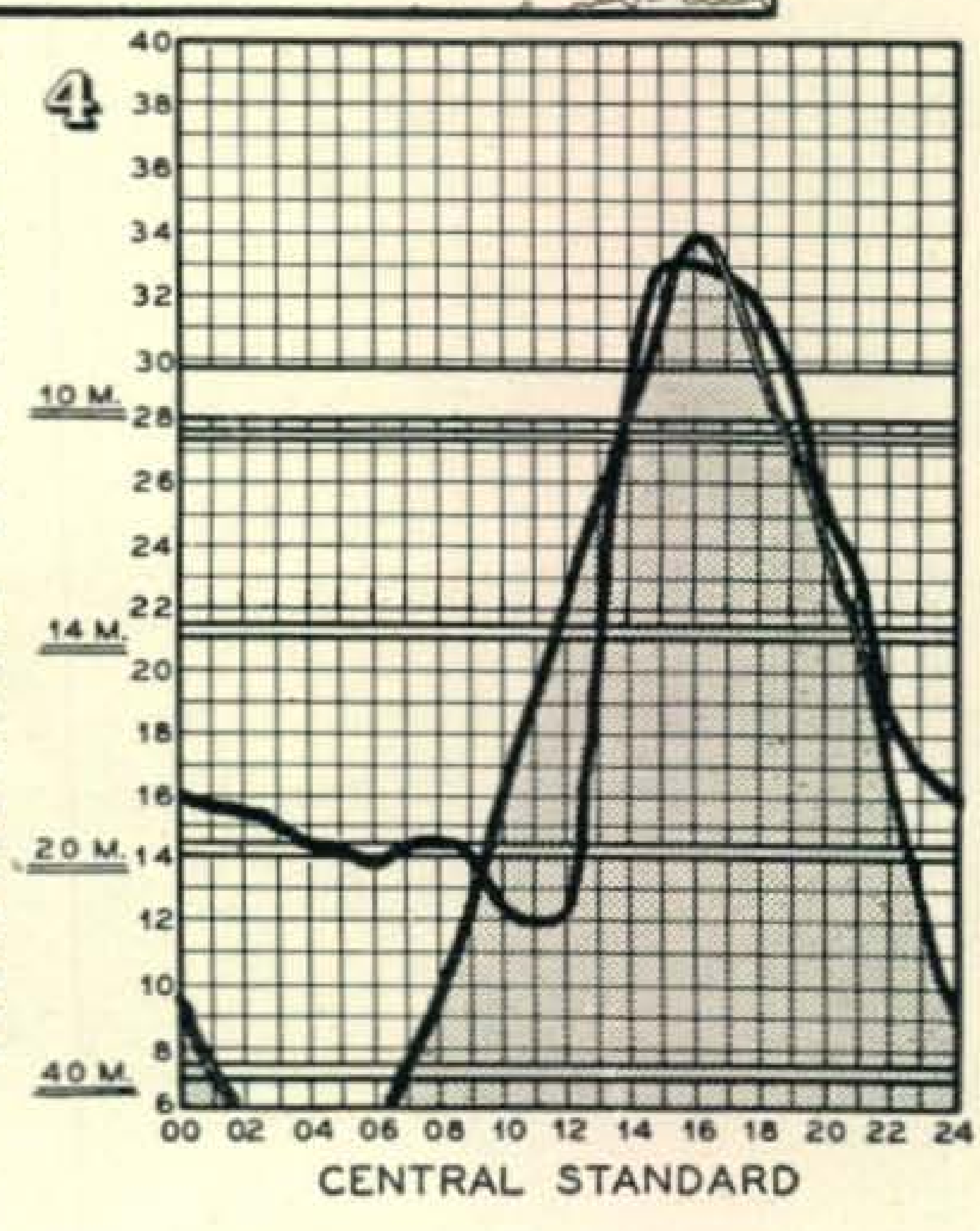




Lowest Usable Radio Frequencies—The shaded area in each chart indicates unusable radio frequencies for the illustrated path. The LUF is calculated for an above average amateur location using a good communications receiver. The effective radiated power is assumed to be 1000 watts. The LUF is based upon average monthly signal absorption and does not include the effects of abnormal or auroral zone absorption.

Azimuth—Radio transmission is known to vary considerably with geographic latitude and longitude. Each path MUF and LUF as illustrated is calculated for the "short-path". This is the path shown in the map.

Variations in Forecast—All graphs are monthly predicted average conditions. On ionospherically "quiet" days some variation amounting to less than 15% may be expected. However, a value representing 0.85 of the MUF will be exceeded over 90% of the total time. The graphs do not indicate radio propagation conditions during ionosphere storms or sudden ionosphere disturbances. They are not adjusted for the effects of sporadic-E layer formation or long and short scatter. Radio disturbances of the ionosphere storm type are the most severe for paths which pass through the auroral or polar regions, the effects gradually tapering off towards the equator.



onducted by VINCE DAWSON, JR., WØZJB*

WHILE THERE have been any v-h-f openings during the past summer the general opinion on 6 meters is that the openings this year did not compare with those of 1947. On 2 meters, the so-called openings appear to have occurred more frequently and according to some operators the band was open almost nightly.

The 6-meter band spor-E skip has been somewhat shorter in the mid-west than usual with numerous W9 to WØ contacts. In most sections of the country the skip has favored once again the north-south paths, although most W5s have been able to work more and better DX in all directions.

Another W.A.S. on 6 Meters

Surprises are usually not too uncommon on 6 meters, but your conductor, WØZJB found a pleasant one on Sunday, July 25. During what appeared to be a scattered opening to the W4 area we tuned 10 meters and found W1 stations coming in on that band. Switching back to 6 and swinging the beam northeast we heard the c.w. of W1CGX in Brattleboro, Vermont. After several futile calls a contact was made at 1248 CST, thus completing our own W.A.S. on 50 mc. A week earlier we had contacted W5HLD in Enid, Oklahoma, for state number 47. The latter at a distance of 280 miles had posed quite a problem, which was fortunately solved when W5HLD put up a beam antenna. So that's that, 2 meters here we come!

At last count W6UXN, W6WNN and W9QUV all had 47 states. The first two lacked the Vermont contact, while W9QUV still needed something from Arkansas. Speaking of 2 meters, W8WJC, Everett, Ohio, worked WØKYF, University City, Mo., for state number 13 on July 8. W1IZY and W1JFF follow closely with 12 states each. At any rate the 2-meter boys are doing a bang up job for many fellows remember when 13 states was a big accomplishment on 5 meters.

Horizontal/Vertical Test

During the June 14th opening on 2 meters, W1PIV in East Freetown, Mass., and W4CLY in Virginia made a few tests on antenna polarization. Before giving the results it is to be appreciated that these are only relative to their individual installations and could be unduly influenced from such a standpoint. However, W4CLY was using a 10-element flop-over beam, while W1PIV was using a 32-element flop-over beam. On cross polarization there was a 12 db drop from the maximum between the two signals. On horizontal the signals were averaging 5 db stronger than on vertical polarization. This theoretically contrasts with optimum vertically polarized fields which might be expected over mostly water paths. Possibly this might be tied in with the problem of coastal refraction that has plagued navigational systems. In any case, it shows that fields over a "mixed" route may depart from theory, probably also, the conditions at 2 meters are too complex for detailed analytical treatment, and recourse has to be made to experiment in each and every amateur installation.

High-Band FM and Low-Band TV DX

During the spor-E season there are always peculiar conditions reported to us, possibly the best so far are these two incidents. W4JEP in Miami, Fla., heard and looked in on WMAR/TV, Baltimore, Md., during the morning opening of June 22. This station is on channel 2. The video was good from 0815 to 0845 EST on 55.25 mc, while the sound was heard strongly from 0845 to about 0900 EST on 59.75 mc. The antenna used was a folded dipole and the receiver was a Consolidated Teleking.

The June 27th opening was very good as reports indicate. W5GWL in Temple, Texas, while tuning across the high FM band from 88 to 108 mc heard the following: WELD-FM, Columbus, Ohio; WHKX, Cleveland, Ohio; WJEM, Springfield, Ohio; WHBC and WCMW, Canton, Ohio, and WOWO-FM, Fort Wayne, Ind. All of these are between 925 and 1125 miles distant. Using only a small folded dipole and an FM tuner, W5GWL has his v-h-f dander up and promises to try this end of the spectrum very soon. When Ferrell was questioned concerning this DX, he stated that such instances should not be too uncommon. A 6-meter skip of about 550 miles will take place when the 80-mc skip is about 950 miles. Thus, these openings can be judged from watching for extra short skip on 6 meters. Ferrell has plans to use some of the Watson Lab spor-E data to show possible TV interference on a nation-wide basis on channels 2, 3 and 4.

Ground Wave DX

The recent article on the Booker Mode Theory [1] as a means of estimating tropospheric DX possibilities has stirred some comment in various circles. The principle reason for describing this theory was

[1] "V-H-F Ground Wave DX," *CQ*, July, 1948, p. 40.

**Send all contributions to Vince Dawson, Box 827, Gashland, Mo.*

W7HEA, Chester Bishop, of Toppenish, Wash.

to acquaint the serious v-h-f workers of trends in England and to dispell the metallic waveguide concept of the duct. A tertiary objective was to show the greater refractive effects at 2 meters when directly compared with 6 meters.

It is well to point out that the "leaky" duct is only one way of extending the 2-meter ground wave. A discrete analysis would show that at 144 mc the "leaky" duct most likely applies when everyone within a 200 to 400 mile radius is hearing and working everyone else. Quite likely when there is a pronounced skip effect (not too uncommon at 2 meters as might be first imagined) propagation will be the result of a reflection from a sharp discontinuity, or inversion at near glancing incidence. These inversions may occur up to as high as 6000 to 9000 feet, but in any case, it is doubtful that a single high inversion could propagate a 2-meter signal further than 600 miles. It would appear from present indications that working 2-meter DX further than this is the result of a combination of both the "leaky" type duct and the glancing incidence reflection.

It would appear to both Ferrell and your conductor that this problem still deserves more study before there will be sufficient grounds to establish what exactly is the means of propagation. Much requires to be done on the problem of optimum antenna heights, where under conditions of a well defined duct the received fields may be adversely affected if both antennas are not within the duct. Certainly, the fact that changes in the azimuth and field strength have been observed, plus momentary changes in the ratio of horizontal to vertical fields belie something completely unknown in the propagation of these signals.

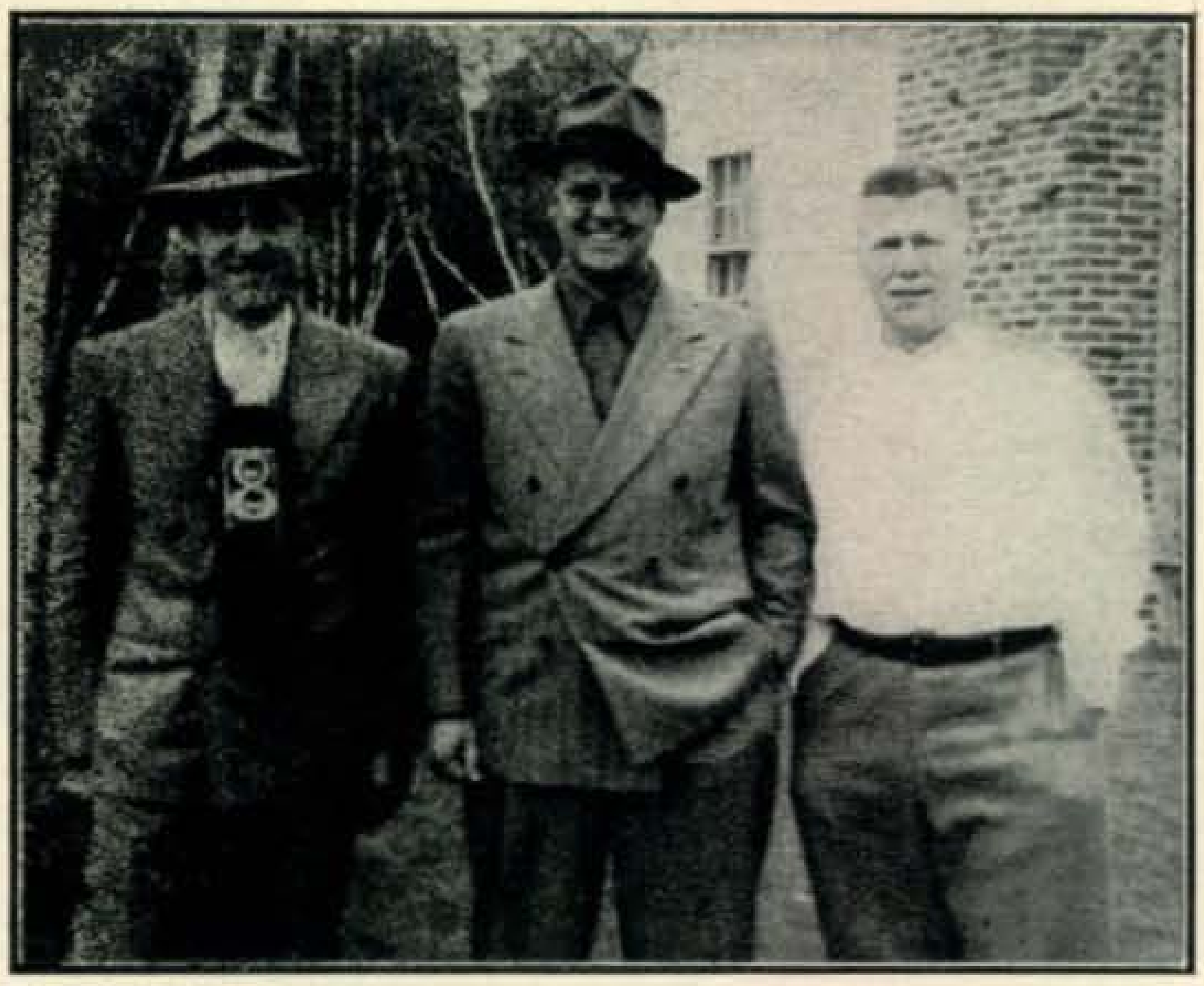
Atlantic 6-Meter Net

In an effort to stimulate activity in the eastern seaboard, W3MFY has formed the Atlantic 6 Meter Net. The net meets on 50.4 mc each Thursday evening at 1900 EST. Present members include: W2PWP, W3MQU, W3OAS, W3KKO, W3NUQ, W2QVH, W3GGR, W3NTD, W3NSI and W3MFY. In an area where the band is notoriously dead for rather long periods of time nets of this type help other fellows get started on the band. Also they offer a chance for a round-table and for checking equipment. Pres is to be commended for his efforts, let's hear more about nets like this on both 6 and 2 meters.

Probably some of you at one time or another have longed to know the airline distance from one point to another. The U.S. Department of Commerce, Coast and Geodetic Survey have now compiled a very comprehensive book giving these distances in the U.S., which is available, cloth bound, for $1.75. Any of you wanting same, and we can assure you it is well worth the money, may obtain one by writing to the Government Printing Office, Sup't of Documents, Washington 25, D. C., and asking for Special Publication No. 238, Air-Line Distances between Cities in the United States.

G5BY mentions that conditions on 58 mc were good from the end of June to the first week in July, when things settled back to normal. June 27 was a

The 50-mc DX Honor Roll has been purposely omitted this month to permit a new tabulation to be made. The Sporadic-E Project work group are requested to notify us through their monthly reports of their standings. The new listing will include states worked and countries worked, without individual prefix listings.



The V. H. F. Editor goes visiting. L. to r.: W1CLS, WØZJB, W1GJZ.

good day in Europe for Es; on this date, G5BY was heard by YR5VV in Bucharest a distance of 1500 miles, approaching the double hop region. This same day, OK2QK, was contacted who was running an input of 1 watt! From the list of stations worked by G5BY, activity is very good in practically all the countries, including D7s in Germany.

While in the English spectrum, we find from *Short Wave Magazine* that a new ground wave record has been established from G3BLP to GM3OL, a distance of 296 miles.

The Mexico City gang consisting of XE1KE, QE and GE are still at it, although the usual run of contacts have been into the W5s and W4s. XE1KE did hear W8NMU on June 24, at 1800 CST. XE1GE heard W6s on June 19, and worked WØIFB on June 23. XE1QE worked on June 23; W7FJD in Oregon, W9QUV, QKM, ZHL, USI, WØNFM and WØKYF to give a total of 10 states, LU and CX.

XE2C in Monterey, in a better situation for Es into the states now has 13 states, and on July 24 worked WØZJB who was running 10 watts when the 500 watts was down with a sick transformer. Gilberto, XE2C, is still on c.w., about 50.2 mc, running 120 watts.

In VE land we find VE6MO still faithfully watching for DX sigs, and on June 13, WØLIL, QIN and KPQ were contacted. VE5NC, near Regina, has been doing quite a job with his 10 watts, going way over S9 here at Gashland on several occasions. Both VE1QZ and VE1QY have been in on 50-mc openings, but their interest has now changed to the 144-mc band, where both have been working the W1-2s over a 300-425 mi. path. June 27 after the 50-mc band quieted down, VE1QY worked 37-W1s on 144 mc from 1950-0100 ADST. Jerry, VE1QY says that the QRM was terrible, and that signals from stations near the ocean were very strong, while those located inland were much weaker, except W1DEO on a mountain in Maine, who poured in all during the opening. This makes a total of 7 states for VE1QY on 2 meters.

50-mc Gang

A day-by-day highlight story will be found later in the column, now let's look at the comments from the gang.

On May 31, at 1735 MST, W7KVU in Bozeman, Montana, heard LU6DO talking very rapid Spanish,
(*Continued on page 82*)

Conducted by HERB BECKER, W6QD*

NOW THAT THE summer vacation season is winding up, I think you should start planning now on *CQ*'s World-Wide DX Contest, which will be held during the last week-end in October, and the first week-end in November. See the August issue of *CQ* for complete details on the contest. We hope you fellows like the setup. I know that every DX man has his own pet idea for a DX contest. We have tried to incorporate as many ideas as we could and yet please the majority. You can help make this contest more enjoyable for yourself by beginning right now to tell overseas stations to mark the last week-end in October on their calendars for phone, and the first week-end in November for c.w. We have contest log forms available which will minimize the bookkeeping work after the contest is over. You can estimate the number of sets you will need, keeping in mind that you should obtain enough for a carbon copy or duplicate for your own file. Send a stamped, self-addressed envelope to *CQ*, 342 Madison Ave., New York 17. These forms will eliminate the copying of the log that most of us go through after the contest is over.

W.A.Z.

This month finds six more rabid DX men getting over the W.A.Z. hump. We want to heartily congratulate the following for having been awarded W.A.Z. certificates during the past thirty days:

50	W6BPD	Herbert R. Grove	40–154
51	G5BJ	George Brown	40–126
52	W7GUI	C. V. Fontaine	40–143
53	W6PKO	L. B. Vickers, Jr.	40–146
54	W6AOA	Frank J. Cuevas, Jr.	40–139
55	W7BE	William Shuler	40–146

W6BPD draws certificate No. 50, while G5BJ is the third from his country to get this award. W7GUI said his "hold out" zone was number 2. W6PKO is one of the more consistent pluggers around here, while W6AOA had a case of nervous jitters waiting to see what certificate number he will get. Then, there's W7BE, Bill Shuler, who was fortunate enough to remain located long enough in his present location to W.A.Z. You see, Bill is a colonel in the Army Engineers. Incidentally, one of his brothers is W4KUR, and another is W6VOE, one of the ops of KX6USN. That family has r.f. in its veins, I guess.

**Send all Contributions to Herb Becker, 1406 South Grand Ave., Los Angeles 15, Calif.*

Country List Change

Effective immediately, please change the country "Little America" to read "Antarctica." After due consideration, and at the suggestion of quite a number of you fellows, Little America as a DX country is somewhat of a misnomer. Antarctica really is a more logical classification for the entire region, and it will certainly simplify the crediting of this country to you regardless of the call letters of the station you work.

Well, let's skip around a bit and see what's been going on during the past month. It looks like W1AB is happy now that he has received his card from C8YR, but Horace still needs one from Zone 19 for his W.A.Z. He is now gunning for Zone 39 in his Marathon, and if he lands this one, it will be all 40 of them. Horace says that so far, the nearest he has come to working anything in Zone 39 this year was when he heard W6AM calling VQ8AD.

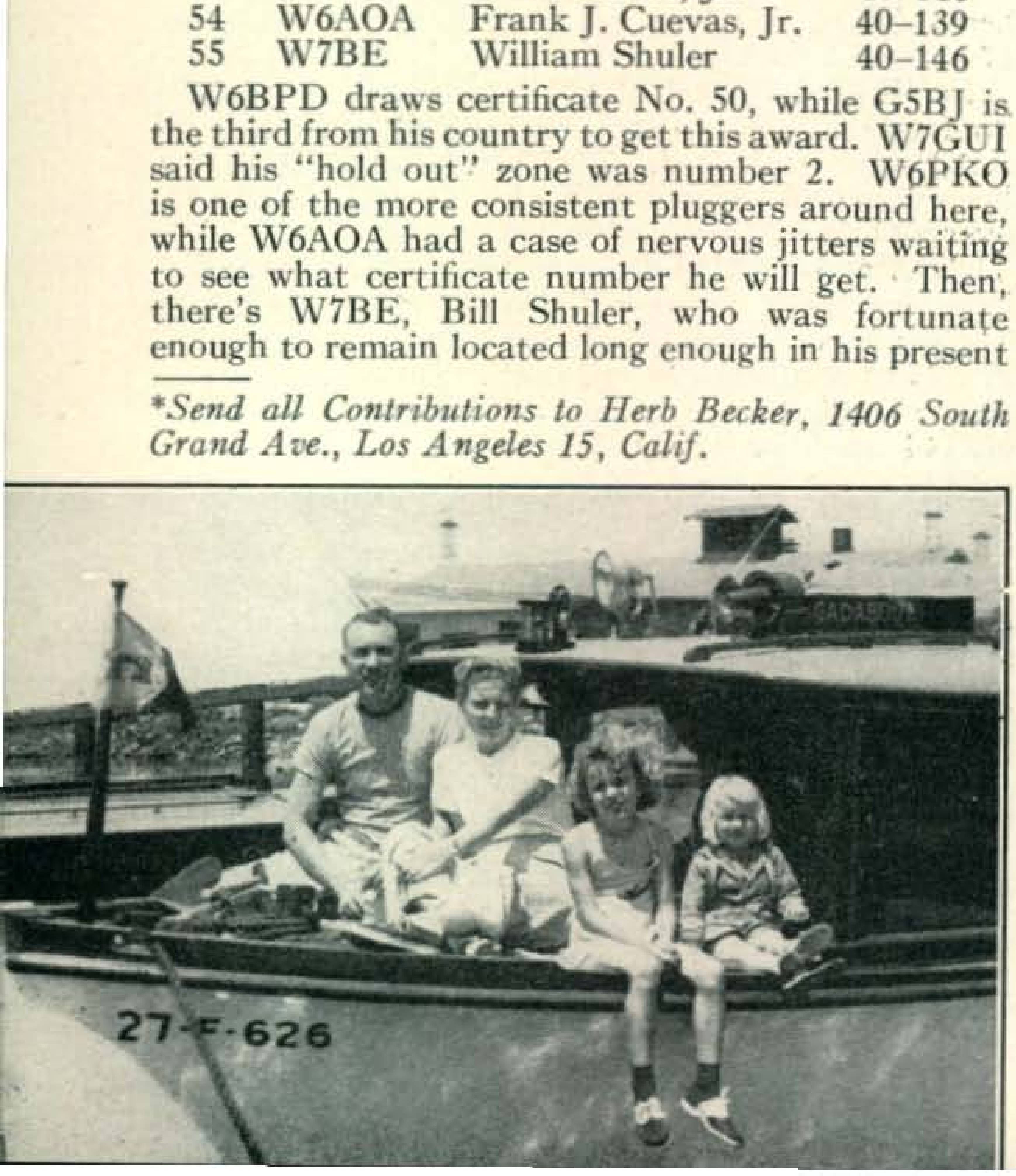
Things surely happen in a hurry in the land of OKs. Last month I ran a blurb about OK1AW and the YL, I1MQ. No sooner had I dumped the August column in the lap of Larry "WAZ" LeKashman than I received an announcement of OK1AW's marriage, but not to I1MQ. Of course, I am wondering what the XYL of OK1AW thinks about the past remarks of Alois. Oh, well, we all know that I1MQ was only a radio acquaintance. You will find a photo of Mr. and Mrs. OK1AW taken the day of their wedding which was June 5th in next month's column. Quoting Alois: "I am sending you list of zones and countries. It was hard work, and I am so busy this time, also marriage spends some time. I can say that my XYL does not make me any trouble yet in s.w. radio. Hi." Congratulations, Alois, and don't forget to work a new country once in a while.

W2AW worked VK9YY on 14,000 T9 and gave us his location as Wewak, New Guinea. A letter from C6HH to W2GWE indicates that he would like to have his QTH appear correctly, so, if you're interested, it will be in the usual QTH section.

What About ZS2MI

We have received quite a few letters from you fellows adding ZS2MI, Marion Island, to your country totals. Here's a place for me to be real cute. Try as hard as I will, I can't find Marion Island listed as a separate country on the official Country List. My DX committee looked over the list, and they couldn't find it either. You ask, "So what?" The answer is, "Well, you don't have another coun-

(Continued on page 68)



W6QD, the XYL Alberta, Linda, Donna and the cruiser *Gadabout*. Who said anything about DX!

W. A. Z. HONOR ROLL

	C. W.-PHONE	
W6VFR	40	202
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W8HGW	40	195
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W6ITA	40	193
W6PFD	40	193
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W6MJB	40	186
W6ADP	40	184
W6SAI	40	183
W6SA	40	179
W6PCS	40	175
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W6AMA	40	165
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W7DL	40	162
W6TT	40	161
W6NNV	40	161
WØNTA	40	161
W7BD	40	160
WØGKS	40	159
W6AM	40	158
W9KOK	40	156
W6OMC	40	155
W6BPD	40	154
W6FHE	40	152
G3DO	40	150
W6SC	40	150
W6LEE	40	150
W6PB	40	149
ON4TA	40	148
W6ANN	40	148
W7DXB	40	146
W9NRB	40	146
W6PKO	40	146
W7BE	40	146
W6LER	40	145
W7GUI	40	143
W6BAM	40	142
W6AOA	40	139
ON4JW	40	136
W2IOP	40	135
W6RDR	40	134
W6TI	40	132
W6YZU	40	129
W6MLY	40	129
G5BJ	40	126
W6NRQ	40	123
W3BES	39	193
W2GWE	39	190
W6EGB	39	189
W8RDZ	39	188
W8BKP	39	187
W2HHF	39	184
W3JNN	39	183
W2PEO	39	180
W4CYU	39	180
W5ASG	39	180
G6ZO	39	180
W6SN	39	177
W9ANT	39	175
W6DI	39	174
W2CYS	39	170
F8BS	39	168
W6ZCY	39	167
W2HZY	39	166
W8NBK	39	165
W9IU	39	164
W3GHD	39	162
W3EVW	39	161
W3DRD	39	160
G5DQ	39	160
W6MVQ	39	158
W1BIH	39	157
W4DKA	39	157
W9RBI	39	156
W3JTC	39	156
G8KP	39	156
VE7HC	39	156
PY1DH	39	154

	C. W.-PHONE	
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W6GDJ	39	152
G6QB	39	152
W4INL	39	151
G5YV	39	151
G2AJ	39	151
W6KRI	39	151
W1NMP	39	150
W2COK	39	150
W6RM	39	148
W6SRU	39	148
CE3AG	39	148
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D2KW	39	147
W8LEC	39	146
W2MEL	39	145
W1AB	39	145
W6RW	39	145
W8SDR	39	142
W6KUT	39	142
VK2ACX	39	141
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G3FJ	39	139
W9LNM	39	136
W6OEG	39	135
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G2VD	39	132
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W6QD	39	129
W6PQT	39	128
G3AAM	39	126
G5VU	39	124
W6EAK	39	123
W6LRU	39	123
W6EPZ	39	122
G3AAK	39	122
G5WM	39	120
G8RL	39	120
OK1AW	39	120
W6UZX	39	119
WØOUH	39	119
G6BS	39	117
G3QD	39	116
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W7GXA	39	106
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W6LN	39	101
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W3IYE	38	161
W3EPV	38	155
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W4OM	38	149
W8FJN	38	147
W1ENE	38	147
W2RDK	38	145
W2CYS	38	144
W8CVU	38	142
W1ZL	38	142
W2PUD	38	141
KP4KD	38	135
W1KFV	38	134
W4BRB	38	133
W4FPK	38	132
W9VND	38	132
G8IL	38	131
W3ZN	38	130
G5CI	38	130
W2PQJ	38	129
G6LX	38	126
W9MZP	38	126
W9TB	38	124
W4VE	38	123
GW3AX	38	123
WØSQO	38	123
W9YNB	38	117
W8VLK	38	117
W9FKH	38	116
W8WWU	38	114

	C. W.-PHONE	
TF3EA	38	114
W5CPI	38	113
OK1CX	38	110
VR5PL	38	109
G3ZI	38	107
G8IP	38	105
W6DLY	38	102
W6ID	38	96
G3BI	38	75
W3DKT	37	141
W2TJF	37	141
W3JKO	37	138
W3KDP	37	133
W4ML	37	127
W1KFV	37	121
G4CP	37	117
VE1EA	37	116
WØAZT	37	112
G4AR	37	108
G5MR	37	100
W2BLS	37	100
G3AAE	37	99
W2SGK	37	95
W7BTH	37	95
W6MUF	37	94
W6WJX	37	92
W2RGV	36	137
W3OCU	36	124
OA4AK	36	123
SV1RX	36	119
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W2CNT	36	115
G2CNN	36	114
G2AKQ	36	112
W2BF	36	108
W4DIA	36	107
W2GUR	36	102
W5BK	36	101
G2AO	36	100
W2EMW	36	100
W8KPL	36	100
G6WX	36	95
W8HSW	36	94
GW4CX	36	92
W7EYS	36	90
W9FKC	36	81
GM2AAT	36	75
CM2SW	35	143
W2DYR	35	123
W3LVJ	35	115
WØDU	35	115
VE3AAZ	35	113
W8AVB	35	113
W9WCE	35	110
W9CKP	35	109
W6ZZ	35	103
VE3ACS	35	103
G8VR	35	100
W2WC	35	99
W3WU	35	98
W6CTL	35	95
G2AVP	35	89
W8JM	35	86
W2HAZ	35	82
D4ANM	35	80
G8RC	35	78
G3BDQ	35	74
W7FNK	35	72
W4DHZ	34	116
W4HA	34	115
W2GVZ	34	105
W9FNR	34	103
G8QX	34	99
G8KU	34	96
VK4RC	34	91
W8JM	34	89
G6XX	34	89
W3AYS	34	89
WØFWW	34	86
W2JA	34	84
W5CD	34	74
J4AAK	34	66
W4LVV	33	111
W4QN	33	104
W8ZMC	33	69
G2LC	33	85

	C. W.-PHONE	
W5BK	33	79
GM2UU	33	79
WØGBJ	33	79
W8PCS	33	78
G8VG	33	78
G3BFC	33	77
W6WUD	33	61
W2NXZ	33	61
W1BFB	32	94
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HA1KK	32	78
W8QUS	32	75
WØFET	32	71
W2AYJ	31	103
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PHONE ONLY

W6DI	38	155
W8BKP	38	145
W6VFR	38	139
W4CYU	37	150
W1HKK	37	136
W7HTB	37	127
G3DO	37	125
G6LX	37	124
G2AJ	37	121
W1JCX	36	146
W2BXA	36	131
W1FJN	36	128
G2PL	36	128
G6BW	36	127
W3JNN	36	125
W8REU	36	123
W6PXH	36	123
F8VC	36	110
G5YV	36	106
W6WNH	36	105
G6WX	36	105
W3DHM	36	96
W6SA	36	92
F8DC	36	87
W1MCW	35	127
W2DYR	35	126
W1NWO	35	125
W9RBI	35	121
W8BF	35	120
G3FU	35	115
GM2UU	35	107
W4OM	35	106
W6PCK	35	103
W6CHV	35	102
G8QX	35	100
W9CKP	35	100
W9HB	35	89
XE1AC	34	133
W2RGV	34	111
W8BIQ	34	103
W4HA	33	105
W5LWV	33	100
W5ASG	33	118
W2ZW	33	115
W2PQJ	33	99
W8QBF	33	87
VE3ZM	33	81
W2DRH	33	60
W9BZB	32	95
W4INL	32	94
W2HY	32	85
WØHX	32	82
W9GZK	32	72
W9RNX	31	95
W4ESP	31	93
W8ZMC	31	87
W9WCE	31	87
W6UZX	31	82
W6AM	31	80
W9MIR	30	82
OA4AK	30	81
W2SVK	30	74
W8SXU	28	59
W2BF	27	52

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The YL's Frequency

Conducted by LOUISA DRESSER, W2OOH*

IN TIME OF DISASTER it is the traditional duty of the ham to step in and provide emergency communications. This holds true for the YL as well as for the OM. During the recent flood in Oregon the YLs were really in there pitching, as you will see from this graphic description by Mary Davis, W7ENU, of that hectic disaster.

"My husband, W7DIS, was appointed emergency coordinator about a month before the flood," writes Mary, "and he started right in with organizing and having drills. Thursday, May 27, he and a group of hams met with officials of the Red Cross, police and fire departments, etc., and by late that night the ham stations were installed and on stand-by basis. I spent all day Friday, Saturday, and from 5 a.m. Sunday on the telephone, contacting the members of the 2-meter gang and requesting them to get their gear in shape to be readily portable.

"Late Sunday afternoon a 10-meter mobile station gave the alarm that the dike protecting Vanport had suddenly given way and water was rushing in on its 24,000 inhabitants. When the alarm came I called one neighbor to take my two small YLs, 3 and 6, across town to my mother, and another neighbor to take me to the station where they wanted me to serve, W7GCZ, and was on duty at 6 p. m. Some time in the wee hours of Tuesday a.m., 7DIS and I slipped home for a little shut-eye. We got two hours in before the telephone started ringing. About the middle of Wednesday a.m. we slipped home for four hours sleep, and again about 5 a.m. Friday we got another four hours.

"Starting Saturday, W7MFS's XYL and I kept a clear channel open on 2 meters between Vancouver and Portland, 24 hours a day. Her husband was busy with the flood, as was also the only other 2-meter man in Vancouver, so Rosemary, or 'Romey,' manned the rig for countless hours at a stretch for days on end without relief. She had no telephone, so had to go a block every time she needed to phone a message. When 7DIS finally told her to secure her station and go get some sleep, she reported back the next morning that she hadn't been able to sleep with the rig turned off!

"We haven't made an exact tabulation yet of the traffic that was handled, but to the best of our ability to estimate we figure that 10,000 messages were handled in that week. It was a vast network on 10, 20, 40 and 80, with the inter-station traffic flowing on 2 meters. In addition to all the hams, we had to use Army and Navy operators home on furlough, youngsters studying radio at Polytechnic High School, and XYLs. A group of the XYLs manned the message center at Red Cross for the first few days, and a group of high school Camp Fire Girls manned the two main message centers handling the welfare traffic for over a week after everything else was fairly quiet.

"In addition to my full-time operating, Marie, W7KAW, handled traffic during the first days of the flood. Lucile, W7FXE, helped her OM, W7KY, who was active in the 10-meter mobile set-up. Wandalee, W7KDC, and her OM, W7IEY, were in town from Rupert, Idaho, and also helped out on 10 mobile. Romey was the only other girl who acted in the capacity of operator for very long, though W7GCZ's XYL, Rhoda, helped us operate when the stations were calling us on both 2-meter circuits and the 75-meter rig all at the same time."

Well done, YLs, say we!

THE YLs TAKE TO THE broadcast bands! On June 19th the YL Radio Club of Los Angeles broadcast for half an hour over the "Salute the Ham" program via the FM station of KUSC, University of Southern California station. On the 18th the members gathered at various "key" 10-meter phone stations and were picked up on 75 phone by W6KGC, acting as net control station operating portable at KUSC where the QSO was recorded. Lenore, W6NAZ, acted as mistress of ceremonies, interviewing the girls from W6KGC's station. The program covered the history of YLRL, the YL Radio Club of L.A. and personal interviews with Clara, W6TDL; Violet, W6CBA; Ida, W6BIS; Maxine, W6UHA; Naomi, W6YZU; Vada, W6CEE; Evelyn, W6NZP; Ruth,

(*Continued on page 58*)

Assistant Editor, CQ. Send all contributions c/o CQ, 342 Madison Ave., New York 17, N. Y.

At the YL Radio Club of Los Angeles installation of officers luncheon held June 19th at the Roosevelt Hotel in Hollywood, the new president Maxine Willis, W6UHA, presents roses to Clara Dishong, W6TDL, retiring president. Standing: Eleanor, W6AWW; Ruth, W6WQK, retiring treasurer; Florence, W6AET; Margaret Mannes; Mary, W6TCN; Maxine W6UHA; Jean, W6ZYD, president of San Diego Club; Clara, W6TDL; Helen, W6MWO, former president YLRL; Maxine, XYL of W6FMK; Neva, W6YXI; Violet, W6CBA, secretary; Ida, W6BIS, treasurer. Seated: Evelyn, W6NZP, and Helene, W6QOG. *Photo by W6NAZ*

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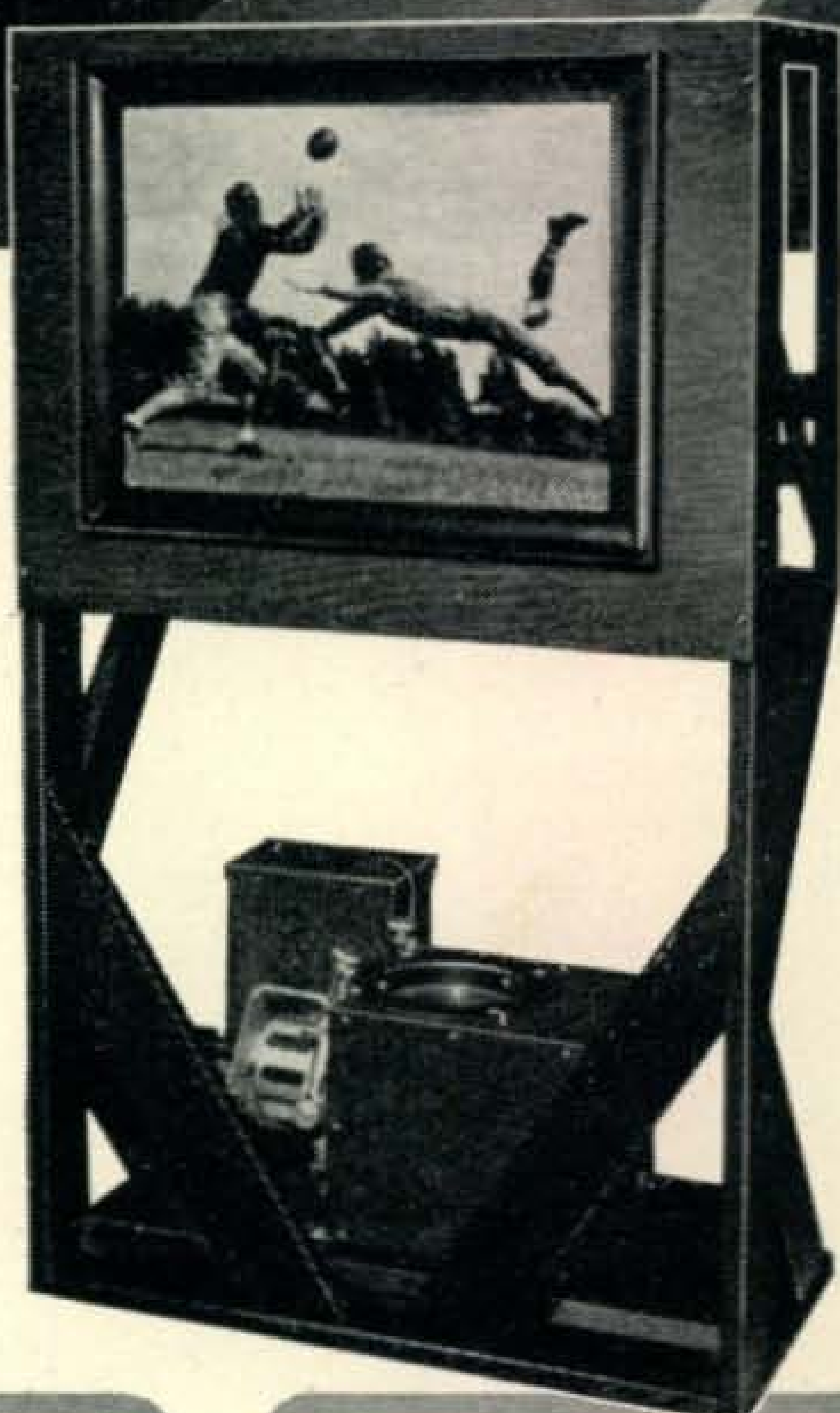

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WORLD'S LEADING MANUFACTURERS OF PRECISION RADIO AND TELEVISION EQUIPMENT!

Teresa Rosario, second op at CR9AN.

W6WQK; Carol, W6WSV, and Louise, W6VWR. W6NZP made a wire recording of the broadcast and played back part of it at the L.A. club luncheon the following day. . . . a really FB affair, we hear, with installation of new officers, and highlighted by the presence of three gals from the San Diego Club.

How would you like to be a YL signing a nice DX call like CR9AN in Macau, Asia? From CR9AN, Adrian Rossario, via Dot, W1FTJ, we received the accompanying picture with the note: "I am enclosing picture of the second operator of CR9AN. She is a YL, 100%—hi! Answers to the name of Teresa Rosario and, in spite of having the same surname as OM CR9AN, is not related at all. Found out that she showed an interest in code, so immediately made her an audio oscillator and induced her to learn the code. After a month and a half she was able to copy 20 wpm, with practically no errors, so put her on the CR9AN/KA1ZU traffic circuit and she did FB. Today she copies long stretches of press without batting an eyelash, and can take close to 30 wpm without any effort. She can also dish it out on a straight key at 20 wpm, and perfectly spaced Morse at that. All in all she is a very FB operator according to the stations she has QSOed!"

Personal Mention

Via Lil, W2PMA, we received interesting news of Verna, KL7AX, and Beryle, W2RNJ/6.

From Ugashik, Alaska, Verna wrote: "We got down from the trapping cabin last Sunday (May 15). The winter was very nice and it just simply flew by. Had a lot of company, and got our mail three times instead of once like last year. Trapping was fair; got our two limits of beaver, ten for each of us, and then got a few mink, land otter, and muskrats. We were not able to be on the air nearly as much as we would have liked to due to a severe shortage of gas. As it was we just did manage to have enough to get down from the lake to the village. The little rig worked fine, though, most of the times we were on."

Writing from Los Angeles, Beryle said she had had no opportunity to see any of the local YLs since the first club meeting she attended because she has been working. She adds: "We have had no time for radio activities while traveling and working, so that will have to wait until we are through with our vagabonding. Since February we have been going two nights a week to classes in mineralogy. It is a fascinating subject and we feel that knowing something of rocks and minerals will make our travels more interesting. The West is so full of mines and minerals, and nearly everyone is a collector of minerals—they call them 'rock hounds.' "

By now Beryle and her OM are on their way to see Sequoia, King's Canyon, Yosemite and Grand Canyon National Parks, San Francisco, Lake Tahoe and many other places. How we envy them!

From Ada, I1MQ, we learn that she is in Lecco, a city in Norhern Italy, about 150 kilometers from her home town. She says: "Here I am the guest of friends of my family who have a machine laboratory, and I am working hard to promote it. Yesterday (June 19) for the first time since I have been in Lecco I was successful in having a QSO with my father in Diano Marina. This was my debut on phone, since the OM who placed his station at my disposal doesn't work c.w. I confess that at the beginning I was a little nervous, but as time went on I redeemed myself and was able to have a beautiful QSO." Sooner or later it happens to all c-w stalwarts, Ada!

Martha, W1OIR, and Eunice, W1MPP, attended the special service on June 27 at W1JLK's church in Woods Hole, Mass., at which "Deke's" sermon was "Loud Speakers" with Psalms 19:3 as the text: "There is no speech nor language where their voice is not heard." Eunice was the guest soloist.

We hear that Sandy, W6YRL, has been making conquests on 10 phone. Using only 10 watts, she has been working ZLs and VKs like mad—the answer being that her fine new beam is 60 feet high.

The F.C.C. has just assigned the call W5ZA to Eunice Falconi. This call belonged to her OM, Louis, whom she lost last January. She is now on 14,280-282 with a new rig.

More newly issued calls: W4NUL, Betty Hewitt; W5OQT, Sue Snarr; W6DKV, Mary Hatcher; WØJHU, Cora Taylor; W2YSE, Dorothea Witchey; W6DIB, Virginia Lansing; W4NRV, Sylvia White; W4NMV, Catherine Mundy; and W3OHL, Betty Robertson.

YL of the Month

How would you like to have a W6, W8, and W5 call all in the same year? Our YL of the Month, Viola June Wheeler, now at Cleveland, Miss., has had all three and comments: "Guess I've kept the F.C.C. busy with my jumping around. First call was W6YYS, got that modified to W8BBE, and now am W5OBR.

"My dad's been a ham since he was a kid and his hobby in radio always interested me. I graduated from the University of Wisconsin in June, '46, with

(*Continued on page 97*)

Viola June Wheeler, W5OBR, YL of the Month.

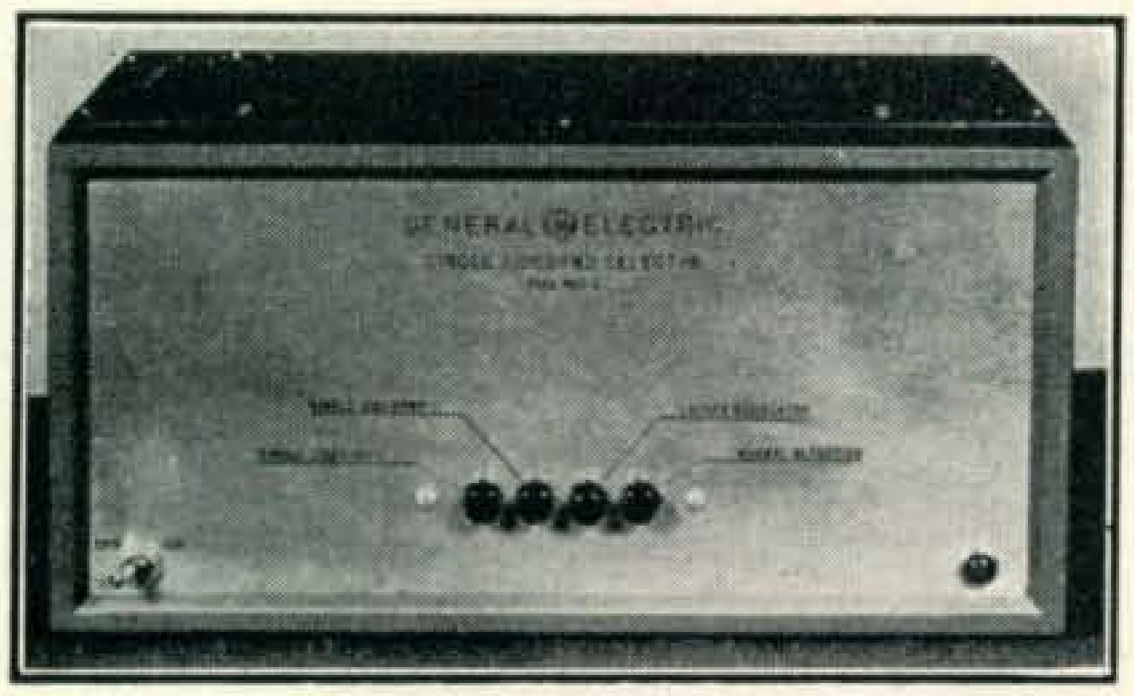
PARTS AND PRODUCTS REVIEW

Single Sideband Selector Announced

A single sideband selector, type YRS-1, which provides improved reception in crowded amateur and communications radio bands without affecting the quality of the received signal, has been developed by the Specialty Division of the General Electric Company's Electronics Department.

For reception of ordinary AM signals, the YRS-1 makes possible the selection of either sideband through simple pushbutton operation, having no elaborate tuning controls. Carrier drift, within limits, is followed by means of a locked oscillator eliminating any need to follow small variations in transmitter frequency or drift in the receiver's local oscillator.

There are four pushbuttons on the device, one for dual sideband reception with reinforced carrier, one for normal reception and one for selection of each sideband. The device is designed for use with any receiver having an intermediate frequency of about 455 kilocycles.



Whether set for single sideband or locked oscillator, the unit reinforces the carrier about 20 fold. This reduces that type of distortion which occurs when the carrier-to-sideband ratio falls below the level required for conventional reception as in selective fading or high percentage modulation.

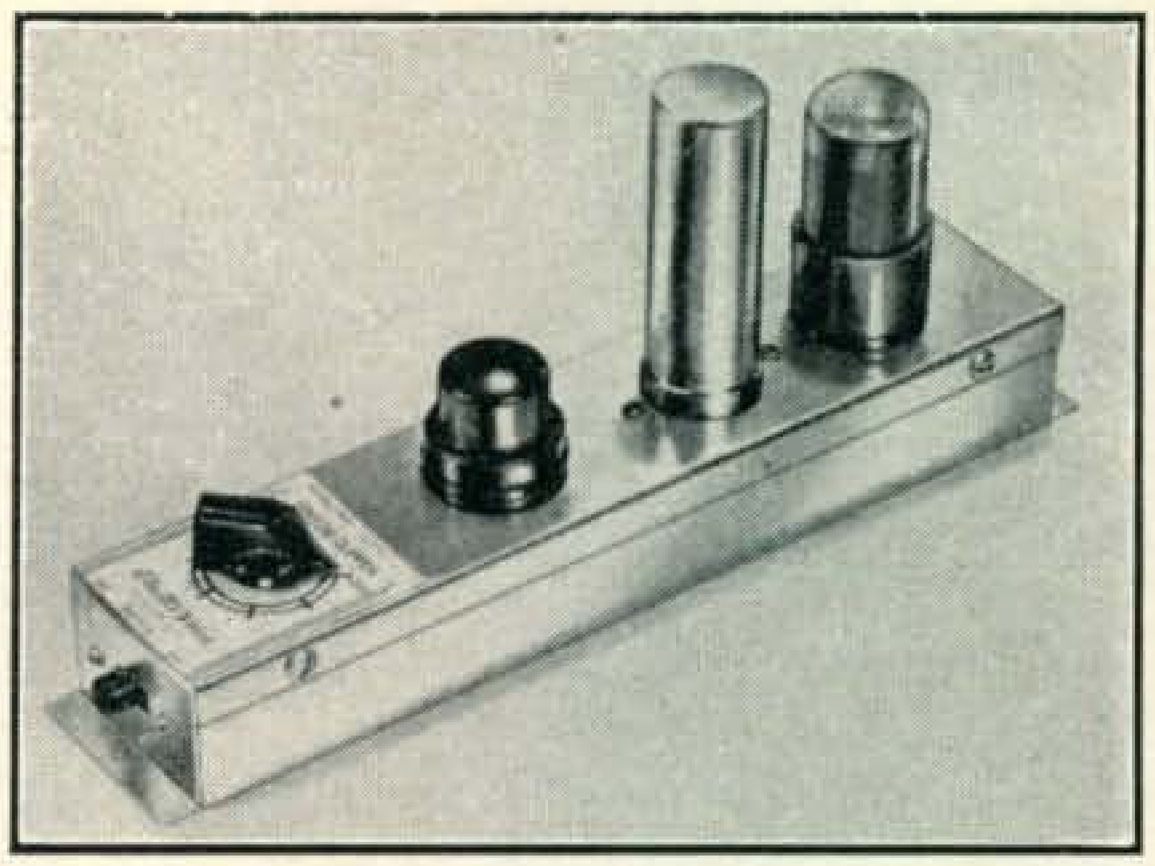
The new device is 14½″ wide, 7¾″ high, 8½″ deep and weights only 15½ pounds. It operates on 105–125 volts, 50/60 cycles power at 60 watts. For further information on the new Single Sideband Selector, write the G.E. Specialty Division at Electronics Park, Syracuse, N. Y.

Speech Clipper

The Electro-Voice Model 1000 Speech Clipper effectively increases the ratio of consonant-to-vowel intensity by clipping the peaks of the vowels while limiting the peaks of the consonants to that of the pre-set modulation percentage. This adds greatly to intelligibility in speech transmission, especially in the presence of high QRN or QRM.

The E-V Model 1000 operates directly from any high impedance microphone into the microphone input of a conventional speech amplifier. The gain of the speech-clipping pre-amplifier is purposely held to unity at an average clipping value so no overload will occur in the main amplifier input stages. The filament and plate power is obtained from the main amplifier.

As clipped frequencies tend toward a square-wave output, it is necessary to suppress the generated harmonics. This is accomplished by a pi low pass filter which provides attenuation of 24 db on the upper skirt of the curve above 3000 cps. The low frequencies, below 200 cps, are reduced to give further improved speech energy distribution on the carrier. ON-OFF switch is provided for selection of conventional or clipped operation.



Specifications are, Gain, unity at average clipping value. Clipping, 3-20 db. Plate voltage required, approximately 150 volts. Plate current required, 5 ma. Filament power required, 6.3 v. at .6 amperes. Frequency response, 200-3000 c.p.s. Tube complement: 6SC7, 6H6, supplied. Case: compact, sturdy aluminum. Size: 10¼″ x 2″ wide x 4½″ high.

For further information, write for Speech Clipper Bulletin to Electro-Voice, Inc., Buchanan, Mich.

New Literature

A new Catalog D-130 has just been issued by Ward Leonard Electric Company, Mount Vernon, N. Y. This convenient reference-guide fully describes and illustrates a comprehensive line of stock units in resistors, rheostats, and radio amateur relays, and gives list prices.

High Gain Pre-Selector

Babcock Radio Engineering, Inc., is now manufacturing a compact pre-selector designed to improve the gain, image rejection, and signal-to-noise ratio of any receiver. The self-contained unit uses

a 6AU6, 6J6, and VR150/OD3. Four bands are covered on a bandspread scale: 10, 11, 15 and 20 meters. General coverage is from 13 to 40 mc. Full details may be obtained from the manufacturer at 6164 Sepulveda Blvd., Van Nuys, Calif.

MORE FOR YOUR MONEY - EVERYTHING FOR THE HAM

BARGAINS GALORE . . . . **Distributors of amateur radio equipment and parts.**

Look at these EXCLUSIVE *WAR SURPLUS* BUYS!

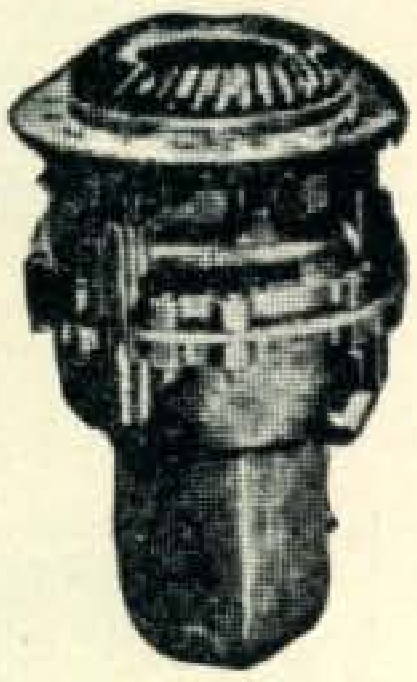
FOR your BEAM!

- Runs on 24 to 33 volts AC or DC (4 amp. transformer will do)
- Reversible—only three wires required.
- 7000 to 1 Gear Reduction stops free swing.
- Approx. 3/4 RPm
- Powerful 1/4 H.P. motor, rugged precision gear train, and sturdy thrust bearing—will support and turn even a heavy dual beam.

Used on aircraft to control pitch of propeller blades, these dependable power units are excellent beam rotators (see pages 22, 23, 29, Nov. QST). Used, but in perfect tested working conditions, with instruction sheet. **$8.95**

Your Net Converted. **$10.95**

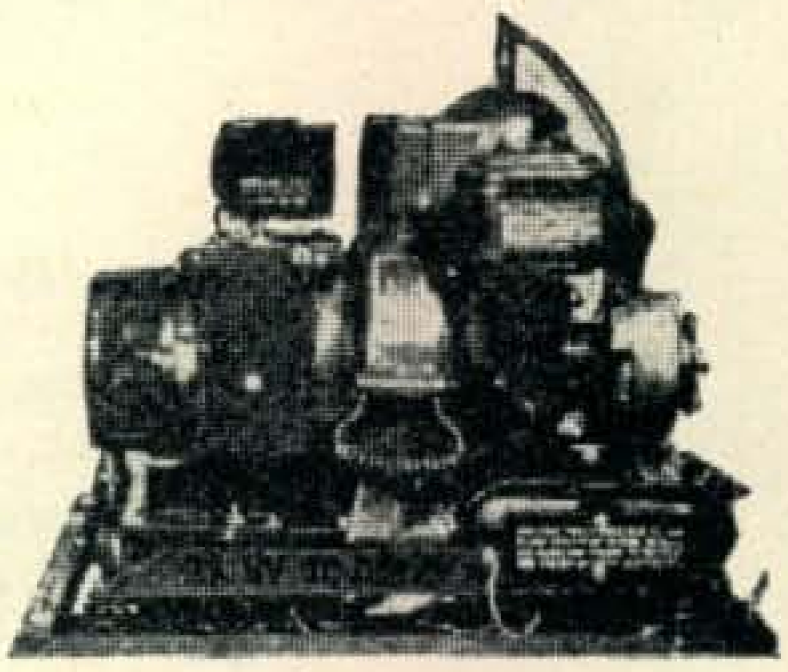
(Mail orders add **$1.25** for packing)



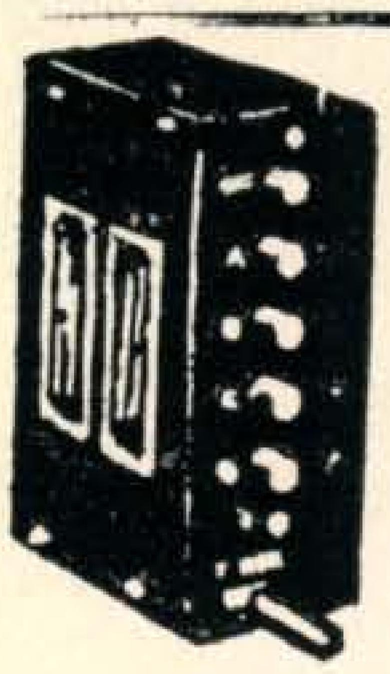
DC POWER SUPPLY

(HRU)

24-28 V. at 70 Amp. 2000 watts gasoline engine generator with electric starter. Power supply which can be used to operate 24-28 V. equipment, start airplane engines, charge batteries.



$69.50



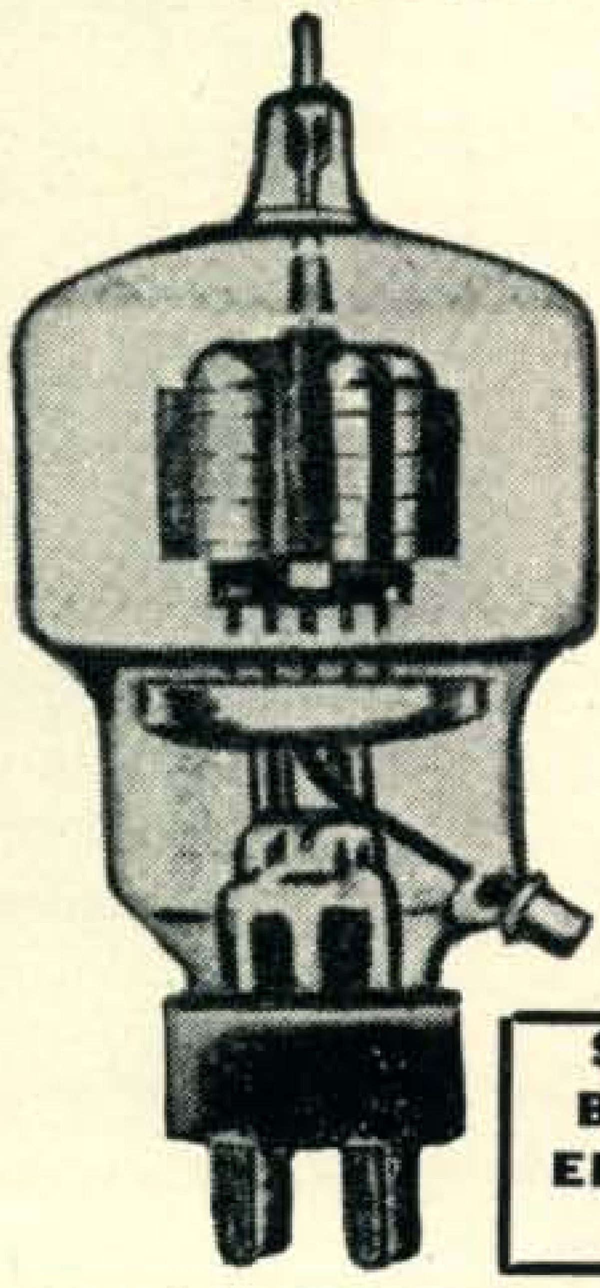
ATTENTION!!!

All SCR-522 Owners

Remote Control Boxes for SCR 522's. Brand New in Original Packing; Consists of 5 push button switches, 5 Western Electric Pilot Assemblies, with Pilot Bulbs and Dimmer, and Lever Switch all finished in Black Crackle. Order yours Today.

Your Cost **79c ea.**

POWER!! POWER!!



EIMAC 304TL

BRAND NEW

JAN. INSPECTED

SUPER VALUE

BETTER ORDER 4 OR MORE TODAY

90c EA

WHILE THEY LAST ANY QUANTITY

SUPER SPECIAL

BRAND NEW EIMAC 304TH $3.95 ea

JAN. INSPECTED

SOUND POWERED PHONES & CHEST SET WITH MIKE $4.95

Vertical Antenna

MAST KITS

Fully Adjustadle

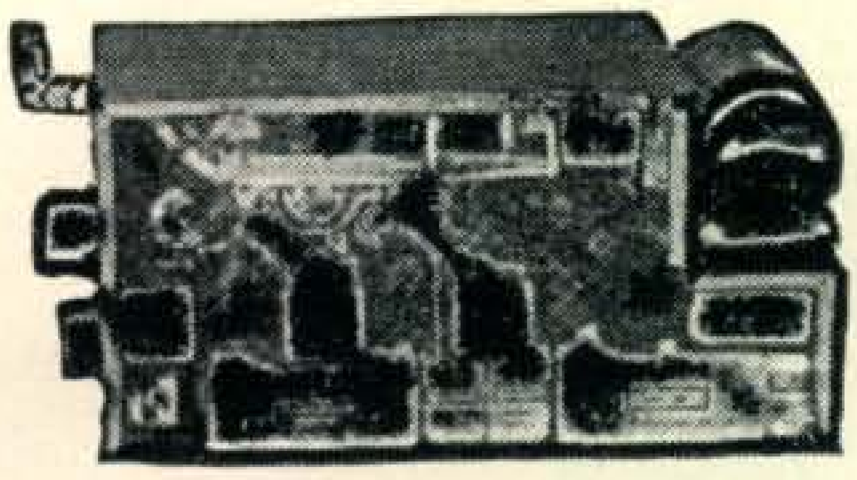
5 to 35 Feet

Easy to Set-up

FOR FM, TELEVISION AND ROTARY BEAM

COMPLETE

$9.95



SCOOP

110 A.C. REC. BARGAIN

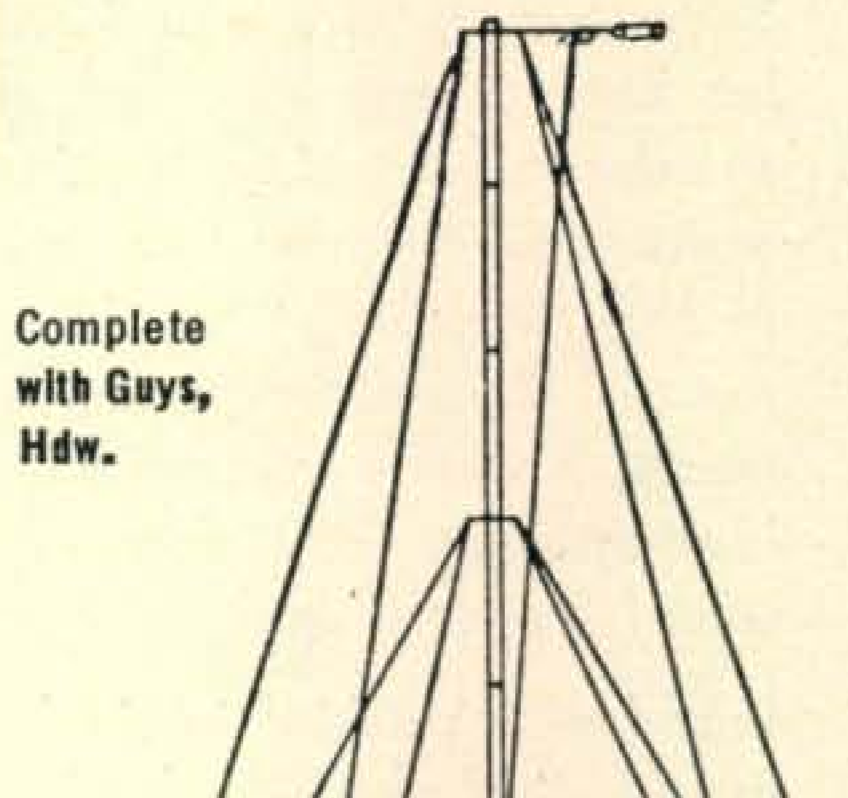
BC-733 D Localizer Receiver

Freq. 108-110 Mc. Tube complement 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—12AH7GT, 2—12SG7, 3—717A. NEAR NEW CONDITION. Companion to the glide path receiver. Also contains 90 and 150 cycle band-pass filters. Has the best AVC system yet developed can use parts or use as a model for construction. 10 tubes, crystals, relays, etc. Schematic included. Don't pass this up. With dynvamotor. At only. **$3.95**

2 for $7.50

Doublet Antenna Kit used with the famous Hallicrafters BC-610, consisting of 7 steel-alloy mast sections in a handy canvas bag. Each section is 5′ 6″ long, 1½″ OD with the last 6″ rolled to a smaller OD to telescope into the end of the preceding section. No taper. Assemble into mast up to 35 high or shorter by any multiple of 5′. Finished in weatherproof olive drab. **Ideal for erection of FM and Television Beams!** Drop your coaxial cable right through the center! Brand new, export packed.

Complete with Guys, Hdw.



TERMS: F. O. B. Pasadena unless postpaid. No C.O.D.'s under $2.00. 25% deposit on ALL Orders. All C.O.D.'s shipped by Rail Express. Save freight and C.O.D. fees by sending full price with order and we will ship by fast truck, transportation collect. Minimum order $2.00. Californians include 2½% sales tax.

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DOW RADIO

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L. A. Ryan 16683

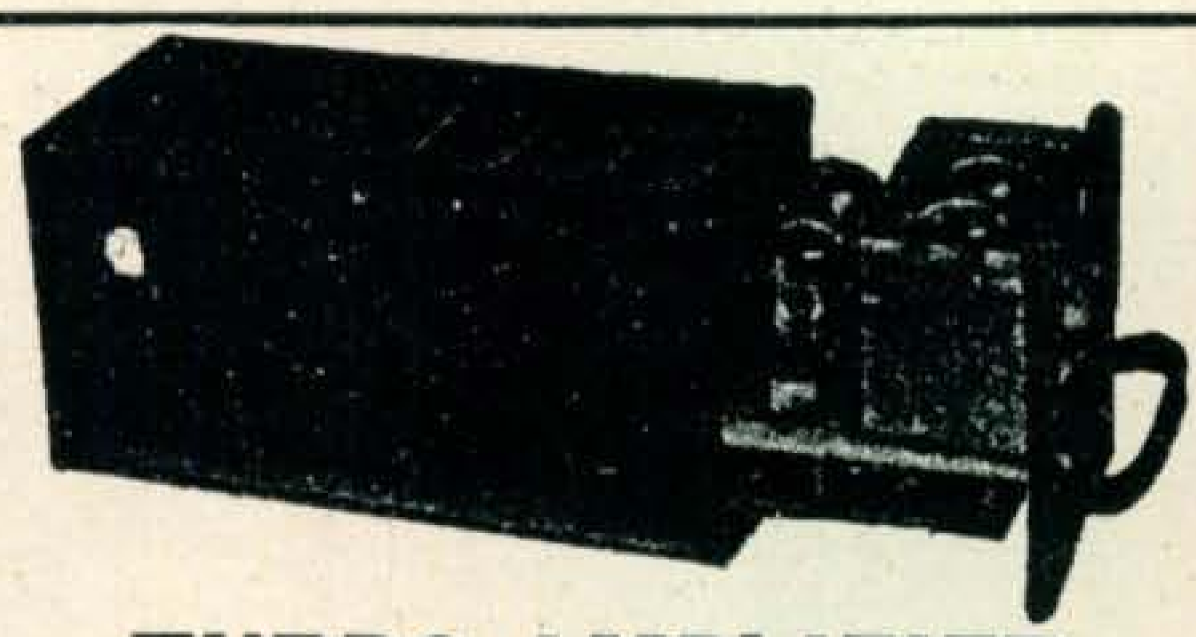
ESSE Specials!

Do not fail to closely examine this list of bargains. We believe that every item listed below is a sensational value that soon can never be repeated. All equipment advertised herein is unconditionally guaranteed to the customer's satisfaction to this extent: Return any item advertised within five days after delivery for full refund except transportation charges (both ways).

C-1 GYRO

$8.95

Part of the C-1 Auto Pilot which is sold separate and may be used to conduct many interesting and amusing experiments. Operates from 24 V. DC or may be operated for short periods on 110 V. AC. Gyro will run for approx. 15 minutes after actuating. Size—approx. 8" x 8½" x 8½".



TURBO AMPLIFIER

Used for parts—shipped complete with the following tubes:

2..........7 C5's
1..........7 Y4
1..........7 F7

Price.....................$1.00 ea.

2-METER BEAM ANTENNA

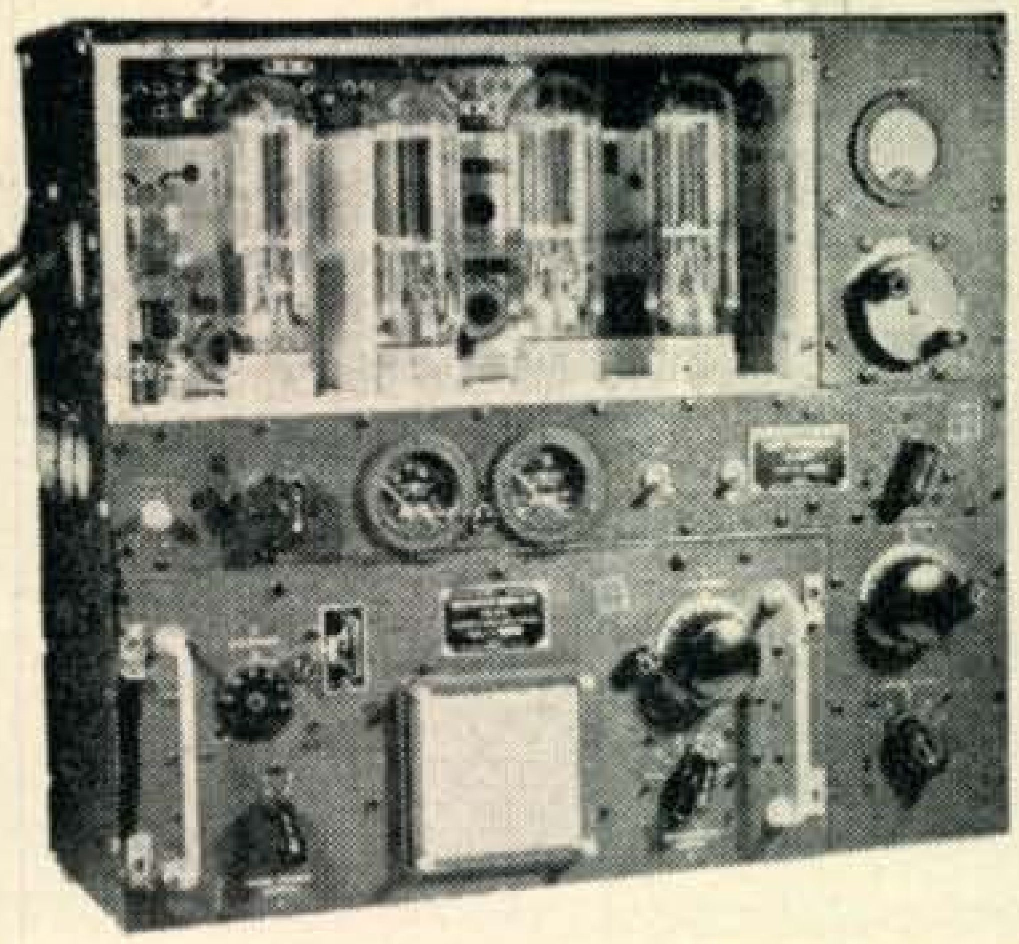
Portable or fixed, manually operated or can be used with beam motor, for use in 100-156 Mc. band. Easily adapted for ham or experimantal use. Contains tuning unit which matches output of transmitter to antenna, 18' steel mast with brass tube containing co-ax cable and fittings inside steel mast (OD color), "H" frame for holding dipoles, 3 sets (4 per set) dipole rods, compensator or sense antenna for "H" frame, 2 steel truncated cones used as antenna support and feed-through, 360 degrees bearing indicator, and hand-wheel for rotating.

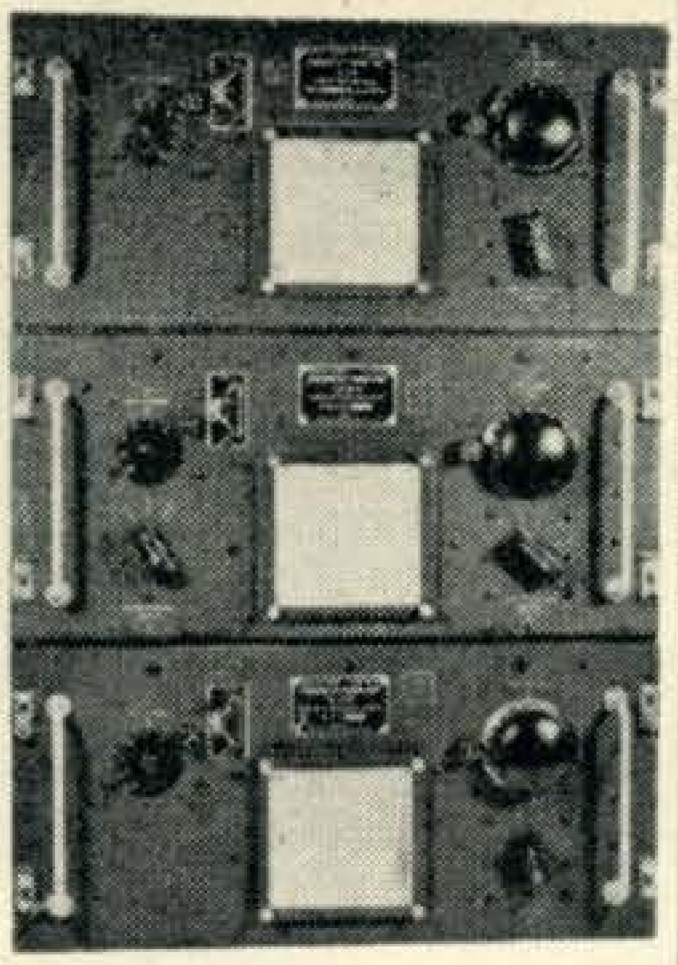
Brand new packed in six boxes, total weight approx. 600 lbs. Limited quantity and in much demand. Place order now.

PRICE $79.50

ANTENNA KIT 2A-264-126

Canvas bag containing 20 ceramic insulators each 3" long (1¼" dia. with screw-in type eyelets), covered wires each 5' long, 10' long, 35' long, 2 each 25' long, 5 each 20' long, 150' long, (all having ⅛" thimbles and 6" connecting leads at each end and all stranded copper covered with weather proof insulation.) Brand new. Original crates. Useful to any ham, serviceman, or experimenter. Each kit............... $4.95





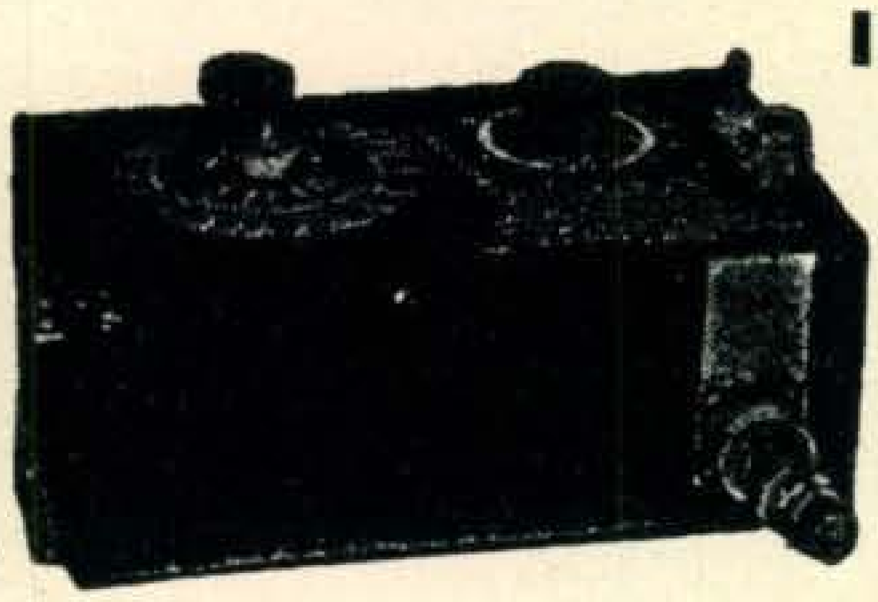
BC-375 GE MOPA TRANSMITTER

The most famous of all surplus transmitters. Was used by the Army bombers and ground stations during the War. Frequency range is covered by means of plug-in tuning units as shown below. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. **Frequency Range:** 200-500 Kc. and 1500-12,500 Kc. (Will operate on 10 and 20 meter band with slight modification). **Oscillator:** self-excited, thermo-compensated, and hand calibrated. **Power Amplifier:** neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. **Modulator:** Class "B"—uses two 211 tubes. **Power Supply:** Dynamotor which furnishes 1000 V. at 350 Ma. **Conversion** instructions and diagram for 110 V. AC furnished upon request for **$1.00.**

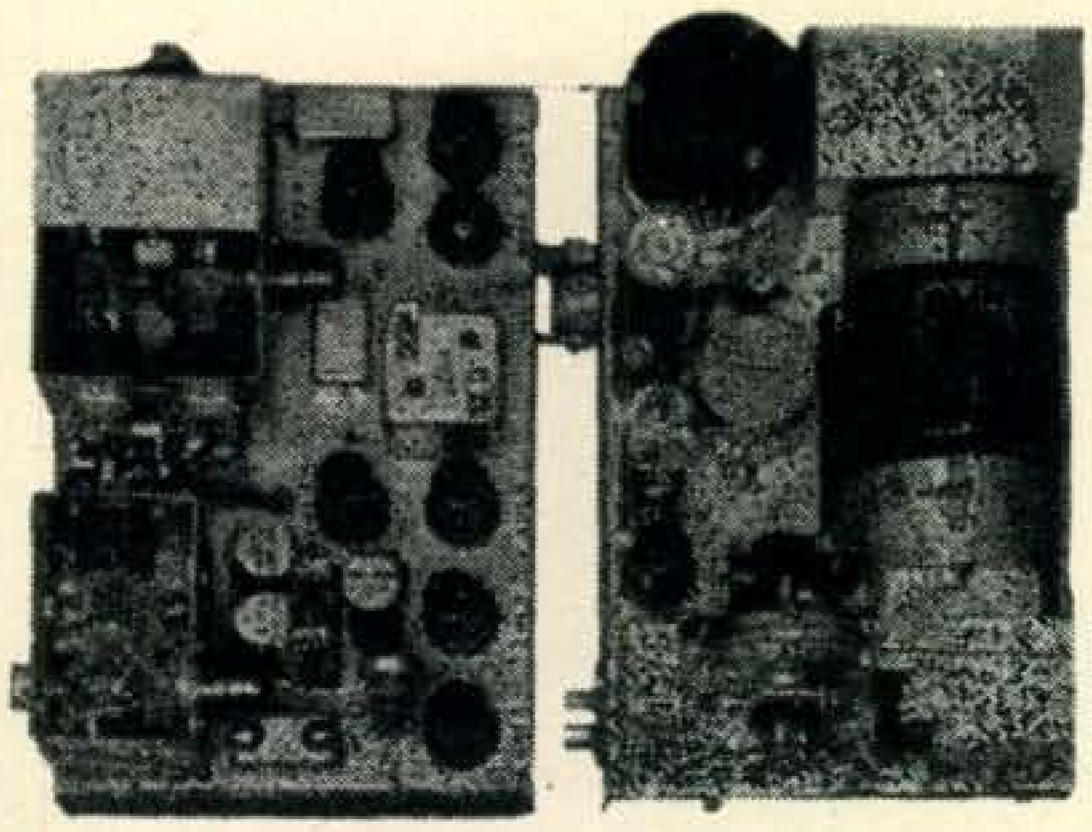
PRICES: As follows—

Transmitter only.............................**$12.50**
Tuning units TU-5B, TU-6B, TU-7B, TU-8B, TU-9B, TU-10B, TU-26B, choice **$2.50**
Dynamotor PE-73C...........................**$3.95**
Antenna tuning unit (BC-306A)..................**$4.95**

INTERVALOMETER



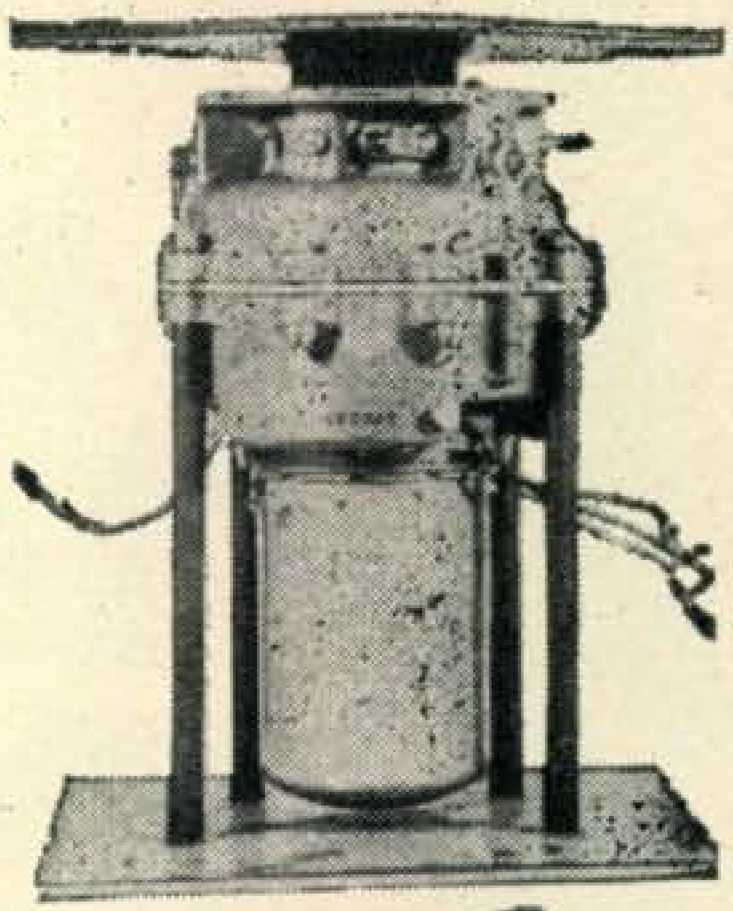
Electronic timing device. Was used for releasing bombs at intervals. Ideal for darkroom timer, model train controller. (Contains relays, switches pilot lights resistors knobs, etc.)
Price...... **$2.25**



BC-966-A IFF
Approximately 2 meter frequency operation. 14 tubes, 350 V. DC dynamotor 18 V. DC input. Contains voltage regulators and many other fine parts. Worth more for parts than price asked...........

$4.75

BEAM ROTATING MOTORS



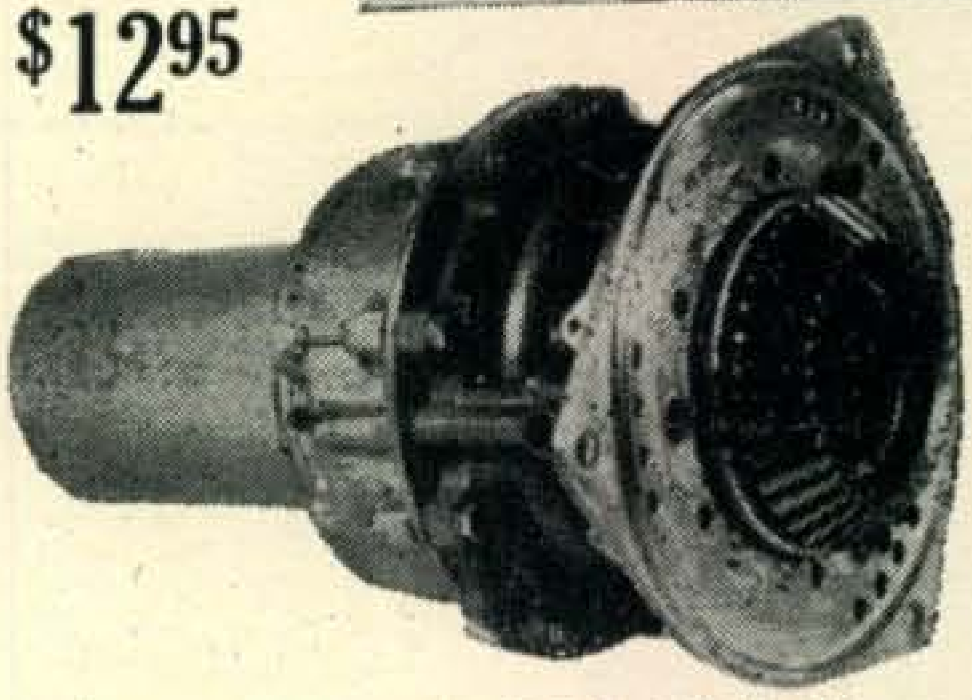
Motor with mounting plates etc.

$17.95

Used to rotate your beam antenna

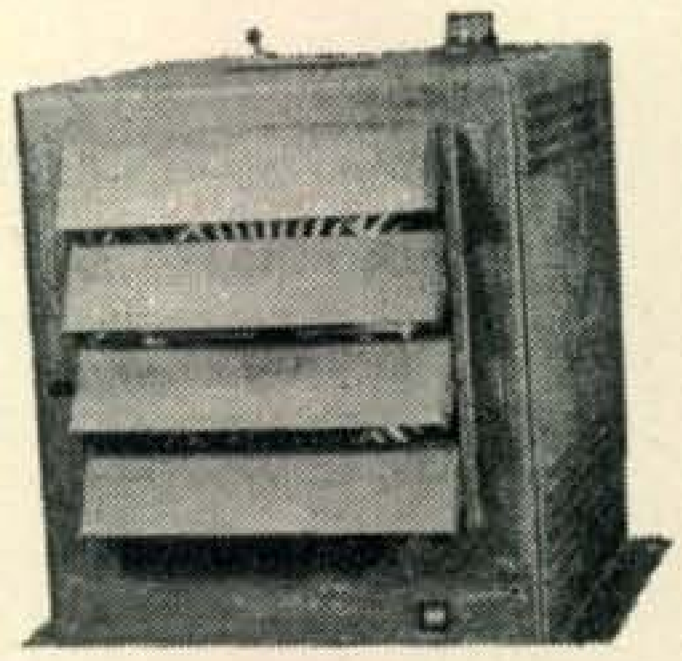
Motor only, 24-28 V.

$12.95

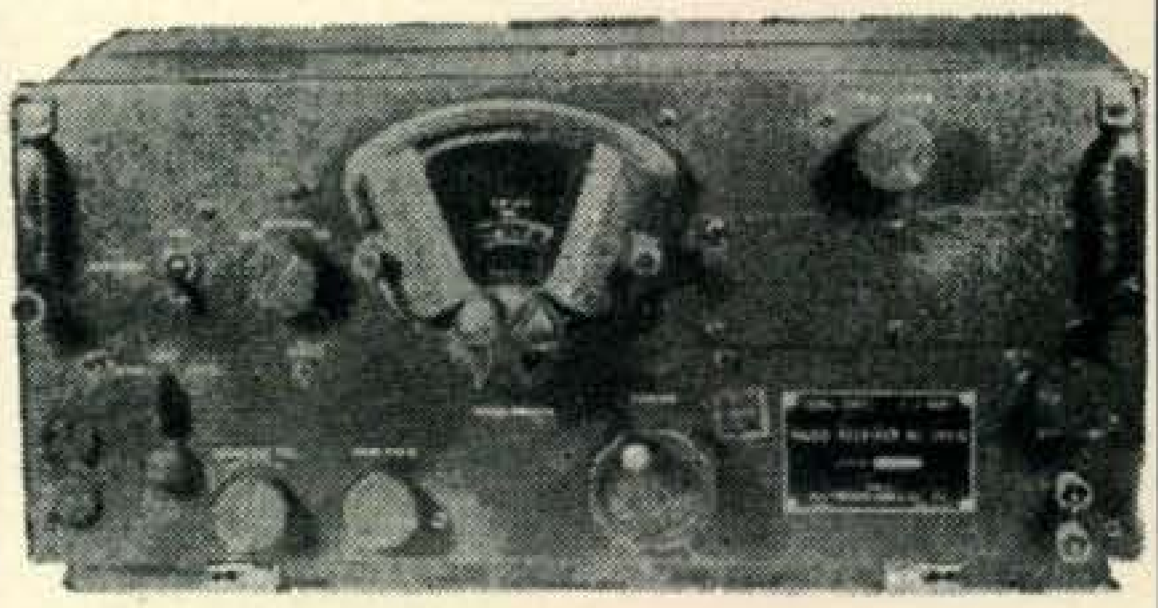


Transformer to operate 110 V.-30 V. (New) **4.9**

ELECTOMODE HEATER

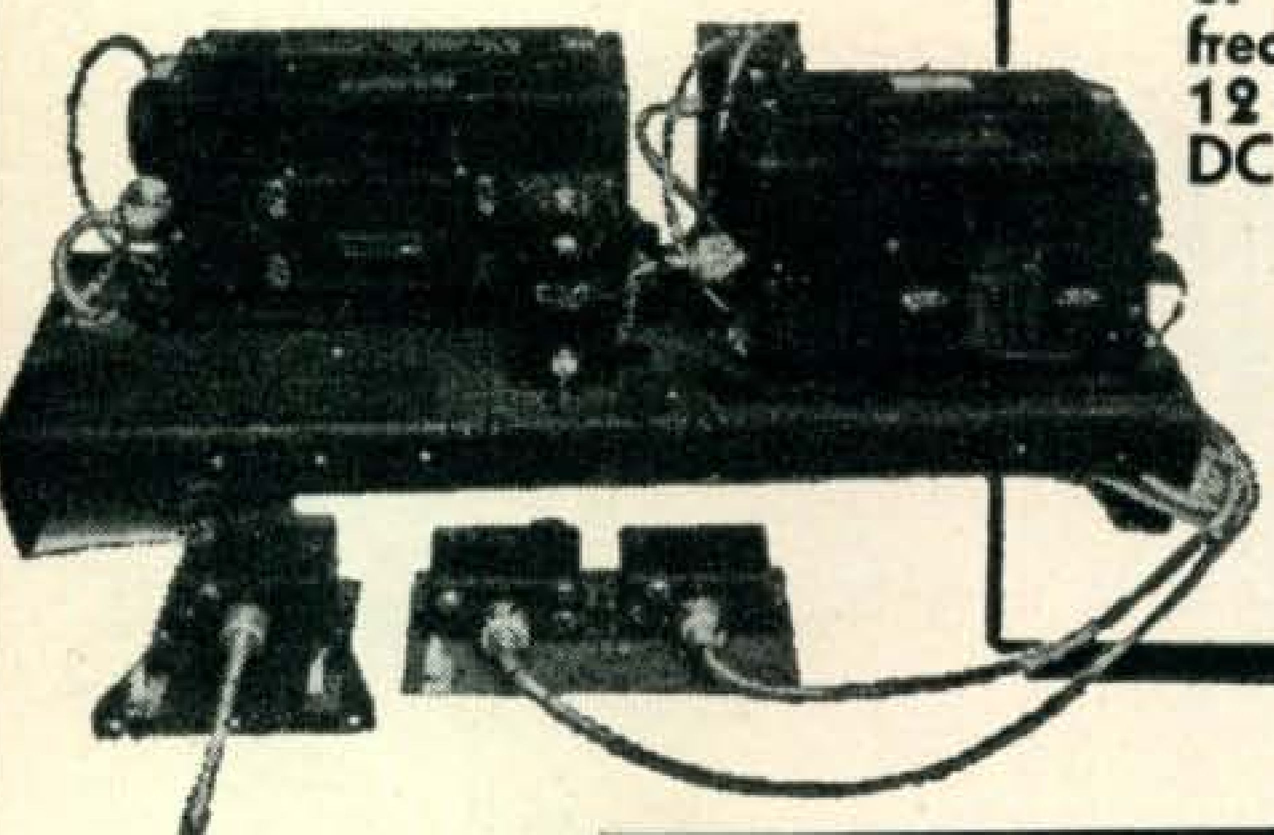


This is a heater used to heat the trucks of the SCR - 299 mobile units — which proved highly successful during the war. Operates from 110 V. A.C. 1,500 watts. Contains blower unit for forced air heating which can also be used for fan during warm weather. Thermostatically controlled with motor protect Thermotron. **29.50**



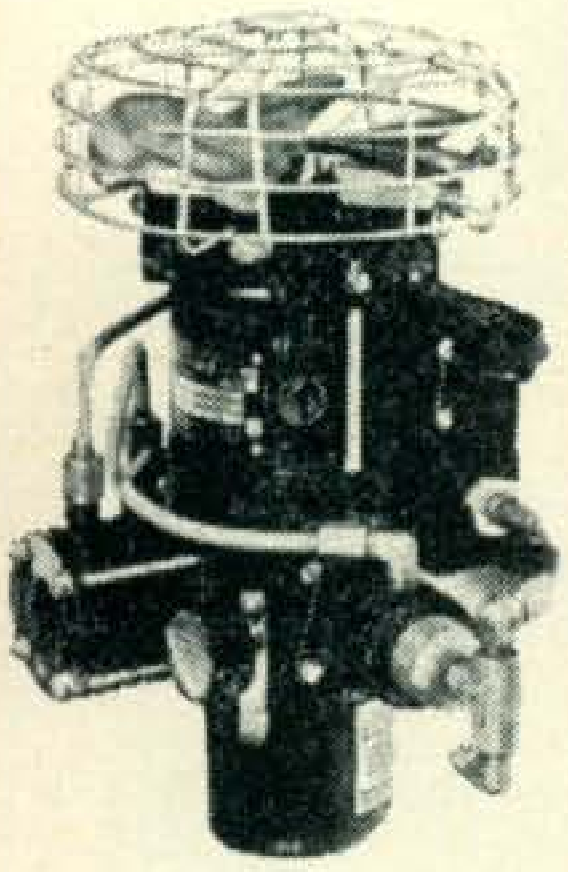
BC-348 Communications Receiver $149.50

6 bands, 200-500 Kc. and 1.5-18 Mc. 2 stages RF, 3 stages IF, BFO, crystal filter, manual or AVC. Complete with tubes and 24 V. dynamotor. These receivers have been thoroughly checked in our work-shop and found in excellent condition.
BC-348, 110 V. AC power supply, including simple conversion instructions. Complete with tube........................ $8.95



RU - 16GF - 11

Transmitter and receiver—12 V.; transmitter frequency 3000-4525 and 6000-9050 Kc.—frequency changes by means of plug-in coils; receiver frequency 195-13,575 Kc.—frequency changes by means of plug-in coils; power output 12 watts on voice, CW, or MCW; dynamotor input 12 V. DC at 10 amps.—output 435 V. at 143 Ma., well filtered. Mounted on rack 13" x 31" (transmitter and receiver shock-mounted.) Has rec., remote tuning control with cable, junction box, receiver switch box, test meter and antenna relay unit, instruction manual, all coils, and tubes. Wgt. approx. 100 lbs. Only a few left at this bargain price............. $49.75



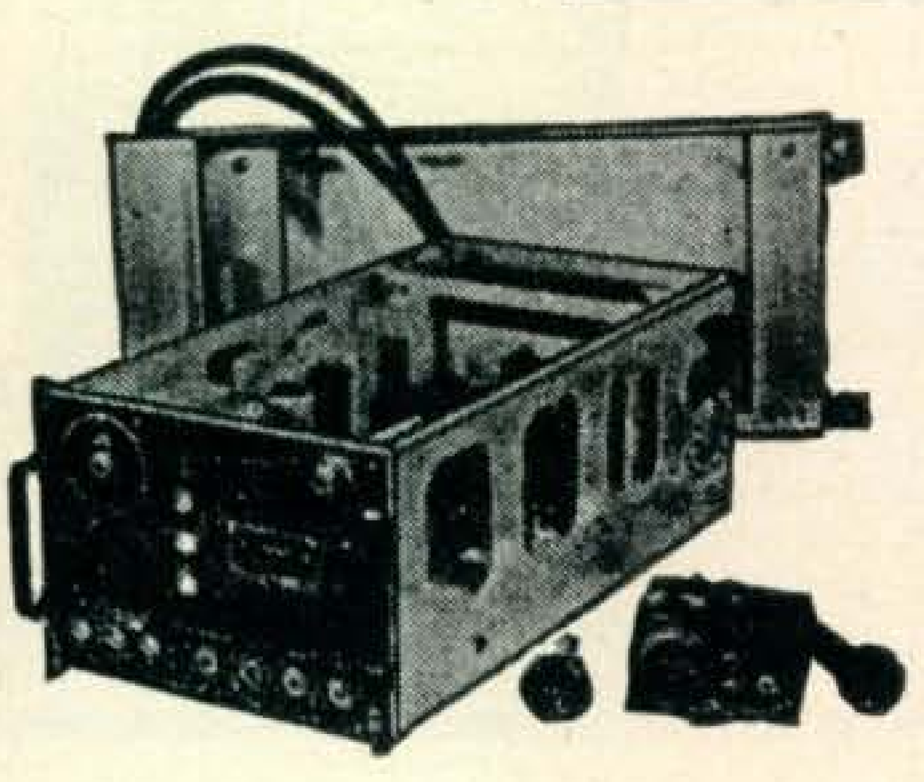
AIR COMPRESSOR

Will pump pressure up to 1000 lbs. per sq. in. 3-stage type—air-cooled, powered by a 24 V. DC motor. Ideal in shop for use with airgun, smal lpaint sprayer, and numerous other applications. Small, compact, precision-built. Only........ **$12.95**

CO-AXIAL CABLE VALUES

Co-axial cable values that we can only offer to customers who buy minimum of 100 foot per type

RG-8/U cable 52 ohms impedance (unmarked) .... **$2.95** per 100 foot
RG-8/U cable 52 ohms impedance (marked)..................... **$3.95** per 100 foot
RG-29/UCO-AXIAL 53.5 ohms impedance (marl ed)...... **$3.95** per 100 foot



ARC-4 Transmitter and Rcvr.

Operates on any of its 4 predetermined crystal controlled frequencies in the range of 140 MC. Complete with tubes, remote control, junction box, shock mounting base and connecting plugs. This unit is ideal for amateur UHF or mobile telephone. Operates from self-contained 24 V DC dynamotor. **$17.95**

INCLUDING CASE

TELRAD 18-A FREQUENCY STANDARD

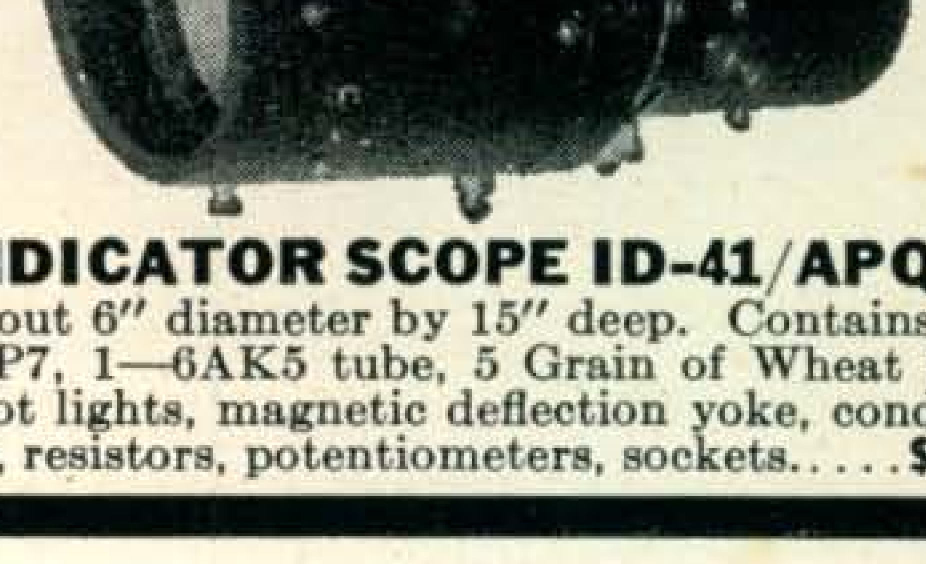
Checks signals in the range of 100 Kc. to 45 Mc. with a high degree of accuracy. Self-contained power supply is 110, 130, 150, 220, and 250 V. 25-60 cycle AC. Complete with tubes, dual crystal, and instruction book. Brand new. Price..........

$24.95

SN-7C/APQ-13

Sensational offer for Television engineers. Contains 19 Mc. IF strip containing 5—WE717A tubes. Other HF strips containing 2—6AK5's, 3—6SL7GT's, 1—WE717A, 4—6SN7GT's, 2—6N7's, 2—6L6's, 1—6H6, 3—6AC7, 2—6AG7, 1—6V6. A total of 26 tubes. Other parts such as DPDT relay, 7 pots, 12 Amphenol 831R chassis connectors, and numerous condensers, toggle switches, RF chokes, variable condensers, and transformers. Weight approx. 25 lbs. Size 20"L x 11½"W x 7¾"H. Price.................................. **$19.50**

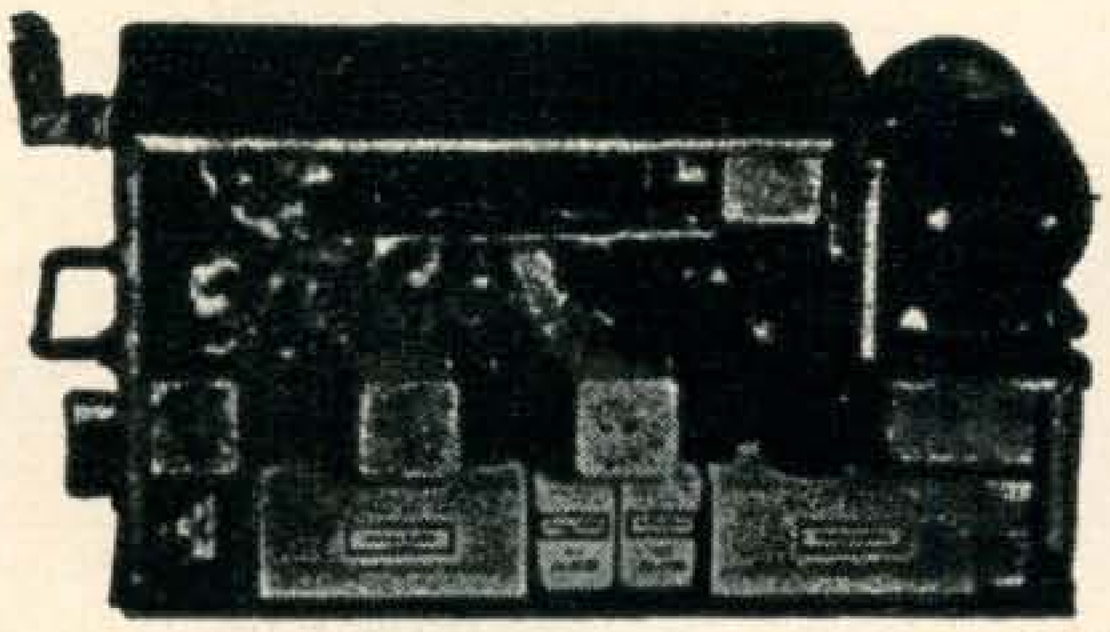
HS 16 A (New) Hi-Imp.... **$2.50**
HS-33 Headphones (New) **1.60**
Headphone Extension Cords **.75**



INDICATOR SCOPE ID-41/APQ-13

About 6" diameter by 15" deep. Contains 1—5FP7, 1—6AK5 tube, 5 Grain of Wheat 3 V. pilot lights, magnetic deflection yoke, condensers, resistors, potentiometers, sockets..... **$6.95**

BC-733D LOCALIZER RECEIVER



A part of aircraft blind landing equipment. Operates on any six of its predetermined crystal controlled frequencies in the range of 108-120 mc. Contains 10 tubes, three of which are WE-717-A's—and crystals. Ideal receiver for conversion to 144 mc. ham band or mobile telephone bands. For 24 V. DC operation. Size 14½" x 7" x 4⅝".

Price with dynamotor.. $5.95
Price without dynamotor.. $4.95

C-1 AUTO PILOT AMPLIFIER

$6.95

Wereused to control operation of Servo units, causing them to move the control surface of airplane in one direction or the other in response to signals received. The complete amplifier includes one rect. 7Y4, 3—7F7's for amplification and control, 3—7N7's for signal discrimination, 1 power transformer, 6 relays, 4 control pots, chokes, condensers, etc. Convert for use on radio controlled models, doors, etc. Operates from 24 V. DC. Size 9¼ x 6¼ x 7⅝". Complete.

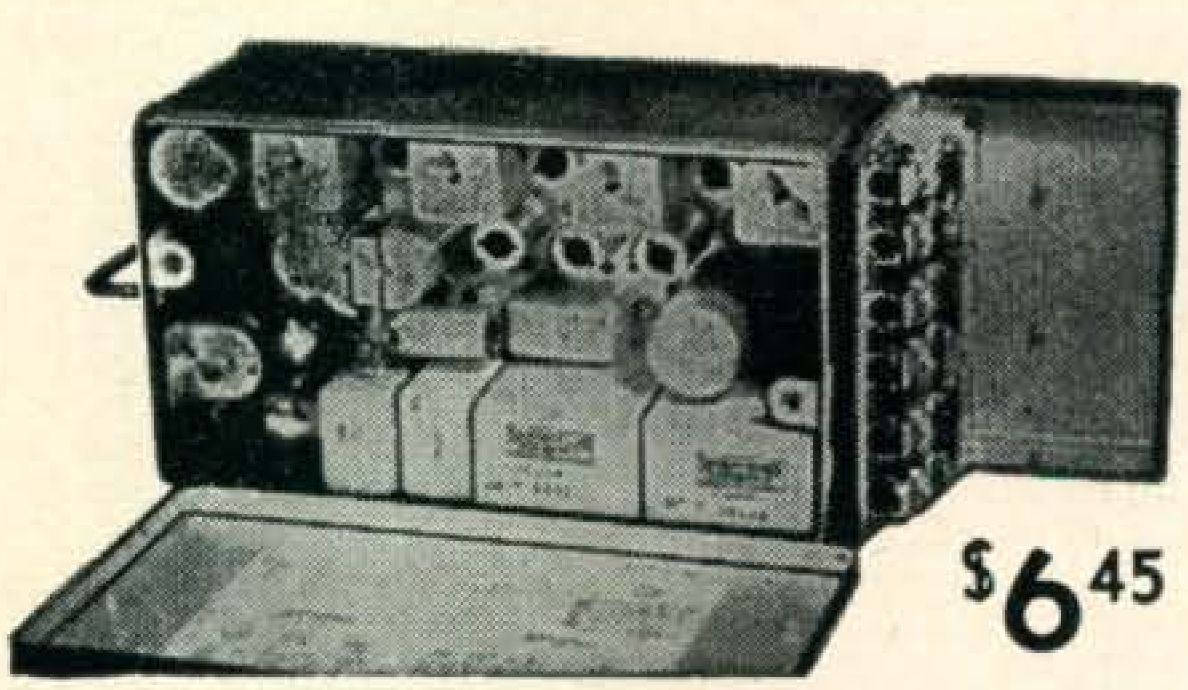
AIRCRAFT RADIO RANGE FILTER

For helpful reduction of QRM on crowded CW bands. When attached to output of any communications receiver:

1—Will pass signal of 1020 CPS, eliminating others.
2—Will pass voice frequencies and eliminate 1020 CPS code signal.

Compact, light weight, with switch. Size 2¾" x 2⅝" x 3¾".
Price.............................. $2.25

R-89/ARN 5A GLIDE PATH RECEIVER



$6.45

Formerly used for blind landing but adaptable tomany other uses such as receiver for new police or citizen's band. Band of operation 326-335 mc. on any of three predetermined crystal controlled frequencies. Contains eleven tubes, 6relays and other valuable parts. For 24 V. DC operation. Size 3¾" x 5¼" x 6⅜"
Price, complete as shown. $6.45

LS-3 LOUDSPEAKER

Size 8" x 8" x 5". Weight 12 lbs. 6" PM type speaker with output transformer to match. 4000 ohm impedance. Housed in heavy metal case. Openings protected by louvres and screen.
PRICE, slightly used.................................... $8.95

MARKER-BEACON RECEIVER

Can be adapted to radio controlled devices. Was used by pilots to flash a signal lamp on aircraft instrument panel when in range of a beacon transmitter. Responds to modulated signals over a variable range of 62 to 80 Mc. Tube plates and filaments operate directly from 24 V. DC. Can be adapted for radio control of experimental apparatus opening garage doors, etc. Circuit diagram and parts list included on either model shown below:

BC-357 — contains 12C8 and 12SQ7 tubes and sensitive relay (size 5⅜" x 5¼" x 3¼").
Price.................... $2.95

BC-1033 — contains 6SH7, 6SL7 and 12SN7 tubes, sensitive relay (size 5⅜" x 5¼" x 3¼")
Price.................... $3.50

JACK BOX BC-1366

Contains 2-pole 5-position switch, rheostat, two phone jacks, etc. In aluminum case 3¼" x 4⅜" x 2¼". Complete with headphone set adapter to match high to low impedance.
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Hamfests

National A.R.R.L. Convention

Don't forget the National A.R.R.L. Convention! The place—Milwaukee. The dates—Labor Day Weekend, Sept. 4-6.

Mount Shasta Hamfest

The second annual Northern California-Southern Oregon Hamfest and Dance will be held in Mount Shasta, Calif., on September 11–12. For information and reservations write M. E. Wilson, W6ARR, Box 65, Mt. Shasta, Calif.

Cincinnati Hamfest

The Greater Cincinnati Amateur Radio Assn. will hold its annual "Stag" Hamfest on September 12. For information and reservations write Jack Hohman, W8MGR, 3159 Harrison Ave., Cincinnati 11, Ohio.

Delta Division Convention

The Gulf Coast amateurs are sponsoring a Delta Division Convention on September 17, 18, 19 at the Buena Vista Hotel in Biloxi, Miss. Highlights will include many nationally known speakers and open house at the Radar Section of Keesler Field. For information and reservations write M. W. Thompson, Lovers Lane, Ocean Springs, Miss.

Boston Hamfest

The 11th Annual Boston Hamfest, sponsored jointly by the Eastern Mass. Amateur Radio Assn. and the South Shore Amateur Radio Club, will be held on Saturday, October 9th, at the Mechanics Building, Boston, Mass.

Midwest Division Convention

The Midwest Division Convention will be held on October 16–17 at the Hotel Broadview in Wichita, Kans. Technical program includes lecture and demonstration on s.s.s.c. technique, mobile equipment and design, multi-element beams, etc. For registration write Wichita Amateur Radio Club, Box 3, Wichita.

WARA "Flea" Power Contest

A field contest for "flea" powered battery operated radio stations will be sponsored by the Westchester Amateur Radio Assn. on Oct. 17, 1948, adjacent to the Kings St. entrance to the Westchester Airport, Harrison, N. Y., on Route 120A. All amateurs are invited to compete. The contest will be held on all amateurs bands with 10 and 11 meters counting as one band, and all frequencies above 148 mc as one band. During the three hours of operating, between 1 and 4 p.m. EST, rain or shine, each contestant must carry his complete station alone 100 feet from a starting point selected by judges, set up the equipment and antenna, refrain from using any existing local supports, and then contact as many other stations as possible which are not participating in the contest. Each contestant must register with officials at least one hour prior to starting time. A prize will be awarded to the contestant having the highest score in each amateur band, and special acknowledgment will be sent each station who contacts a station operating in this contest, upon receipt of confirmation of contact addressed to the WARA, c/o W2RH, RFD 1, Portchester, N. Y.

DX

(*from page 52*)

try . . . yet." You fellows just keep this one in the bag, and as soon as we hear from R.S.G.B. and QST, we will probably chalk them up for you. In the meantime, we haven't, of course, credited any of you fellows with a country called "Marion Island." Just in case some of you haven't located the spot, it looks to me like it is about 46° South and 43° East. Now, after reading over the above, don't you think that is real clever? Seriously, though, as I mentioned in previous columns, please hold off adding anything which you might think has possibilities of being a new country until it is actually announced in this column. Since we don't maintain a "hold file" for future possible countries, it is necessary that we do not allow credit until they have been agreed upon by all three DX committees.

Some of the boys have asked if we would stick to the sixty day time limit rule in the Marathon scores when a new country is approved and announced after the sixty day period. We're not that hard hearted. . . . When any new country is announced, and if it happens to be after sixty days from the date of the QSO, you just register it with us, and we'll see that you get credit.

Hold These Dates

October 29, 30, 31 — November 5, 6, 7

CQ's World Wide DX Contest

1 WEEKEND C.W. — 1 WEEKEND PHONE

Spread the word around overseas. Complete details in August issue. We are going to help you take the pain out of keeping a DX contest log. Special "World Wide DX Contest" log sheets are being prepared so that they may be used in duplicate—you keep one for your log and submit one with your score. Send directly to the New York office for your forms. Ask for as many as you or your friends need. Forms will be mailed in ample time for the contest. Watch for additional details on the rules and regulations. It's a contest for big and little DXers alike.

VQ3HJP Goes to VQ4

After eleven years on the air in VQ3, our old friend John Powell is QSYing to VQ4. (See QTH section for complete address). He regrets leaving, and, of course, we do too, but let's hope he can get on the air in Kenya Colony. John says that at the moment the prospect of getting on the air looks remote owing to the housing problem. Gee, I guess they have that situation everywhere. In a couple of photos, I notice there are some very tall trees which he uses for holding up his antennas. John says that any of them can take care of a 67′ vertical, and he would like to have the W7 gang take notice of this fact that he, too, has trees. As you may know, the station of VQ3HJP has consisted of a Bendix RA1B receiver, while the transmitter is a Bendix TA12B, of course, converted to a-c operation, and this is used to drive an 813 final. Two finals are used, one for 7 mc and another for 14/28 mc. Grid modulation is occasionally used on 14 mc and also for local rag-chews on 7 mc.

W2EMW says he doesn't like to be listed in the Honor Roll as W3EMW. I don't blame him, except

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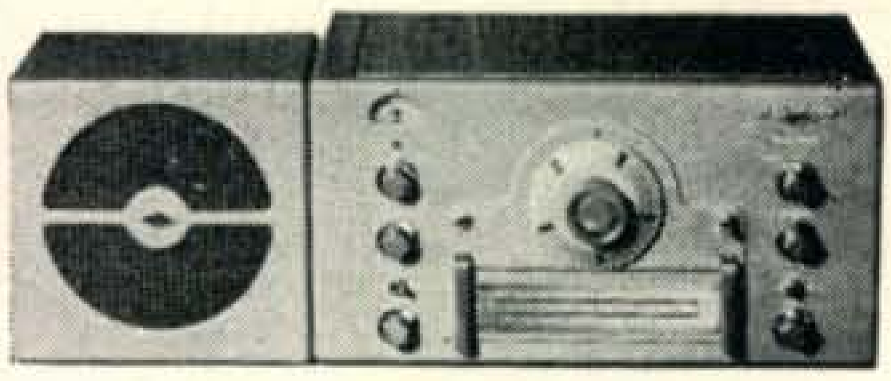
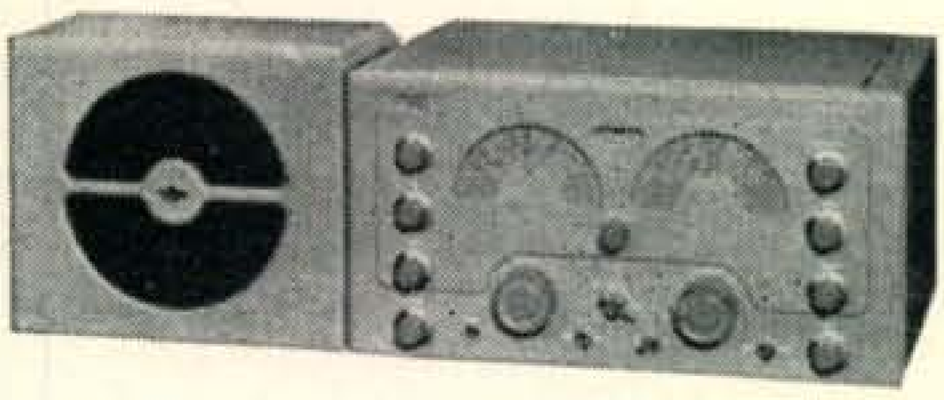
NATIONAL RECEIVERS

HRO-7

$311.36



The old standby in its latest form. Covers 1.7 to 30 mc with four coils. Complete with power pack, and 8" speaker.



NC-183

$269.00

5 bands from 540 kc to 56 mc. Bandspread tuning, crystal filter, noise limiter, etc. With 10" speaker

NC-57

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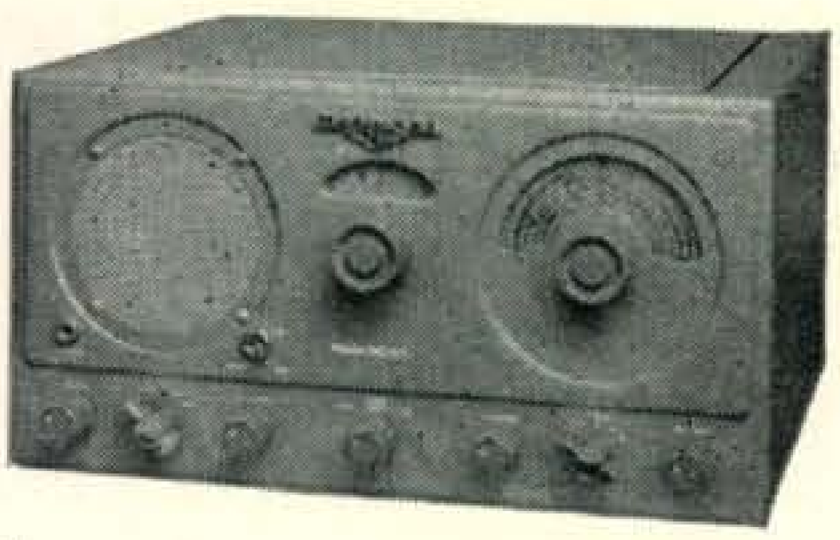

9-tube super with BFO and ANL, built-in speaker. A good receiver at a moderate price.

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Receiver with range from 27 to 250 mc. Can also be used as a converter or front end of hi-fidelity FM.

POWER SUPPLY, National 5886 .... $22.43

COLLINS EQUIPMENT

75A-1 RECEIVER

$375.00

80, 40, 20, 15, 11 and 10 meter ham bands. With speaker in matched cabinet. Shpg. wt. 93 lbs.

32V-1 TRANSMITTER

150 watts CW, 120 watts phone. Shpg. wt 128 lbs

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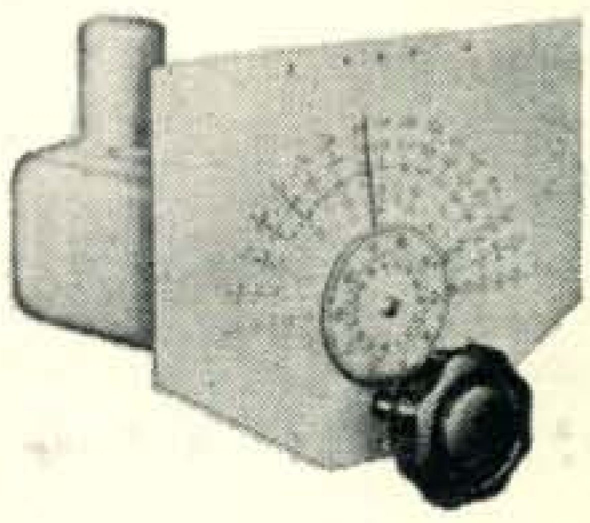


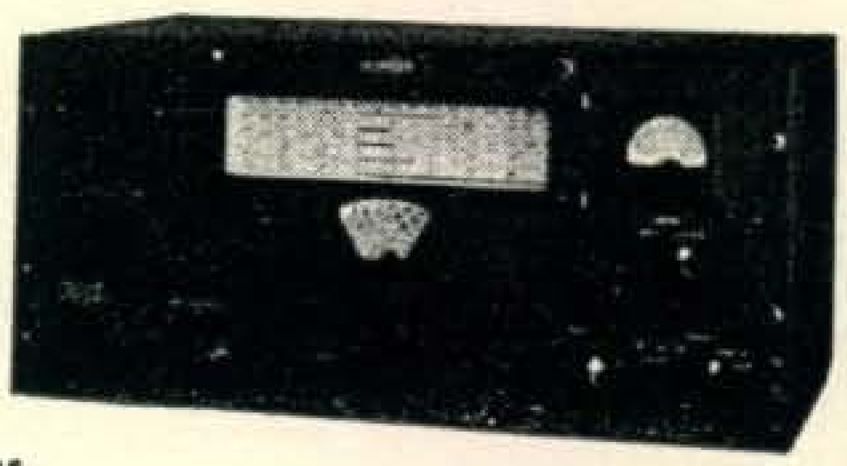
70E-8 VFO

$40.00

Basic unit for high quality VFO exciter unit. Shpg. wt 8 lb·

310B-1 EXCITER

$190.00



Self-contained band-switching exciter, 15-watt output. Shpg. wt. 48 lbs.

310C-2 EXCITER — 70E-8 and multiplier to drive power stage or plug in xtal socket. Shpt. wt. 28 lbs. **$100.00**

310C-1 EXCITER — Same as 310C-2 but without power supply Shpg. wt. 26 lbs.................................**$85.00**

30K-1 TRANSMITTER — 500 watts CW, 375 watts phone, complete with 310A exciter unit. Shpg. wt. 601 lbs. **$1450.00**

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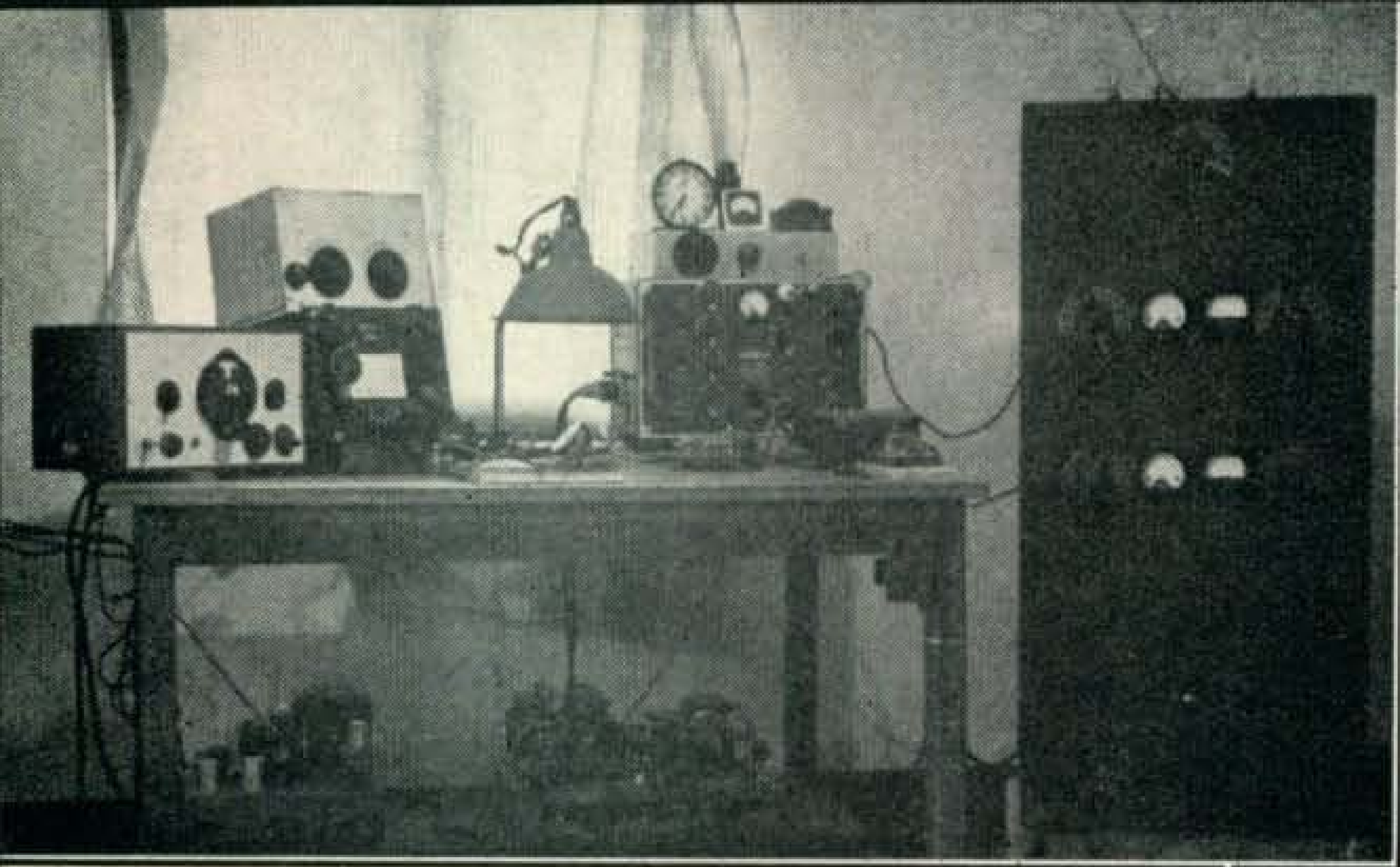

Jumping off place for the potent signal of John Powell, VQ3HJP, soon to be a VQ4.

I wonder what he has agianst the W3s. He also calls my attention to W2CYS and W2MEL being in the Honor Roll twice with different totals. Honest, fellers, . . . they don't pay us extra to list them twice. It's simply one of those doggone printer's mistakes. If the printer ever gets to become a ham, we'll knock one zone off of his list.

W2SVK, a transplanted W9, runs 500 watts into a pair of 100THs on 20 phone and is a new one in the Honor Roll. At the end of his letter, he says: "Well, there's my 'malarky,' and how does one go about getting QSL cards?" My answer to this: "Thanks for the malarky, and if you find out how to get QSL cards, let me know."

TG9MG, Manual Gomez de Leon, president of the Radio Club of Guatemala, would like to have it known that he is the QSL manager of the Guatemala Republic. We are very happy to record it here, as well as the full QTH in that section.

New ones that keep the keys thumping for the W6s for a while are AR1WW, F8NE, MD4TH, ZD2GHK, W6ODD/FI8, MD4JG, 4UN/Rhodes, and ZA2AA.

C3EL is on phone and located in Formosa. It seems like some of the good phone boys around here, like W6ENV, W6DI, and W6VFR, have hooked him, and he is on approximately 14,315. Of course, as Andy says, "I am not really a phone man." Naturally, he couldn't resist it when he heard 6DI and 6VFR going after him. We all expect ENV's phone totals to skyrocket from here on. Incidentally, C3EL says he can only copy code at the rate of 1 or 2 words per minute.

Speaking of W6s, the other morning W6TI protruded through the door, and since he is quite a DX man (W.A.Z. No. 14), we seemed to talk a little about the subject. As some of you know, he is QSL manager of this district, and has been for years. I asked him what brought him to Los Angeles (a suburb of Oakland), and he said he had a lot of unclaimed QSL cards from Zones 2, 19, and 39 that he wanted to sell. If I didn't know him as well as I do, I would have interpreted this to mean what is commonly known as "giving me the business." (Guess I had better stop now and tell you that he really isn't selling the cards, or Horace would have several

W.A.Z. Honor Roll

To enter the Honor Roll it is necessary only to fill out the zone and country list forms available from the N. Y. office. Full details will be found on page 78 of August CQ

1948 DX Marathon

CQ is sponsoring a DX Marathon for the year 1948. The purpose of the DX Marathon is to revive some of the interest that has been lost during the terrific last two years of DX. The rules appear in May CQ on page 74.

orders in the next mail.) W6TI is president of the Northern California DX Association, several members of which are W.A.Z. I guess being president allows one to call DX stations five minutes longer than anyone else. (Hi, OM.) I want to be a president, too. . . .

After W6TI and I finished our enjoyable personal QSO, he took a powder, and shortly thereafter in popped W6SN, who said that 6ENV would be along soon. After Andy arrived, we talked about some of the same stuff, ending our little huddle with a discussion on whether or not W6SN needed two more "mikes" of filter, or a new 6L6 without loose elements. If any of you fellows have any thoughts on W6SN's problem, please communicate with him . . . not me. Oh, yes, Bill is also looking for his card from Zone 19. Hey, Horace!!!

If any of "youse guys" haven't heard there was a ZD7 on the air, by this time, you had better start looking around 14,000 for ZD7AA. . . . Let's hope he's a good one! Some of the local boys say the ZD7 doesn't "point up" from right direction, though.

The Marathon is sailing right along, and the boys are really piling up some incredible totals. Just take a look at the present standings. W1AB in Zone 5 has 39Z and 115C, and possibly by this time he has knocked off his 40th. In Zone 4, both W9VW and WØYXO have worked 40 with VW leading YXO with 131C to 128C. In Zone 3, there are 13 who have worked all 40 this year, and this represents just six months of DX. The foreign participation at this point is not too great, this being largely due to the lack of previous publicity overseas. In the phone division, W7HTB leads one of our local brethren, W6DI, with 37Z and 111C to Guy's 36Z and 129C. W9NDA now leads the pack in Zone 4 with 36Z and 93C. W1JCX is heading the Zone 5 boys at the present time. I would like to hear from some of you fellows who are our regular Marathon contestants, and who are down the list aways, answering one question. Do you fellows want the Marathon to run again next year? We have felt that if this DX Marathon was a yearly contest, the leaders, of course, would constantly be changing. However, I would like to get your reactions on this the next time you drop me a line.

W6PFD, who is leading the pack in Zone 3 of the Marathon with 40Z and 170C, says that *XZ2HP* is now on the air from Negombo, Ceylon, and signing *VS7PH*. As Mark says, a nice line of phonies showed up last month, FD1KP, AC3GG, PX2AB, and SU2FO. W2IOP reports that *HS1SS* is now en route to the States, but will stop over in England. That ends that one. Of course, Larry doesn't mind since that was the last one he grabbed for his W.A.Z., a month or so ago. I wonder if he planned it that way.

W8BKP worked *AP2F*, *UA1KEC* on c.w., and *TA3FAS* on phone. Many of you guys will be glad to know that one of the operators of TA3FAS is that old DXer ex-W8OSL.

VK2DI, who was the first VK to W.A.Z., uses a band switched exciter of 6L6s driving an 813 in the final. . . . modulators are 807s. Of course, Gordon uses a v.f.o. consisting of a 6J6 cathode coupled oscillator, driving a 6SH7, which in turn drives a 6AG7 output tube. The receiver is a 13 tube "VK2DI special." The antenna which he has used until recently was a rotary half-wave dipole, but now he is using a 210′ long wire.

In case you haven't heard, VR2AZ, who is on Canton in the British Phoenix Group, has now apparently received his new and correct call, *VR1B*, . . . he doesn't like Ws. [*QSY to page 74*]

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With this Complete
Allied-hallicrafters
Low Cost Ham Station

hallicrafters HT-19 Transmitter

The ideal medium-power transmitter! Completely self-contained; power output not less than 125 watts on all bands. Covers 5 Amateur bands; 3.5-4 mc; 7.0-7.3 mc; 14.0-14.4 mc; 21.0-21.45 mc; 27.16-29.7 mc. Complete band-switching on all frequency bands; VFO all bands, plus 3-spot-frequency crystal positions; narrow band FM on all frequency bands; FM deviation calibrated for each band; preamplifier for high-impedance mikes; oscillator keyed for CW; temperature compensation and voltage regulation of VFO; variable output impedance from 50-600 ohms; two separate antenna outputs; 4-65A final amplifier. 20" x 18" x 10¼". For 105-125 v., 60 cy. A.C. Shpg. wt., 85 lbs. Complete with tubes, less crystals.

No. 97-589. HT-19 Transmitter, f.o.b. Chicago $298.00

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No. 97-636. Complete Amateur Station. NET, f.o.b. Chicago, Only.............. $103.75

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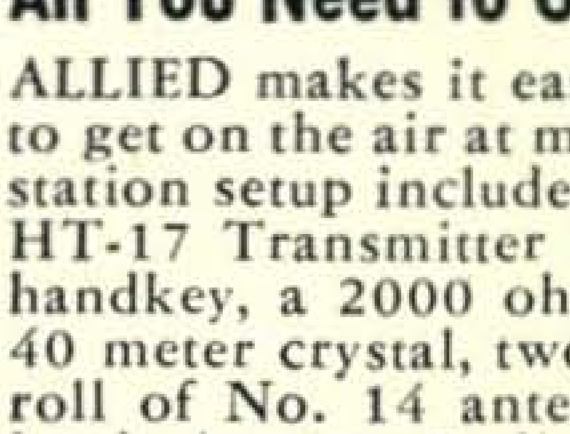

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W9LNM is still trying to catch up with W9RBI. Art echos the feeling of most of the gang when he says he hates to see this DX practice which some of the boys use in passing around the rare DX within their own little circle. He says: "Can you blame an outsider for trying to break it up and then getting called a so-and-so for causing QRM?"

Now, from his pal (I hope) W9RBI, says this: "After two years of scarcely hearing Zone 39, W9LNM and I each worked two in this zone in one morning." However, LNM worked them both two days before RBI got a crack at them. Oh, yes, the stations in question are *VQ8AD* and *ZS2MI*.

VK-ZL DX Contest

The following is the schedule for the 1948 VK-ZL contest:

1201 GMT October 1st to 1159 GMT October 3rd—c.w. operation
1201 GMT October 8th to 1159 GMT October 10th—phone operation
1201 GMT October 15th to 1159 GMT October 17th—c.w. operation
1201 GMT October 22nd to 1159 GMT October 24th—phone operation

Each period will be 24 hours long, and there will be three sections: transmitting c.w., transmitting phone, and receiving for phone and c.w. All amateur bands may be used. Only one contact per band per week-end with any one station is allowed. If more than one operator is used at any particular station, each operator must submit a separate log. A self-assigned serial number, the same as the ARRL contest, will be used, and this will follow the usual signal report. Three points per contact will be allowed, providing, of course, the serial numbers of each of the two stations is acknowledged. For stations out of VK and ZL, band multipliers will be the number of VK and ZL districts worked on that band. These are VK2, 3, 4, 5, 6, 7, and 9; ZL1, 2, 3, and 4. Contest logs from stations other than VK and ZL must be into the NZART, P. O. Box 489, Wellington, New Zealand, by January 14, 1949.

W8BKP has received cards from *ES1TU* in Estonia, as well as *LZ1AB*; both worked on 10 phone. George is up to 38Z and 145C on phone.

G6QX added three new countries on his recent birthday (shhh! he's 52), and these were good ones, too. Bob got another bang out of working W6ZZ, who, as you know, is ex-W1WVand was G6QX's first American QSO in 1929.

Take a peek at the guy who heads the c.w.-phone section of the Honor Roll, and you will see that W6VFR is the first guy to break 200. A year ago, Marv sent in his cards for W.A.Z., being number 2, and at that time, he told me he was going to do a little more concentrating on his studying and less on DX. As I look back on it, I don't think he told me WHEN he was going to begin his studying with renewed vigor, and up until the other night, it looks as though his studies are still taking a beating. I am wondering now if possibly he didn't mean that he was going to major in DX at U.C.L.A. . . . Now back into the groove. . . . VFR worked *FI8ZZ* and tossed a little French at him, and it seems as though he has promised to write Marv, since he says, "No QSL." I1KN told VFR that *M1A* recently passed away. . . . Still from the margin notes of VFR's log, it appears that VQ8AD who was intending to go to VQ9 last month is not going for another year. So, you fellows can stow away your "piling on" equipment as far as that one is concerned. . . . Oh, yes, *ZD2GHK*, a new one, says he is G8VR. [*QSY to page 76*]

A.R.R.L. LOS ANGELES CONVENTIONEERS
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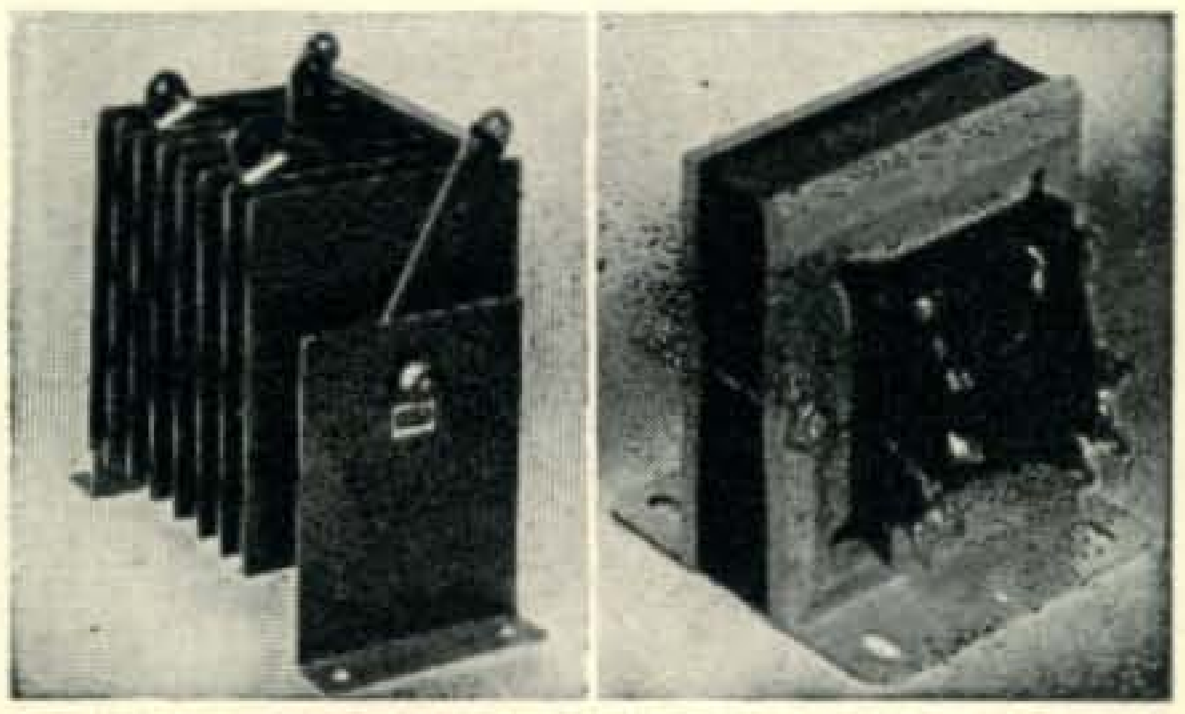

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IMPORTANT — HOW TO ORDER — The input rating of your dynamotor must not exceed d-c output rating of the rectifier. For example, dynamotor series DMDX — 12 v. 2 amps. — requires Rectifier No. S-295A and Transformer RPS-8883.

Shipping weights are listed — please contact your local freight agent for cheapest means of shipment — and include shipping charge with remittance.

ALL NEW—FULL WAVE VICKERS SELENIUM RECTIFIERS

Code Number Rectifier	d-c Output Volts	Amps.	Ship. Wt. in lbs.	Amateurs Net Price
S-295A	14	2	1.25	$ 6.95
S-458A	14	4.5	1.75	7.25
S-167A	14	10	3.75	10.95
S-292A	14	40	12	29.95
S-296A	28	1.8	1.25	5.75
S-344A	28	5	5.75	11.50
S-172A	28	10	6	16.50
S-291A	28	20	12	29.95
S-297A	28	40	23	52.25

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Code Number Transformer	Secondary Volts	Amps.	Taps See Note A	Ship. Wt. in Lbs.	Amateurs Net Price
RPS-8883	18	3		3.5	$ 3.75
RPS-8884	18	5.2		5.5	4.25
RPS-8885	18	12		12	6.15
RPS-8886	18	46		35	19.65
RPS-8888	36	2		5	4.15
RPS-8889	36	6		12	6.75
RPS-8892	36	12		25	11.65
RPS-8890	36	23		32	19.25
RPS-8891	36	46		78	51.25

NOTE A: All transformers have 3 extra taps — for example; 20, 19, 18, 17 volts and 38, 37, 36, 35 volts.

All prices F. O. B. Los Angeles (California purchasers add 2½% sales tax). Include 25% with order—balance on delivery. Foreign orders cash. Address correspondence Dept.. C7.

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FE8AB has sent in his list for the Marathon, and you might be interested to have a few details about Ivan. He was originally F3AT, and in January, 1947, he left home with a portable rig which used a 6L6 in the final and running 20 watts input. It wasn't until June, 1947, however, that he got on as FQ3AT. He got a big thrill out of his first CQ, because he found many stations calling him (*many* is certainly an understatement). Of course, he was the first FQ station on the air after the war. In November he left FQ3 for Douala in French Cameroons. He was on the air from there January 1, 1948, signing FQ3AT/FE. Then, on April 5, he received his FE8AB call. Ivan now runs 100 watts into a pair of 807s in parallel. His antenna is a vertical dipole. FE8AB is in the French airforce, and says he thinks he will stay there until 1949 or 1950.

W8BHW is trying to find time to get his list in for the Honor Roll. Lindy says he is up to 193C, and that's a heck of a lot more than he had prewar as W2BHW. This is the first I have heard from Lindy since early in the war when I bumped into him in St. Louis, where I seem to recall Lindy giving me the ingredients of a special deal of his to be used on hot days . . . not that I ever use the stuff.

W4LVV had his card returned which he sent to *LX1ST*. LVV says, too, that the next time he sends in a report for the Marathon, he is going to have a "CM" on it. He says working a CM from Miami on 20 meters is no cinch, so he is looking around for his 40-meter coil.

WØNTA recently had a personal visit from WØYXO. They would have liked to have had their pal WØGKS in on the bull session, but Doc, who is chief chemist for Morrell Packing Co., was tied up due to a strike condition existing at the plant. Leo worked *PX2AB*, and he said that he put out such a good story, and after watching his signal characteristics for a couple of hours, he finally came to the conclusion that PX2AB is either O.K. or a darn good salesman. Time will tell.

We'll stick our necks out and say that *FI8ZZ* is O.K. We don't know a single thing against him, although on the air he seems to admit that, for the time being, he cannot QSL. Some of the locals are trying to get him to at least send a list tc the ARRL QSL Bureaus. Others, which for the time being seem O.K. are *FI8AB*, and *ZA2AA*. You happy? . . . But, if you have worked *PK2GA*, don't expect a QSL card, as mail apparently isn't getting in or out of there very well. Speaking of PKs, a lot of the boys have been working *PAØQO* who has been putting in a loud T7 or maybe it's T8, I don't know, signal, and he is located aboard ship stating that he is in the Royal Packet Navy, and is operating at Bali.

J2AHI keeps me informed on what the F.E.A.R.L. is doing by sending their "News" to me each month. Among some of the items we're lifting are the following: HL1HF is W2BIU, and HL1BG is W2MAD. Other active HLs are 1BH, 1AB, 1AQ, 1BD, 1AJ, 1AA, and 1MH. J2AHI is doing his share of DX, and in the first part of July, he worked all continents in 32 minutes. J3AAD is doing good DX work as usual, and apparently is leading the boys there with 161 countries, but according to AHI will have left Japan by the time you read this.

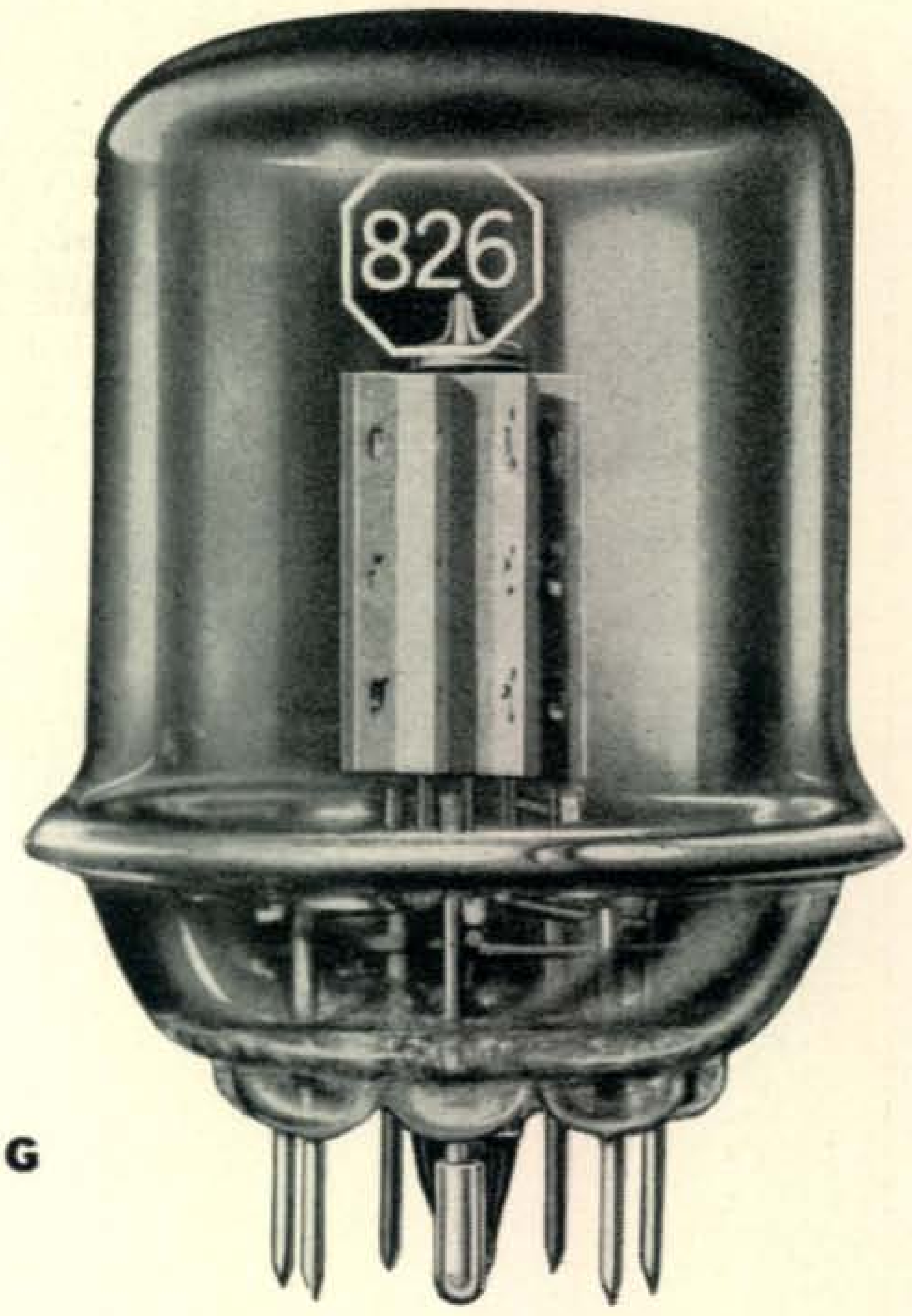
Guess you've heard *IS1AHK* is on Sardinia . . . W6SA says it's the new prefix.

Somebody told me the other day that ZS5Q is interested in contacting other "Bee" raisers. That is the truth! I don't think you'll get stung on this

(*Continued on page 80*)

WELLS

TUBES *Guaranteed*



This is a Partial List of Tubes in Stock

TYPE No.	PRICE	TYPE No.	PRICE
2C26	.55	807	1.25
2C26A	.65	810	7.95
2X2/879	.80	813	7.85
3B25	3.00	814	4.25
3C24/24G	1.60	826	.49
5D21	6.00	10Y	.75
6AC7	1.10	829B/3E29	3.95
6AG5	.80	830B	2.25
6AK5	.80	832	2.75
6B4G	.95	832A	3.50
6C4	.75	836	1.75
6E5	.80	837	1.25
6SL7	.90	841	.85
6SN7	.90	864	.80
6V6	1.00	869B	29.50
12C8	.80	872A	2.45
12A6	.55	954	.65
VT33	1.00	955	.65
VT67	1.00	957	.65
RK34	1.00	1005	.70
VT52	.55	1148	.40
VR90	.75	1201	.40
VR105	.80	1616	1.95
VR150/30	.75	1625	.55
VT127	.25	1626	.65
211	1.15	1629	.50
304TH	7.25	2051	.90
304TL	3.75	7193	.35
GL471A	1.00	9001	.80
532A	3.50	9002	.80
559	1.25	9003	.80
801/801A	.95	9004	.85
803	8.75	9006	.80

Minimum Order $5.00

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- **RECEIVING**
- **INDUSTRIAL**
- **SPECIAL PURPOSE**

All Tubes Are Standard Make, Brand New and Fully Guaranteed

Prices Represent Tremendous Saving

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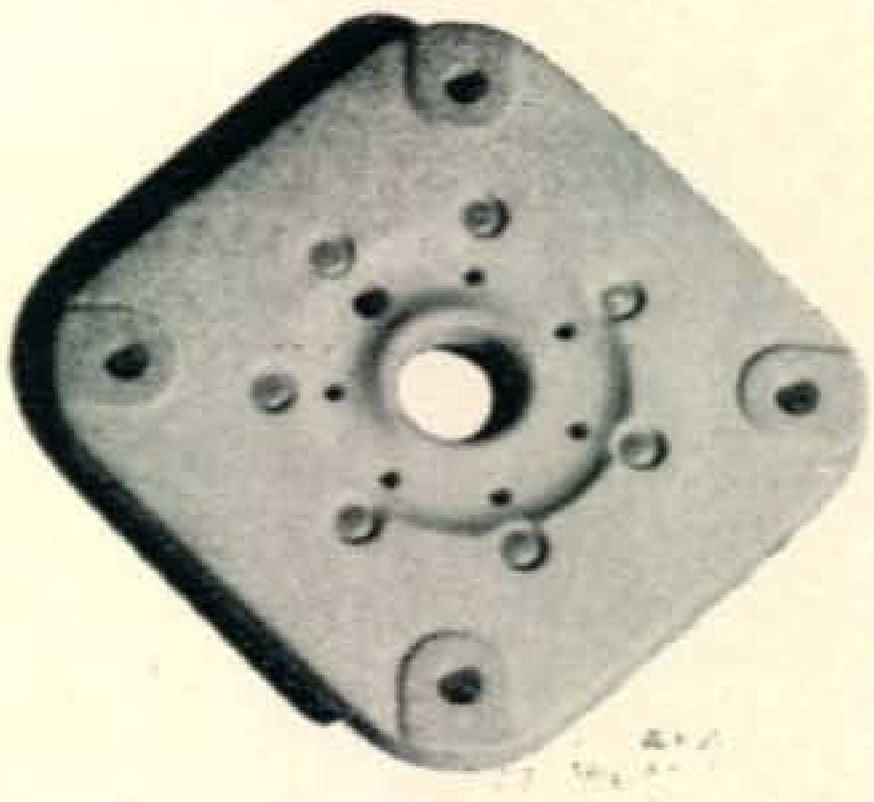
The new Wells Amateur Catalog H400C is now ready. Send for your free copy today. Hundreds of the highest quality radio items are listed at a fraction of their normal value.

Ceramic Tube Sockets for the 826 and 829B . . . 50c each



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DX MARATHON

CW—PHONE

Zone 1

KL7KV	23– 37
KL7KI	15– 23
KL7CZ	12– 12

Zone 2

VO6EP	35–100
VO6J	15– 38

Zone 3

W6PFD	40–170
W6ITA	40–163
W6SN	40–156
W6ENV	40–152
W6NNV	40–137
W6AM	40–128
W6RM	40–119
W6OMC	40–117
W6HZT	40–115
W6KRI	40–114
W6WKU	40–111
W6SRU	40–107
W6FSJ	40– 92
VE7ZM	39–115
W6ANN	39–109
W6PQT	39–107
W6LRU	38–103
W6UCX	38– 88
W6GAL	37–133
W6LN	37– 66
W6MI	36– 78
W6OEG	35– 80
W6MUF	35– 64
W6WWQ	34– 71
W6ZZ	33– 77
W6CTL	33– 75
W6UZX	33– 69
W6LER	32– 53
W6BIL	31– 50
W6QD	30– 53
W6MXN	29– 59
W6KYV	26 49
W6QWL	25– 43
W6AGT	24– 44
W6MGZ	23– 29
W6CID	22– 27
W6OKL	20– 45
W6EYC	20– 33
W7PK	17– 30
W6UXF	17– 18
W6VAT	15– 15

Zone 4

W9VW	40–131
WØYXO	40–128
W5ASG	39–152
W9NDA	39–140
WØGKS	39–122
W8SDR	39–111
W9GA	39–106
W9IU	38–131
W9LM	38–124
W8EWS	38–110
W9LNM	36–109
W9CIA	36– 97
W9TB	36 89
W8GLK	34– 91
WØDU	34– 85
WØSBE	33– 95
WØEYR	32– 98
VE3QD	31– 89
W9WCE	31– 84
WØCFB	31– 79
WØCMH	30– 48
W5CPI	29– 75
WØAZT	29– 60
W5EWZ	29– 51
W8MQR	28– 57
W9MZP	28– 49
WØUOX	27– 57
W8BF	25– 68
W5ZD	25– 62
W8KPL	25– 53
W8LFE	23– 38
W8NKU	21– 46
W5JPC	19– 37
W9EHS	19– 34
W9KMN	15– 13

Zone 5

W1AB	39–115
W1JYH	38–132
W1NMP	38–126
W1BIH	38–119
W3IYE	37–105
W3OCU	36–124
W3DPA	36–117
W2TJF	35–120
W1ENE	35–119
W4JFE	35–118
W3DRD	35–102
W3EPV	35– 80
W2RGV	34–101
VE2WW	33– 87
W2MEL	33– 87
W1AWX	33– 87
W2PQJ	32– 89
W4HA	31– 99
W1BFT	31– 89
W4LVV	31– 88
W2AW	31– 72
W3WU	31– 68
W2EMW	30– 79
W3NOH	29– 80
W8JM	29– 60
W3AQT	28– 59
W1MRP	27– 74
W2BF	27– 72
W4TO	26– 76
W1CJH	26– 66
W4ALJ	26– 52
W2OM	25– 54
W3RJS	25– 52
W4JUJ	24– 51
W2IOP	23– 47
W2PUD	23– 40
W4LK	21– 46
W1HJ	21– 44
W1QCJ	21– 38
W3NPZ	18– 41
W4CY	18– 36
W4BRB	16– 36
W4HKJ	12– 19

Zone 7

TG9JK	31– 62

Zone 8

W8LZK/KP4	36–114
KV4AD	23– 56
KP4KD	21– 48

Zone 10

OA4AK	36–110

Zone 11

PY1DH	39–117

Zone 12

CE3AG	39–105

Zone 14

F8BS	38–106
G3DO	37–111
ON4MS	35– 76

Zone 20

SV1RX	31– 93

Zone 27

KG6AI	28– 51

Zone 30

VK2DI	40–126

Zone 31

KH6PY	32– 49
KH6NB	30– 48

Zone 32

ZL1HY	28– 56

Zone 36

FE8AB	25– 56

Zone 37

VQ3HGE	39–116

Zone 38

ZS2X	37–10

PHONE

Zone 3

W7HTB	37–111
W6DI	36–129
W6CHV	32– 84
W6ITA	31– 88
W6PXH	30– 81
W6PCK	29– 84
W6WUI	28– 54
W6AM	26– 48

Zone 4

W9NDA	36– 93
W9RBI	34– 93
W5ASG	32– 99
W8HUD	31– 83
W8NK	31– 70
W5LWV	29– 71
WØSBE	26– 60
VE3BBZ	24– 52
W5ERY	23– 48
W9WCE	21– 53
W8LFE	16– 23

Zone 5

W1JCX	34–108
W1ATE	34– 87
W1NWO	33–107
W1FJN	33– 97
W2RGV	31– 76
W4ESP	30– 91
W4HA	29– 88
W2IUV	29– 66
W2DYR	27– 66
W2PQJ	25– 51
W1CJH	23– 52
W1EQ	22– 57
W2BF	20– 44

Zone 6

XE1AC	33–119

Zone 8

KV4AD	21– 43

Zone 10

OA4AK	30– 63

Zone 12

CE3AB	28– 76

Zone 14

G3DO	34– 93
F8DC	28– 47

Zone 31

KH6NB	23– 36

Build YOUR OWN TEST EQUIPMENT

$39.50
Nothing
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5" OSCILLOSCOPE KIT

A necessity for the newer servicing technique in FM and television at a price you can afford. The Heathkit is complete, beautiful two color panel, all metal parts punched, formed and plated and every part supplied. A pleasant evening's work and you have the most interesting piece of laboratory equipment available.

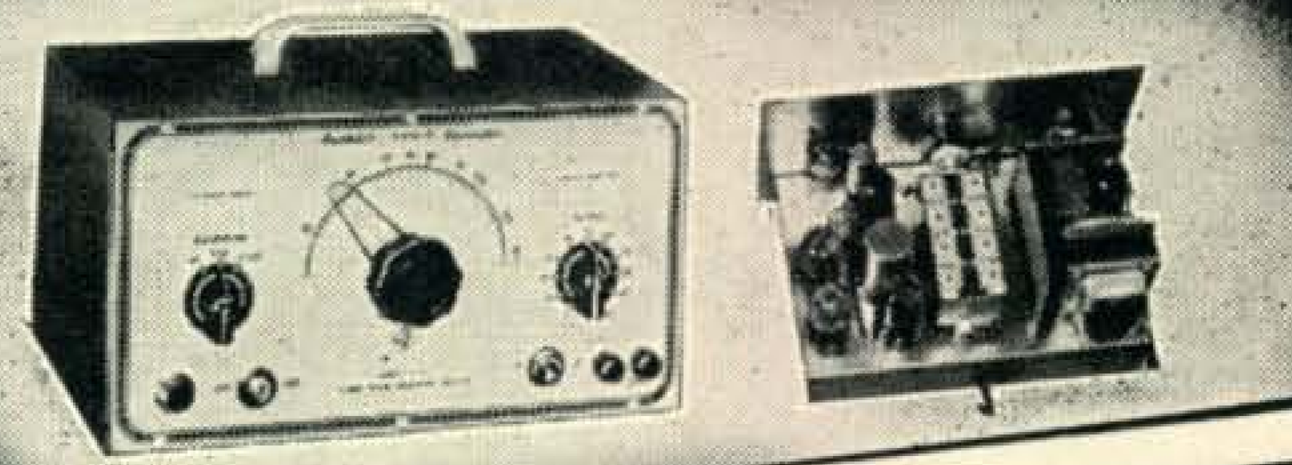
Check the features — large 5" 5BP1 tube, compensated vertical and horizontal amplifiers using 6SJ7's, 15 cycle to 30 M cycle sweep generator using 884 gas triode, 110V 60 cycle power transformer gives 1100 volts negative and 350 volts positive.

Convenient size 8½" x 13" high, 17" deep, weight only 26 pounds.

All controls on front panel with test voltage and ext. syn post. Complete with all tubes and detailed instructions. Shipping weight 35 pounds.

Order today while surplus tubes make the price possible.

$34.50
Shipping Wt., 13 lbs.



HEATHKIT SINE AND SQUARE WAVE
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The ideal companion instrument to the Heathkit Oscilloscope. An Audio Generator with less than 1% distortion, high calibration accuracy, covering 20 to 20,000 cycles. Circuit is highly stable resistance capacity tuned circuit. Five tubes are used, a 6SJ7 and 6K6 in the oscillator circuit, a 6SL7 square wave clipper, a 6SN7 as a cathode follower output and 5Y3 as transformer power supply rectifier.

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Reduces service time and greatly increases profits of any service shop. Uses crystal diode to follow signal from antenna to speaker. Locates faults immediately. Internal amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions.

Small portable 9" x 6" x 4¾". Wt. 6 pounds. Ideal for taking on service calls. Complete your service shop with this instrument.

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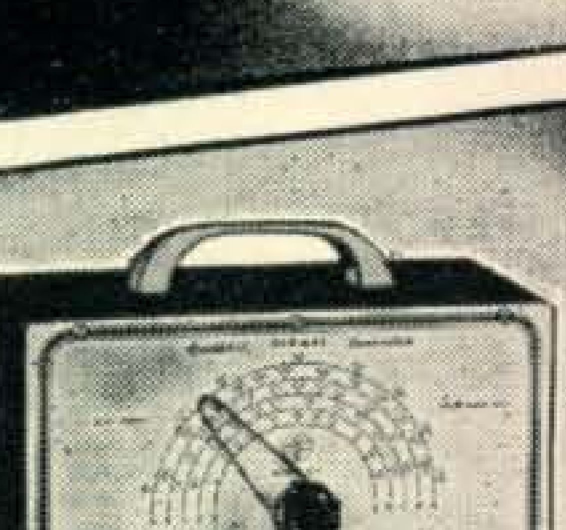

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Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V 60 cycle transformer operated power supply.

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Weight 4½ pounds.

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THE NEW HEATHKIT VACUUM TUBE
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The most essential tool a radio man can have, now within the reach of his pocketbook. The Heathkit VTVM is equal in quality to instruments selling for $75.00 or more. Features 500 microamp meter, transformer power supply, 1% glass enclosed divider resistors, ceramic selector switches, 11 megohms input resistance, linear AC and DC scale, electronic AC reading RMS. Circuit uses 6SN7 in balanced bridge circuit, a 6H6 as AC rectifier and 6 x 5 as transformer power supply rectifier. Included is means of calibrating without standards. Average assembly time less than four pleasant hours and you have the most useful test instrument you will ever own. Ranges 0-3, 30, 100, 300, 1000 volts AC and DC. Ohmmeter has ranges of scale times 1, 100, 1000, 10M and 1 megohm, giving range .1 ohm to 1000 megohms. Weight 8 lbs.

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A condenser checker anyone can afford to own. Measures capacity and leakage from .00001 to 100 MFD on calibrated scales with test voltage up to 500 volts. No need for tables or multipliers. Reads resistance 500 ohms to 2 megohms. 110V 60 cycle transformer operated complete with rectifier and magic eye indicator tubes.

Easy quick assembly with clear detailed blueprints and instructions. Small convenient size 9" x 6" x 4¾". Weight 4 pounds. This is one of the handiest instruments in any service shop.

The HEATH COMPANY
DEPT. Q . . . BENTON HARBOR, MICHIGAN

one. What next???? . . . W9LM is another one to work *AC3GG*, and he seems to agree with us that he is NG.

W2IOP, whom I know quite well, is on the air again, and submits these stations for those who might want to know the frequency: *YU7ZZ* 14,095 drifting to 14,020, *ST2AR* 14,149 T5, *CT3AB* 14,056, *CR5AH* 14,045, *W4DGW/KJ6* 14,117, *ZK2AA* 14,115, *ZA2AA* 14,089, *ZD2RGY* 14,062, and *MD4TH* 14,056.

OY3IGO, since having his picture in the column, says that many Ws and Gs tell him that they have seen his "funny face" in *CQ*.

W5HHT, who I had always thought never worked anything outside of New Orleans, did work G5GK. G5GK told Irv that a station signing *XP1CQ* is on and operating from Katamandu, Nepal. George, that's G5GK, said that XP1CQ operates on 14,220 phone, using a BC-610 with 500 watts input, while the receivers are a BC-342 and a BC-312. George also passed word along that *VS9GT* is operating both phone and c.w., 14,140.

VK3NR is heading for Norfolk Island, which is about the same latitude as Brisbane and lies midway between New Caledonia and the northern tip of New Zealand. . . . He'll be signing *VK9NR*. The rig will wind up with an 807 with about 50 watts input. VK3NR says he will be there about three years, and he will be a radio operator at the air field. Yeh, I know . . . you want to count it as a new country already.

W6NNV tells me he won an 18" pink painted clay pig as a booby prize at a card party, and he has decided to use it for a little unusual type of bank. Norm says he decided to drop a dime in the piggy bank each time he calls a new country and misses. Now he says, "I suppose I have about $15.00 in vested in that blasted bank by this time."

W6EPZ has had a couple of cards bounce which he sent to *LX2DN*.

We're glad to hear from CE7AA. He says he doesn't expect to work all 40 zones as DX at Punta Arenas is not easy. If Andres could get on a little more, I think he would surprise himself. ZL1HY is still looking for his postwar Zone 23 card. Who can help him?

Is *FD1KP* O.K.? He says he is on Togo Island, but until we know more than we do now, we "ain't" allowing him.

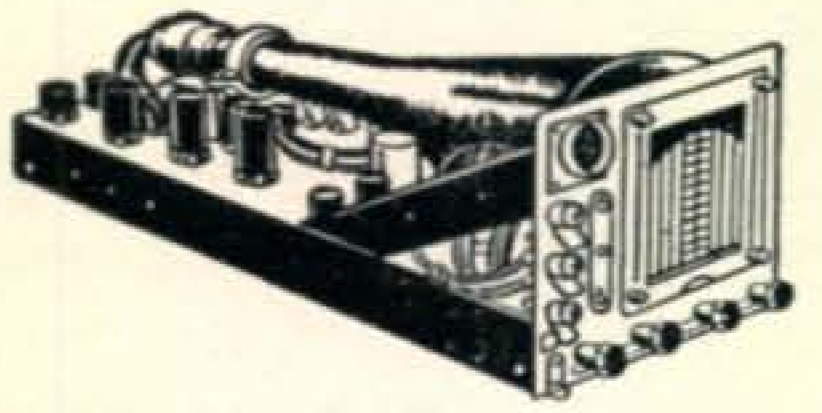
XE1AC says a new radio club has been formed in Mexico City. It is called the Alligator Club. To qualify as a member, one must be a DX hound, and of the type that misses DX and cries about it. He says there are no dues or obligation, but just to cry for not receiving QSLs, for not raising DX, and for not having ideal conditions. Membership is by invitation. This is necessary, I guess, otherwise the club would no doubt have an unusually large membership.

PY1DH says he has a broken heart after having his card to *C8AAJ* returned. Ed has a card from *TA1DB*, as does his friend *PY1AJ*, so that sort of clears up this one.

KH6PY suggests that a tabulation be made of the average number of operating hours of each station. He thinks it would be interesting to compare the hours per month the various stations put in to reach the same country totals. This might be a good job for somebody, but count me out.

Now I am going to run along and take a belated vacation. While you're struggling through this column, the XYL and I will be taking it easy on our

INDICATOR BC 704 A



Indicator Part of Radar Set SCR 521, makes an excellent foundation unit for a high gain scope. Has following tubes: 4-6AC7, 3-6H6, and 1-5BP1 CR tube. Comes enclosed in metal shield. New, with all tubes less power supply. With wooden carrying case, schematic diagram **$17.50**

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TR 1210, 12 vdc, 5 pin **$1.20**
OAK V-6675, 24-32 vdc, 7 pin ... **1.10**
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Radiaart VR2, 6 v. DC. 6-pin special **1.40**

Mfrs. quantities in all types available.

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Dynamic mike and headset combination. A high quality, efficient unit, used in B-19 tank Xmtrs. Mike and phones complete, new **$2.75**

R-15 headsets: 8000 ohms impedance, rubber cushions. Comes with 8" cord and plug PL 55. New **1.95**

HEADBANDS: HB-1, HB-4, HB-30. New .... **.25 ea.**

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Carbon transmitter element for TS11-J, TS11-L, TS13-E, TS15-A .... **.75 ea.**

Element for microphone T-24, 30 ohm resistance .... **.95 ea.**

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Extends range of field telephone apparatus, such as EE-8 up to 25 miles, when inserted in a line. New, with spare tube and instruction manual, less standard type batteries **$21.50**

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#5083: 6.3 v .6 A ct, 5 v 2 A **1.85**
#5087: 6.3 vct 1 A, 6.3 vct 7 A **2.75**
#5103: 6.3 v 1 A, 6.3 v 1 A, 6.3 v 1 A **2.35**
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#5105: 800 vct 40 ma, 760 vct 500 ma **5.85**
#5108: 50 or 46 v 200 ma, 5 v 2.4 A, 5 v 1.2 A **2.50**
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#5127: 6.3 vct 3.2 A, 6.3 vct 1 A **2.25**

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25 hy, 65 ma. **1.10**
Dual 7 hy, 75 ma, 11 hy, 65 ma **1.65**
Dual 2 hy, 100 ma .... **.75**
.116 hy, 150 ma **4.50**
6 hy, 150 ma. **1.50**
Dual, 120 hy, 17 ma **2.45**
.01 hy, 2.5 A. **1.50**
.35 hy, .35 A. **7.50**
Dual 2.5 hy, 130 ma **1.25**
.1 hy, 12 A, 46 ohms **16.00**
Dual .5 hy, 380 ma .... **.95**
5 hy, 40 ma, 312 ohms .... **.65**
2 hy, 200 ma. **.75**

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01-A	$ .45	225	$ 8.80
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2J22	15.00	531	45.00
2J26	15.00	532	2.00
2J27	15.00	559	4.00
2J31	25.00	562	90.00
2J32	15.00	615	.89
2J38	25.00	703-A	7.00
2J39	25.00	704-A	.75
2J55	25.00	705-A	2.85
3J31	25.00	707-B	20.00
2X2/879	.69	714 AY	15.00
3A4	.65	715-B	12.00
3BP1	2.25	720CY	25.00
3C24	.60	721-A	3.60
3C30	.70	723-A/B	7.75
3D6	.79	724B	1.75
3CP1/S1	3.50	724-D	2.50
3D21-A	1.50	725-A	25.00
3DP1	2.25	726-A	9.50
3EP1	2.95	800	2.25
3FP7	1.20	801-A	1.10
3GP1	3.50	804	9.95
3Q5	.79	811	1.95
5BP1	1.20	814	5.95
5BP4	4.95	815	2.50
5CP1	3.75	836	1.15
5FP7	1.35	837	1.95
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5J30	39.50	860	15.00
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6SC7	.70	889R	78.50
6SL7	1.00	1005	.35
7C4	1.00	1613	.95
7E5	1.00	1619	.21
7E6	.72	1624	.85
10Y	.60	1629	.35
12A6	.35	8012	3.95
12K8Y	.65	9004	.47
12SF7	.49	9006	.47
12SR7	.72	CEQ 72	1.95
15R	1.40	EF 50	.79
28D7	.75	E-1148	.75
30 (Spec.)	.70	F-127	20.00
35L6	.69	FC 258A	165.00
35Z5	.66	FC 271	40.00
45 (Spec.)	.59	GL 562	75.00
50L6	.79	GL 623	75.00
39/44	.49	GL 697	75.00
35/51	.72	ML 100	$60.00
227A	4.95	QK 59	45.00
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		VR 130	1.25
		VR 135	1.25
		VR 137	1.25
		VR 150-30	.75
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		VU 134	1.00
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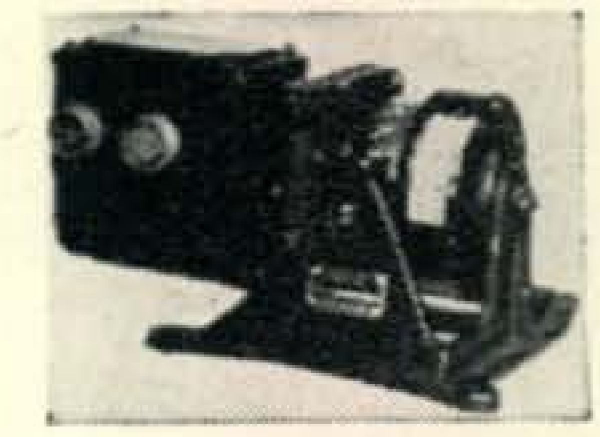

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DX Qths

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C8YCW, Box 73, Lanchow, Kansu, China
CT3MN, Capitan de Artilleria, Mario Portela, Funchal, Madeira
EAXXX, P. O. Box 7073, Newark, New Jersey
ET3AH, Frank Frost, SPO Box 858, Addis Ababa, Ethiopia
HP1LS, Stanley Lawrence, Box 1616, Panama, Republic of Panama
HS2F, Signal Division, Siamese Navy, Bangkok, Siam
HP1LT, P. O. Box 528, Panama City, Panama
MD4TH, Box 436, Mogadiscia, Somalia, East Africa
OE1AS, Via G2MI
OE1AD, Via PAØBK
OQ5RA, Box 271, Leopoldville, Belgian Congo
PK4PQ, P. O. Box 400, Rotterdam, Holland
PK500, B. Jansen, Bandjermasin, Koteistr. 5, Borneo, N. E. I.
PX2AB, Box 31, Andorre
PK6XA, Bert Krygsman, c/o N.N.G.P.M., Sorong, New Guinea, N. E. I.
TA1DB, Via HB9U
VP1AA, Dwight Hunter, Box 178, Belize
VP2KS, St. Kitts, B. W. I.
VS9GT, RAF Station, Sharjah, British Forces in Iraq
VP8AM, Via RSGB
VS3DS, c/o Mr. Sim, 43 Seafield Crescent, Aberdeen, Scotland
VQ3HJP, P. O. Box 581, Nairobi, Kenya Colony, East Africa
W8WEA/Truk, c/o Navy 3410, FPO San Francisco, California
XALF, Box 3024, Mombasa, Kenya Colony, East Africa
ZS2Z, Marion Island, c/o P. O. Cape Town
ZS2MI, Marion Island, c/o Postmaster Capetown, South Africa
ZC6AO, State of Israel, Tel-Aviv, Box 4099
ZD2GHK, Via G8VR
ZB1AP, O. Connell, 119 Guardamangia, Pieta, Malta
ZD7AA, c/o Wireless Station, Saint Helena
Swiss QSL Bureau, U.S.K.A. QSL Service, Postbox 1203 St. Gallen, Switzerland
Guatemala QSL Bureau, Manuel Gomez de Leon, P. O. Box 12, Guatemala City

V. H. F. - U. H. F.

(from page 51)

announcing his call in English. The signal was S5 with a slow rolling QSB, W7KVU called him several times but to no avail.

VE3ANY, long a hold out in VE land for verticals finally put up a 3-element wide spaced beam, and has been checking it in comparison to his vertical dipole. Tom Stence, W8NQD, says it is maddening to hear what apparently is a ham signal on 50 mc and listen to it for half an hour, only to have it go off with no identification. Also in case of antenna tests or tuning up and where no QSO is desired, the operator should state that, when cutting the carrier. All of this would make for better operating, par-

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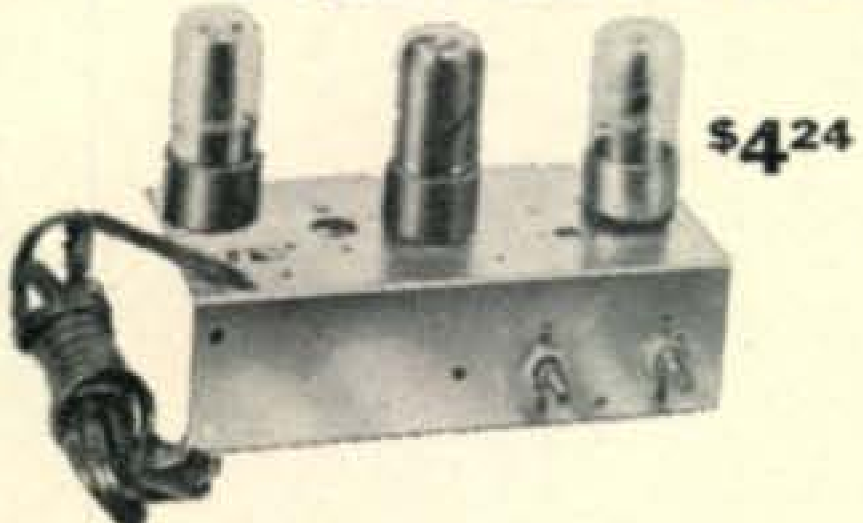

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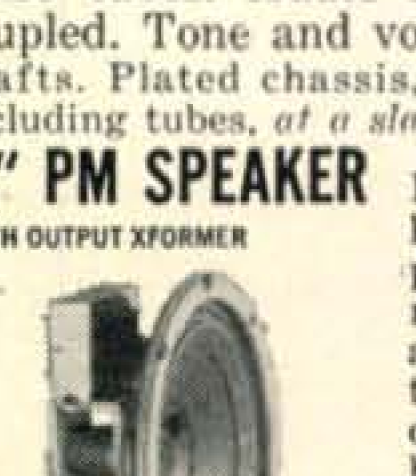

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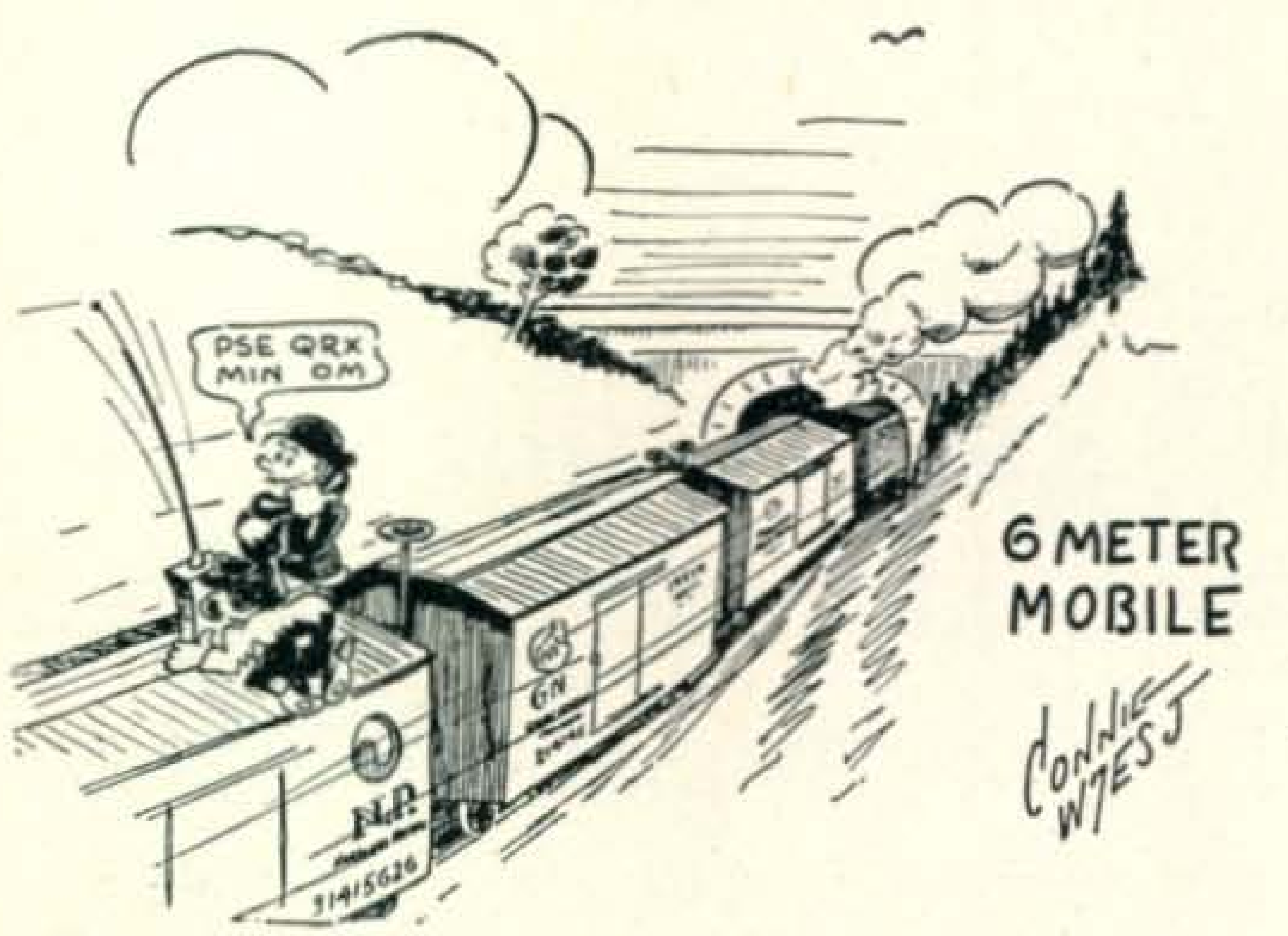
ticularly when the state hunt is still on. Tom, W8NQD, tried a crude experiment, being that he is a gunsmith by trade, of firing half wave lengths of wire to a considerable height by means of an old Civil War musket. The wire reached up about 3-4000′. He was unable to observe any reflection from them, or any effect whatever. Hmmm, better change brands of cigarattes, or give me a drag, Thomas me boy, that's a new one for sure, I theenk!



W5FSC snagged TG5CH and TG9UA on June 16, for his seventh country. On June 8, at 2130 CST a VP9 was heard on 50 mc peaking S9, but bad static and his low modulation made him hard copy. Anyone else have news about this VP9??

W9UIA says the band was open 12 days in June, at least the openings he was able to get in on. XE1 and XE2 was also added to W9UIA's list, making it 35 states and VE1-2-3, XE1-2.

The F.C.C. finally caught up with Rick Emerson, ex-W1KMZ/3, now W3OJU. Rick is using his circular polarized antenna, claiming 8 db gain in any direction over a dipole. At least it saves rotary worries in apartments! Two double hops opening were caught by W3OJU on June 16, when it was open for W6s about 15 minutes, and on June 27 when WØUEL in Colo. was worked. Condx in the D.C. area has been down in comparison to last year.

W6BPT in Santa Clara, Calif., says that the openings have been shorter than last year in both skip and duration, with new states getting harder day-by-day. He has reached 35, for the total to date.

The town's champion knob twister for Pampa, Texas, is W5HVP who has tuned the band daily since May. On June 5, the band finally opened for W5HVP. W5HVP is new but to date has worked 20 states XE1-2. The rig is 130 watts to a 3-element beam 40′ up in the sunny skies of Texas.

Last month we mentioned the boys on our sick list—W7ACD, WØYKX and W8MVG. All are coming along nicely now, and WØYKX has returned home, but is still bedfast with little chance of being up for time to come. If you haven't dropped Bill, WØYKX, a card, showing that we on 50 mc don't forget a feller, please do so for Bill is still yearning to join in on the openings with little chance of doing so until next year.

W9AQQ is back in Indianapolis after several years in Jacksonville, Fla. So far he has low power on 6 but with a new QTH in prospect, bigger things are planned. Even with the low power of 40 watts, Clair has been working some good bending into Chicago, Elkhart, Plymouth, Mich., and Ky., all around 200 miles.

W5HLD in Enid, Okla., recently put up a 3-ele-

ment Workshop beam and has been working Oklahoma City and Wheatland about 90 miles with good regularity in comparison to his folded dipole. On July 18, WØZJB, at 280 mi. was contacted, proving further that a beam does wonders. W5GVS and W5LHU in Enid are also interested in getting on 6 meters and are in the process of building up gear.

From Jacksonville, Fla., we have a letter of protest from A. S. Rhoads, Jr. about the picture we printed recently of W4EID, saying that Miles couldn't get any movie contracts or marriage proposals with the poor picture printed of W4EID and his dog. My friend, it was the only picture we received and as my wife and daughter practically swooned when they saw it, I had to get rid of it fast.

Tex Brewer, ex-J9AAK and now W4MVD, says that the J9AAK being heard from the Islands isn't legitimate and that Tex isn't QSLing for him. Tex still hopes to get on 6 meters, when his work of training the Reserves while stationed at Gunter Field, Ala., eases up somewhat.

50-mc Openings

As mentioned last month the tremendous number of reports received each month in response to the Sporadic-E Project for the Watson Labs and the USAF precludes the individual listing of stations heard and worked during the openings. Although even at this writing the project is still not in full swing (it will run about two years) the reaction of the 6-meter boys has been excellent. Each station participating in the project will receive a certificate of appreciation, and approximately five plaque awards will be given each year to the five stations turning in the best and the most useful reports. We don't mind saying that considerable thought is going into the methods of judging and rationalizing the reports. Also, look for, or perhaps you will hear of, a surprise announcement concerning the project to be made within the very near future.

While the Sporadic-E Project is attempting to make things as easy as possible for the work group, the copying of the logs to the reporting forms is somewhat tiresome. At WØZJB we have taken about twenty sheets of the reporting forms inter-

mixed with yellow or white second sheets and stapled them together. Then by inserting a carbon paper between the form and the second sheet we can get a copy of the form, which serves for the station log. As the pile runs down, they are unstapled and the reporting forms sent along to the project analysis. This also has the advantage that remarks, or unusual observations can be made directly on the form, while the contact is still fresh in your mind.

June 25—Good two hour openings from the W4 area into W1, W2, W8 and W9. W5FRM reported excellent conditions over the south and mid-west paths. W9ALU heard a harmonic on 50.4 mc from KLCK on c.w.

June 26—Sudden ionosphere storm began during early morning. W7QLZ had fluttery signals from upper W7 between 1940–2050 MST. W9ALU worked into W1 after 1900 CST. Upper W7 also report working in W6, while W6IWS worked into Colorado at 1930 PDST.

June 27—Ionosphere storm abated slowly during morning hours while band appeared open in all directions at same time. Probably open before, though first signals reported shortly after 0900 EST between W1, W2 and W3 to W4, W5, W9 and WØ. Also same paths later in evening with W9 to WØ skip down to less than 400 miles when W9ALU heard WØZJB. In the west the W6 and W7 areas found conditions good from 1800 until 2200 PST. XE1GE worked W5AJG at 1900 CST. W4FNR worked double hop into W5ELL and W5VWU. W5AJG totalled 31 contacts during 13 hours. W3OJU also double hopped into WØUEL at 1015 EST.

June 28—Another good to excellent day, though not as long in duration as the 27th. W6 into W7, W5 into W8, W9 and WØ. WØDER reports very good conditions to east and southeast from 1105 until 1830 CST. No double hop reported.

June 29—Ionosphere conditions again very quiet with scattered good openings. W1, W2 into W8, W9 and WØ. W7LYA worked as far east as Indiana. W5HLD crossed this reflecting area into upper W7. W7HEA and W7ILL report many W5, W6, W9 and WØ contacts. W6 into VE7 while VE5NC heard W6 and WØ from 1930 until 2200 CST.

June 30—Weak scattered openings. W2RLV worked four VE1 stations. W7JPA reports periodic scattered signals from Colorado and California during afternoon and evening.

July 1—W6 to W7 weak from 2100 to 2200 PST. W9 to W4 shortly after 1100 with fair signals and W4 to W1 and W2 scattered after 1900 EST.

July 2—Poor to fair openings from W4 to W8 and VE3; WØ to W2, W3 and W8; W3 to W5 and from W7 to W5, W6 and WØ. Mostly in early evening.

July 3—XE1KE worked W5 and W4 from 1150 to 1610 CST. W4 to W8 and W9 from 1145 to 1245 EST. W5 and W6 to upper W7 during early evening.

July 4—Scattered morning opening W5 to W7 and WØ. Also W1 to W9 after 0930 CST. Ionosphere storm began in early evening.

July 5—Scattered upper W7 to W6 during morning around 0815 PST. Weak signals from WØ into W2, upper W4 and W9 shortly after 1600 CST. Ionosphere conditions still greatly disturbed.

July 6—Late evening opening from W1, W2 and VE2 into WØ between 2230 and 0100 CST the following day. Few W7 to WØ contacts around 2100 CST.

July 7—Good to excellent opening from W9 and WØ into W2, W3, W4, W5 and W7 from 1745 to 2300 CST. W5AJG again worked more than 30 stations, while W5ML worked 22. Fair W7 into W5 from 2145 to 2245 CST. XE1KE worked W5JBW at 1215 CST while band was also open from W3 into W5 and W9 after 1200 EST. W6 to VE7 after 1600 PST. VE5NV heard W5 and W9 after 1830 MST.

July 8—Fair opening from WØ to W1, W2, W3 and W8 between 1830 and 2245 CST. Spotty opening W9 to W4 and W5 during this period. W7 to W6 from 1300 to 1515 PST. Some W3 and W2 into W4 and W5 from 2100 to 2145 EST. W4FNR in Florida heard double hop from W6 and W7 after 1440 EST.

July 9—Some scattered W9 to W5 work after 0900 CST. W2BYM worked W9ZHL at 1155 EST. Scattered W6 to W7 from 1514 to 1530 PDST. W4GJO and W4EID worked into W5 from 1900 to 2245 EST. W7ILL in Wyoming worked W4, W5, W9 and WØ between 1850 and 2150 MST. XE1KE heard several weak W2, W5 and WØ signals between 1945 and 2005 CST. VE5NC heard W5 and WØ during the same period.

July 10—Erratic opening with fair signals from 0900 until 1800 EST between W1, W2 and W3 to W4, W5, W8, W9 and WØ. W5 to W2, W4, W9 and WØ from 1715 to 2050 CST. W7 to W6 and WØ from 1916 to 2218 PDST.

July 11—Only report W5HLD and W4GJO at 2050 CST.

July 12—No reports.

July 13—Poor conditions from W6 to W7 around 1900 PST.

July 14—Poor conditions again over same paths with some scattered WØ signals.

July 15—Poor conditions from W6 to W7 around 1845 PST. WØDER works W5AJG while W4EQM works weak WØs.

July 16 and *17*—No reports received of sporadic-E.

July 18—Short W7 to WØ opening from 1700 CST. W6 to

W7 after 2040 PST. VE4YW worked W5, W9 and WØ after 2000 CST.

July 19—W7JPA reports working W5, W6 and WØ from 1815 to 1920 PST.

July 20—Reports incomplete.

July 21—Good conditions from W4 and W5 into W1, W2, W3 and W8 from 1830 to 2230 EST.

July 22—Reports incomplete, but probably an inactive day.

July 23—Some scattered to good W4 and W5 work between 1200 and 1500 EST. Also W4 to W1, W2 and W3 from 1600 to 1800 EST with good signals.

July 24—Scattered good to excellent conditions especially double hop from W4 into W6 and W7 peaking around 1300 TST. Also good conditions from WØ to W5, W7 and western WØ.

July 25—Shifting scattered good to excellent conditions with sharp peaks and then abrupt fadeouts. W9 and WØ into W1, W2, W3, W4, W5, W8 and W9. Possible double hop, not fully reported as yet. More next month.

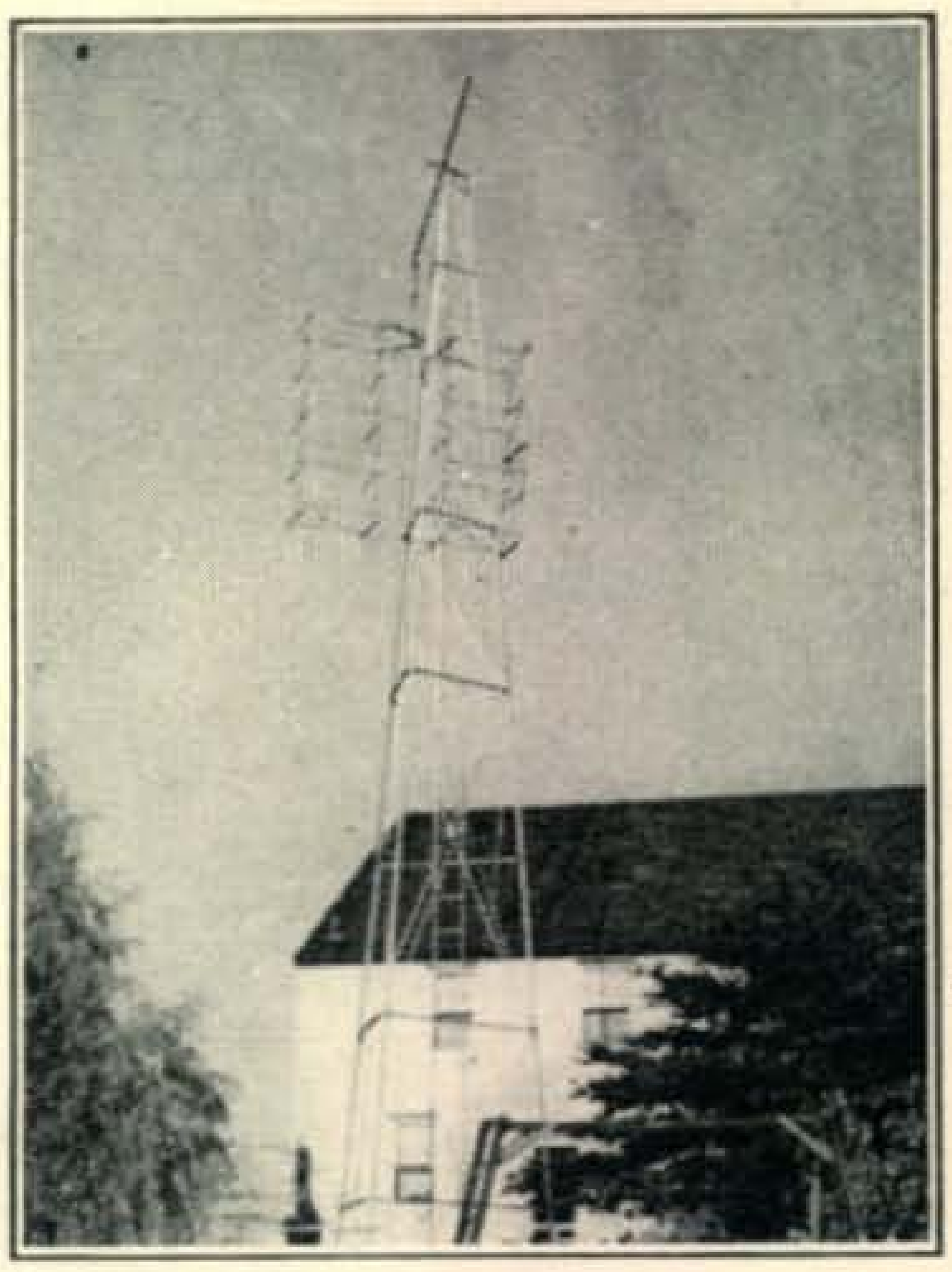
144-mc Notes

The Midwest V.H.F. Club of Chicago is planning a 144-mc QSO party to be held late in September or early in October. V-h-f hams in Ill., Ind., Mich., Wisc., and Iowa are invited to participate in this contest. Surprise awards are promised to winners, according to W9NFK, who is committeeman in charge.

The Chicago area gang now sport anything from verticals to horizontal arrays of the 12 to 32 element variety. W9JIL has been hearing a W5 in the early AM who bears watching. W9ALR took himself a bride (it says here in small print)!

WØBJV has worked WØSV and WØHXY in Minn., at 154 miles and has heard WØUYU at 185 miles, but no QSO as yet.

W9AB worked WØNFM a fair haul of 400 miles for a new state, VE3BHE was heard as well as W4FBJ in Ky. W5JLY in San Antonio, Texas, worked W5AJG at 260 mi., W5FSC at 200 mi., W5AVW at 275 mi., W5VV 85 mi., and has heard other signals sounding like DX. Early morn skeds are now being kept with XE1QE and XE1KE by the W5s, says W5JLY, all with blood in their eye to really get that record in the deep south!



W3GKP's 144-mc array. 4-8JK's stacked. The beam is suspended from a windmill tower. The polarization may be changed by tuning the beam on its side.

W8WRN reports that 2 meters was very good on June 2-3-5-13-15-16-10-20-25. July 2 was very good when W8EP in Terra Alta, W. Va., came in S6. More stations were heard at this time than ever before from Pittsburgh. W4JBF in Ky. was an S6 off the back of W8WRN's 4-element beam in the attic.

W9MBL got in on several openings on July 1-2-3-4, when stations in Ind., Ill., Wisc., Ohio, Ky., were worked. A newcomer to 2, with 20 watts and a 4-element beam, W9MBL is now hugging the band for all it s woith.

W5AJG mentions that his vertical dipole up 75′ gives just as good account of itself as his 16-element beam up 30′. This has been checked locally and on the early morn openings. Plans are now to raise the 16 element to the 75′ position just to see if it's so!

In Pensacola, Fla., W4EQR, CNK and HIZ are active and have looked for the W5s in the early morn, but to date no DX, although they are hoping.

W5NLZ in Oklahoma City says the gang there are at it also for DX but nothing to date, although lots of listening has been done. They are working into Watonga, Okla., a distance of 60 miles. A daily sked with W5AJG is kept from 0700-0800 CST. On July 21 from 0732 to 0800 signals were heard in the 144-145 mc region from the southeast; c.w. would have made the contacts as signals were too weak to read on phone.

W4CA and the gang in Roanoke, Va., are now experimenting with rhombics on 144 mc. A few weak carriers have been logged but nothing definite as yet.

144 MC Honor Roll

	States	Districts			States	Districts	
W1IZY	12	4	VE1	W8QKI	7	4	VE3
W1IPV	11	4	VE1	W8PYY	7	4	
W3GV	8	5	VE3	W3RUE	5	3	VE3
W1JFF	11	4		WØWGZ	4	4	
W9ZHB	9	6		WØDDX	2	1	
W9LWE	8	5		WØMZH	2	1	
W9IPO	8	5		WØRNC	2	1	
W9BRU	8	5		WØZJB	2	1	
W3GKP	8	4					

W1PIV says that the band has been good in the east to as far south as Va., but not much to the west. June 27, VE1QY was heard 20 db over S9, off the back of W1PIVs 32-element beam. Ed, W1PIV is still looking out west for DX, and calls CQ each night on both horizontal and vertical around 2130 EDST.

W9LWE in Chicago made a trip to Caledonia, Minn., on July 3, just to see what could be worked from there in the way of 2-meter DX. Contacts ranging from 100 to 300 miles were made in Ill., Wisc., Minn., and Mich. Indiana and Iowa were heard, as well as a W4 whose call just didn't come through again, the use of c.w. would have made some of the contacts that were too weak for phone. A return trip is contemplated and advance notice cards will be sent out.

ONE SIDEBAND, ONE STAGE

(from page 22)

should be vertical and horizontal, however, and it should tip only slightly as the frequency is varied over the above audio range. The shape of the ellipse should not change over the audio range, although its size should decrease toward each end of the range.

(Continued on page 92)

If the 'scope can be adjusted to give equal deflection sensitivities and zero phase shift and is set in this manner, the appearance of an ellipse is an indication that something is amiss. If the ellipse has axes which are horizontal and vertical and does not tilt or change shape as the frequency is varied, it is merely an indication that the two output voltages are not equal, but the phasing is proper. (This effect can also occur if it is necessary to make the two deflections unequal to eliminate phase shift in the scope, as mentioned above.) Unequal output voltages can be corrected by changes in the 6SJ7-6L6G sections, as previously described, but if the pattern is an ellipse at some frequencies and turns into a circle at others or if it is an ellipse which changes its shape or tilts, the fault lies in the phase-shift networks.

The easiest test which can be made on the networks is to check their resonant frequencies. This is done by connecting one of the 'scope inputs to the plate or cathode of the 6SN7GT while leaving the other connected to one of the 6L6G grids. Resonance is indicated by a diagonal straight-line pattern at some frequency. The resonance should appear quite sharp, and should be at 1590 cycles for the "A" channel and 350 cycles for the "B" channel. At the resonant frequency of the "A" channel, the "B" channel should show a 90-degree phase shift, and vice versa. If these relationships are not obtained, the networks may be doctored slightly by shunting large resistors across those already in place or connecting small resistors in series with them. Decreasing the resistance raises the resonant frequency, while increasing the resistance has the opposite effect. The object is to get the resonant frequencies to have a ratio of 4.53:1 and keep the output of each network constant over the audio band. This is not easy to do by cut-and-try, and it is much better to select the R and C values accurately at the outset.

In all the foregoing it has been assumed that there is at all times 180 degrees phase shift in the 6SJ7s which are between the networks and the 6L6G grids, and this should be true unless there is something drastically wrong. The phase shifts through the 6SJ7s may be checked with the aid of the 'scope, if they are suspected of adding a shift which varies with frequency.

With the networks operating properly, the feedback resistors may be re-connected, and the scope inputs transferred to the modulation transformer output terminals (one terminal against ground on each channel), and whatever changes necessary may be made in the two channels to equalize their outputs. At this point, a comparison of the outputs should show a pretty respectable circle over the whole audio range, with an elliptical pattern just beginning to be evident at 150 and 3500 cycles.

Tuning The R-F Section

The r-f section should be first tuned up at a plate voltage in the neighborhood of 1000 to 1500 volts, with the slider on resistor R_{32} in the modulator initially set to give zero screen bias. With the plate voltage off and no modulation, C_1 should be tuned to resonance as indicated by maximum grid current to the upper pair of tubes of *Fig. 6*. The coupling to the exciter should be adjusted to give a grid current of about 20 milliamperes. L_1 and L_2 should be widely separated when this is done, and C_2 should be set at maximum capacitance. A dummy load consisting of a 100-watt lamp should be connected to the antenna terminals, and plate voltage and modulation applied. As the modulation is increased, the plate current to the r-f section should rise, and it should be possible to find a plate current dip when varying the plate-tank capacitor. The load lamp should indicate power output at this point. A circuit resonant at the operating frequency should now be connected directly to the vertical plates of the oscilloscope, and a link run from this circuit to a loop which is loosely coupled to the leads connecting to the lamp load. The purpose of the tuned circuit at the 'scope is to eliminate harmonics, which would otherwise cause confusion. With a moderate amount of modulation applied to the transmitter, the tuned circuit at the 'scope should be resonanted, and the coupling to it adjusted for a convenient amount of deflection. The regular linear sweep should be used on the horizontal plates of the 'scope. At this point, the picture obtained should be an envelope of half sine waves. The outline of the top and bottom of the pattern should look like the output from a full-wave rectifier before filtering. If the proper picture is not obtained, adjust the load coupling, plate tuning, and excitation.

Next, place L_2 about an inch from L_1 and adjust C_2 for resonance. Resonance will be indicated by maximum grid current on the lower pair of tubes of *Fig. 6* and a sharp dip in the grid current to the upper pair. Adjust the coupling between L_1 and L_2 so that the grid currents to the two pairs of tubes are equal when C_2 is resonated. The tuning of C_1 will not have much effect on the relative grid currents, and C_1 may be left at the point originally used when operating with one pair of tubes alone. The pattern appearing on the 'scope will now be something approximating an unmodulated "carrier" (or a c-w signal) when modulation is applied. At this point it is desirable to reduce the modulation to zero and observe whether any vertical deflection appears on the 'scope. Deflection without modulation indicates either that the excitation frequency is leaking through the amplifier, due to unbalance, or that there is direct coupling into the 'scope from the exciter or the amplifier grid circuit. Detuning the amplifier plate circuit will immediately show whether there is leakage through it, by changing the amount of vertical deflection. The carrier-frequency component of the unit shown in the photos has never been strong enough to give more than a very slight deflection on the 'scope, but direct leakage around the amplifier has been a real problem. Leakage must be eliminated, as the output patterns obtained when leakage is present can be exceedingly confusing. Proper grounding of the 'scope chassis and removing it to a respectable distance from the r-f equipment have been found to be the most successful methods of eliminating stray r.f. The use of a coaxial line for the link between the 'scope and the amplifier has also been found helpful.

With stray coupling removed and modulation applied, the pattern appearing on the 'scope will be an unmodulated carrier, such as might be obtained from a c-w transmitter with plenty of filter, if the modulating source is a sine wave and only one side-frequency is being produced. In practice, there will always be a certain amount of the unwanted side-frequency produced, and the r-f envelope will contain a small amount of ripple on the upper and lower edges. L_2 should be slid back and forth a small amount and C_2 adjusted to give minimum ripple.

Once the proper setting for C_2 and the proper coupling between L_1 and L_2 has been found for each band, frequency shifts of 30 to 50 kc in either direction on the 14-mc band and 20 to 30 kc on the 3.9-mc band may be made without retuning. Retuning by means of trimmer C_7 will be necessary if a greater frequency change is desired. Retuning is simple, however, as C_7 is merely adjusted for maximum grid current to the tubes connected to L_2-C_2.

Next, try reducing the modulation to zero, and then increase it slowly. For the first small amount of modulation, the plate current to the r-f section should either remain at the zero-modulation value, increase immediately, or decrease very slightly and then rise. If there is a very marked drop in plate current, the screen bias and excitation should be changed to find a combination which results in only a slight drop in plate current, or no drop, followed by a rapid increase, as the modulation is increased further. As the modulation is increased, a point will be found where the output seen on the 'scope stops increasing, and the ripple begins to flatten off. Adjust the loading and excitation to get the highest possible output before flattening occurs, checking to make certain that the changes do not cause a large drop in plate current for small amounts of modulation. If the ripple is too slight to allow the flattening to be observed conveniently, detune C_2 slightly to produce some ripple when adjusting the loading and excitation for maximum output, and then restore C_2 to the proper position.

Once familiarity with the proper method of adjustment has been obtained, the plate voltage may be raised to any amount up to 3000 volts. A pair of 100-watt lamps should be used for a load at plate voltages above 1500 volts. The screen bias should be set to give the maximum possible zero-modulation input within the previously mentioned limitation that the plate current should increase and not decrease for small amounts of modulation. The maximum allowable input with no modulation is 150 to 200 watts, however. Under these conditions, the plate dissipation may rise to somewhat over the maximum tube ratings when the audio oscillator is used as a modulation source. Under normal conversational voice modulation, however, scarcely any increase in dissipation over the zero-signal condition will be noticed.

With a plate voltage of 2500 volts, the output should be somewhat over 200 watts, with a plate current which rises from something less than 80 milliamperes with no modulation to about 200 milliamperes under sustained sine-wave modulation. The plate current under voice modulation depends somewhat on the characteristics of the meter used, and it is best to use the oscilloscope, with the sweep reduced to small horizontal deflection, as a peak output indicator. The output peaks should be kept below the point which was found to give maximum output without flattening when sine-wave modulation was used.

An Improvement

A worth while addition to the unit described here would be some sort of simple fixed-frequency audio oscillator located on the modulator chassis arranged to be connected into the audio system by throwing a switch, as tuning of the r-f section requires a steady, pure modulation source. To be of any value, however, the oscillator would have to deliver a signal free of harmonics. A single-tube oscillator of the phase-shift type should be suitable.[1]

Acknowledgment

Grateful acknowledgment is made to K. H. Rothman, W6KFQ, for portions of the mechanical and assembly work on the equipment described.

1 F. E. Terman, "Radio Engineers Handbook," 1st ed., pp. 505–506, McGraw-Hill, 1943.

DX MAN TICK?

(*from page 39*)

ating procedures were criticized severely when 50% of those polled thought that calling CQ DX was a very poor practice. 14% said it was permissible under some circumstances, i.e., when the band is open and/or you already know your signal is reaching near the desired area. 36%, however, thought that it was very useful, in fact, quoting examples of good DX who had answered such calls.

The practice of calling DX on their own frequency and thus confining the two station QSO (?) to one channel was also criticized. 60% definitely stated that this just meant more congestion and piling up on the frequency. 30% thought this procedure was reasonable from an objective viewpoint, while 10% thought it would work sometimes if everyone would cooperate in keeping that particular channel otherwise clear during the individual QSOs.

The question that attracted the most vehement replies was *Question 4* on whether the log of the station could be used to establish W.A.Z. and DXCC. Omitting the descriptive "No's" and the discourses on human frailities, 68% voted that under no circumstances should a notarized log be used for certification. 26% were a little more lenient in their judgment of fellow hams and voted "Yes." 6% preferred to offer no opinion. Of the "Yes" vote it is interesting to note, however, that it is tempered by the fact that the acceptance of the logs should not be considered good practice and when no QSL cards are available for a legitimate reason the DX station should be asked to send a copy of his log to a central agency here in the States for the purposes of double-checking.

21-mc Band Division

The last question to be analyzed dealt with the phone and c-w division of the new 21-mc band. In particular, over 80% of those polled had visions of operating there as soon as it was opened. The division of the band was polled and questionee was asked to make his own phone/c-w separations. Many were so random that only a general grouping could be tabulated.

Question: Mow do you think the 21-mc band should be divided?

All phone	25% for c.w. 75% for phone	50% for c.w. 50% for phone
7%	13%	48%
	75% for c.w. 25% for phone	All c.w.
	8%	3%

It appears that one out of every two DX men thinks that the 21-mc band should be split 50-50. Of these, however, 15% wanted it limited to either Class A or Class B phone privileges, while about 8% thought that we should sacrifice 50 kc for the benefit of foreign signals, free of VE phones and all W signals, phone or c.w. A surprisingly large group, one out of every four hams, prefered a little more discussion on what the band is like before committing themselves.

Summary

Excluding the personal factors given in the first part of this article, we find that when considering the group of radio amateurs particularly interested in working DX, one out of every five has built separate transmitters for each of the DX bands while one out of every twenty uses a separate final amplifier on 10-20-40 meters. Seven out of every ten DXing amateurs have some type of bandswitching to permit rapid changeover from one band to another.

About three out of every five amateurs can operate break-in and about the same proportion use a keying monitor. Two out of every five are convinced that their own station location is below average, seven of every ten amateurs suffer from auto ignition QRN, while six of every ten have local QRM from fellow hams in the immediate neighborhood.

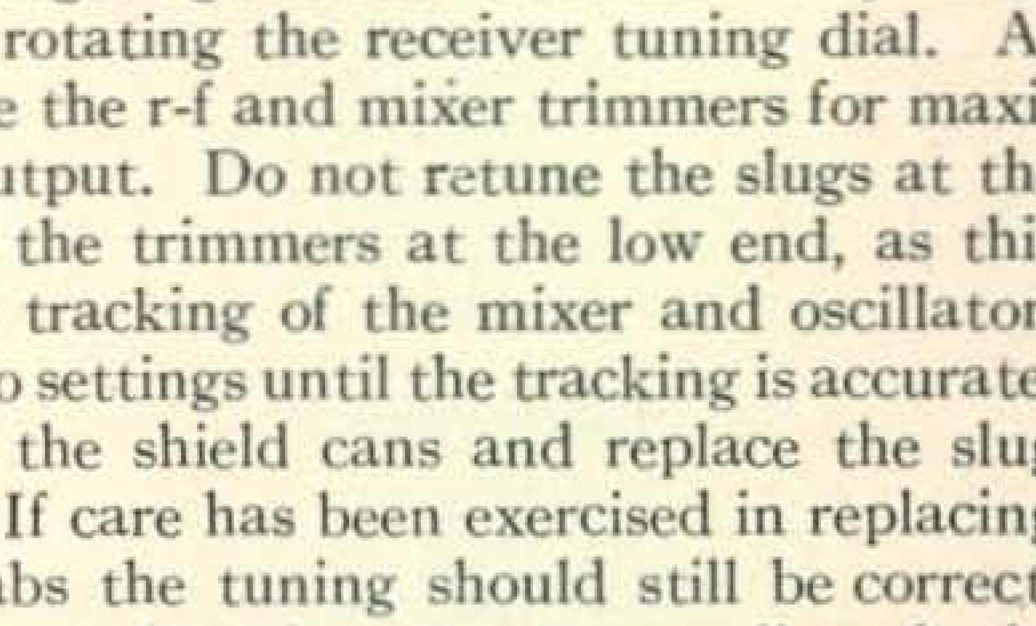
Only four out of every ten favor the practice of calling DX on their own frequency and less than three of every ten would trust the sworn-to log of a station in place of a QSL card.

BC-455 ON 10

(*from page 44*)

Preferably a signal generator feeding a 28-mc signal into the mixer grid should be used to start the realignment. Set the dial to 6.5 mc and adjust the oscillator trimmer and slug until a signal is heard. Next feed the 28-mc signal into the r-f stage through the antenna post and tune the mixer and r-f slugs for maximum signal output. An output meter should be used rather than tuning solely by ear. Now tune the signal generator to 30 mc and pick up the signal by rotating the receiver tuning dial. At this point tune the r-f and mixer trimmers for maximum signal output. Do not retune the slugs at the high end, nor the trimmers at the low end, as this will upset the tracking of the mixer and oscillator. Repeat the two settings until the tracking is accurate. Then remove the shield cans and replace the slug locking tabs. If care has been exercised in replacing the locking tabs the tuning should still be correct. Sometimes it may be advantageous to align the i-f transformers with the 28-mc input as the last step.

An a-v-c circuit has been added to our receiver and the detailed changes are shown in *Fig. 1.* The 25,000-ohm midget potentiometer is wired into the circuit to replace the external gain control of the BC-455B. The arm and one side of the potentiometer are grounded and the other side is connected to *pin 1* on *J-1*, or *pin 3* (outside view) on *J-3*.



THE YL'S FREQUENCY

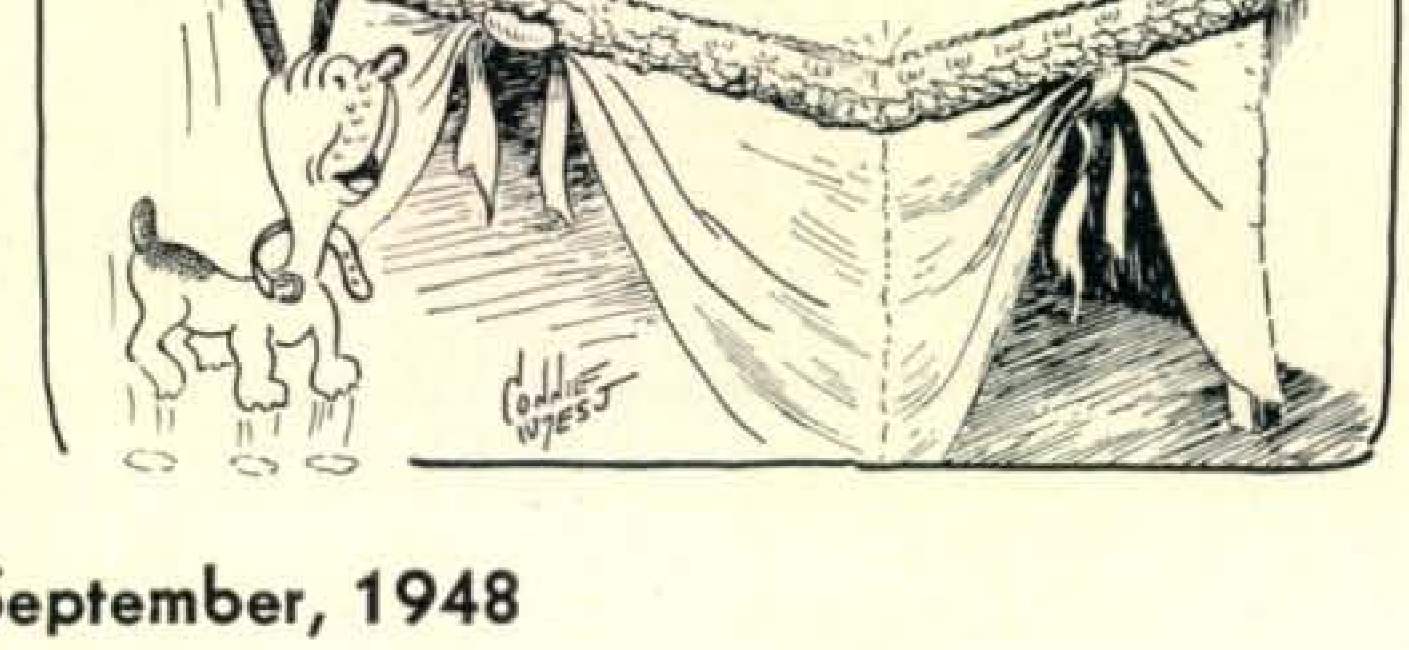
(from page 58)

my degree in electrical engineering tucked away. I had taken the power option, but as it so often happens I started doing work more along the communications line. While in school I was editor of the engineering mag there—was also elected honorary member of Tau Beta Pi.

"I left for California and North American Aviation in August, '46, and worked in their research department as a research analyst in the servomechanism group. W6WRJ took up where my dad left off and got me up on c.w. so I could pass the exam. Met the OM at North American, where he was an aeronautical engineer, and when he left for Ohio and Curtiss-Wright Corp. I followed him and got a job with Curtiss doing about the same type of work I did in California. I was in their research department and besides the paper work did some testing in the electronics lab—all on proposed servos. By the way, I knew Terry McLaughlin, W3VYU, there. She took my job when I quit.

"We lived in a trailer while in Columbus, and even though it was only 19 feet long I got the rig in. Space was so limited, though, that the speaker for the receiver had to sit on the floor. The receiver and transmitter sat in a little cubby hole in the end of the trailer, which was all right as long as the station was operating okay and I didn't have to get inside either one. Then it was really a job, because putting the gear anywhere else practically made one of us move outside. My first amateur operations were from there as W6YYS/8, and the first contact was with my dad in Wisconsin—W9DP. I was on 40 c.w. The antenna was a half-wave doublet strung between a tree and a short pole on top of a telephone pole and up about 20–25 feet. Have my Class A now and am on 20-meter phone. Receiver is an RME-69. Transmitter is a Lafayette with a T-40 in the final and running about 60 watts. This must be a good location because my 60 watts are working out fine. The antenna is a half-wave doublet a few feet above the roof of the house.

"My OM's brother is ex-W5FBY (he's in New York now) and he often listens in on the skeds to Wisconsin so he can get the news first hand. My OM isn't a ham, but he's just about decided that he had better take it up. He says after having put up my antenna three times he has to protect his interests by being able to use it, too!"



UNDERSTANDING SS

(*from page 26*)

trying to hold one phase fixed and vary the other by 90 degrees, Dome's scheme was to let both voltages shift in phase, but keep them shifting in such a way that they were 90 degrees apart over a wide band of frequencies. To do this, a pair of networks in which the output amplitude is constant while the phase varies as the logarithm of the frequency are used. The networks are designed so that at the point where one has a shift of 90 degrees the other has 180 degrees. At another frequency where the first has a shift of 100 degrees the other will have a shift of 190 degrees, and so on, always maintaining the 90-degree difference between the two. Relatively simple networks serve for voice communication frequencies, where a band of 150 to 3500 cycles is adequate.

Figure 5 shows a pair of the networks with design data for voice-frequency use. It is worth noting that in each network the *RC* products of the three resistor-capacitor combinations are equal, and that the *RC* product used in one network is 4.53 times that of the other. To shift the band over which the network operates up or down in frequency it is merely necessary to lower or raise the *RC* products accordingly, holding the 4.53 ratio between networks. The networks have a resonant frequency at which the phase shift through them is 180 degrees. If the networks are operating properly, the resonant frequency of one will be 4.53 times that of the other, and this makes it easy to check their performance by measuring the two resonant frequencies with the aid of an oscilloscope and a calibrated audio oscillator. Ordinarily, the networks are fed from a phase inverter tube, rather than from the center-tapped transformers shown for simplicity in *Fig. 5*.

By using a pair of these networks, as shown, each one feeding a separate modulator, and the two networks driven from a common audio source, the necessary audio outputs to make the single-sideband generator of *Fig. 4* work are obtained, provided each modulator has a center-tapped output transformer or an equivalent phase splitter.

Variations

Figure 4 shows the four amplifiers being plate modulated. Plate modulation is not necessary, however, and is seldom used with this type of single-sideband generator. If triodes are used for the four amplifier tubes, grid modulation is quite suitable. When tetrodes or pentodes are used, either grid, screen, or suppressor modulation may be used.

Figure 4 also shows a separate plate tank for each of the four amplifiers. As these tank circuits are all connected in parallel, they may obviously be replaced by a single tank to which all four tubes are connected. The single-ended plate tank may also be changed to a push-pull arrangement if changes in the phasing of the four grids are made. This method of connection leads to a somewhat simpler circuit, and is shown in a practical 200-watt single-sideband transmitter described in this issue.

LOW COST AUDIO SELECTIVITY

(*from page 27*)

Melt out *all* of the wax on a hot plate or the stove (if you can get away with it) and cut the leads to the condenser block close to the block (lower compartment). With the casting still warm so that the remaining wax coating is soft, the coils may be pulled gently out of the channels with pliers, after the adjusting screws on top are loosened.

Select the proper coils, but keep the rest—maybe you can figure out a filter to use them in. The coils may be put back in the casting as a convenient mount for them and the new condensers packed in the remaining space. Fair results may be had using the coils as they come, but for peak performance the inductance should be adjusted by means of a bridge to the values given in the table. I took mine out and bent the laminations until the correct inductance resulted and then taped them down with scotch tape. The other components were soldered together, taped and re-potted in an old transformer case. It is well to use the best condensers obtainable since condensers with poor Q may spoil the cut-off of the filter.

The circuit of *Fig. 2* is recommended for optimum performance. It allows the filter to be matched properly by the cathode follower. Do not use a circuit which allows d.c. to flow through the filter because it will saturate or change the inductances.

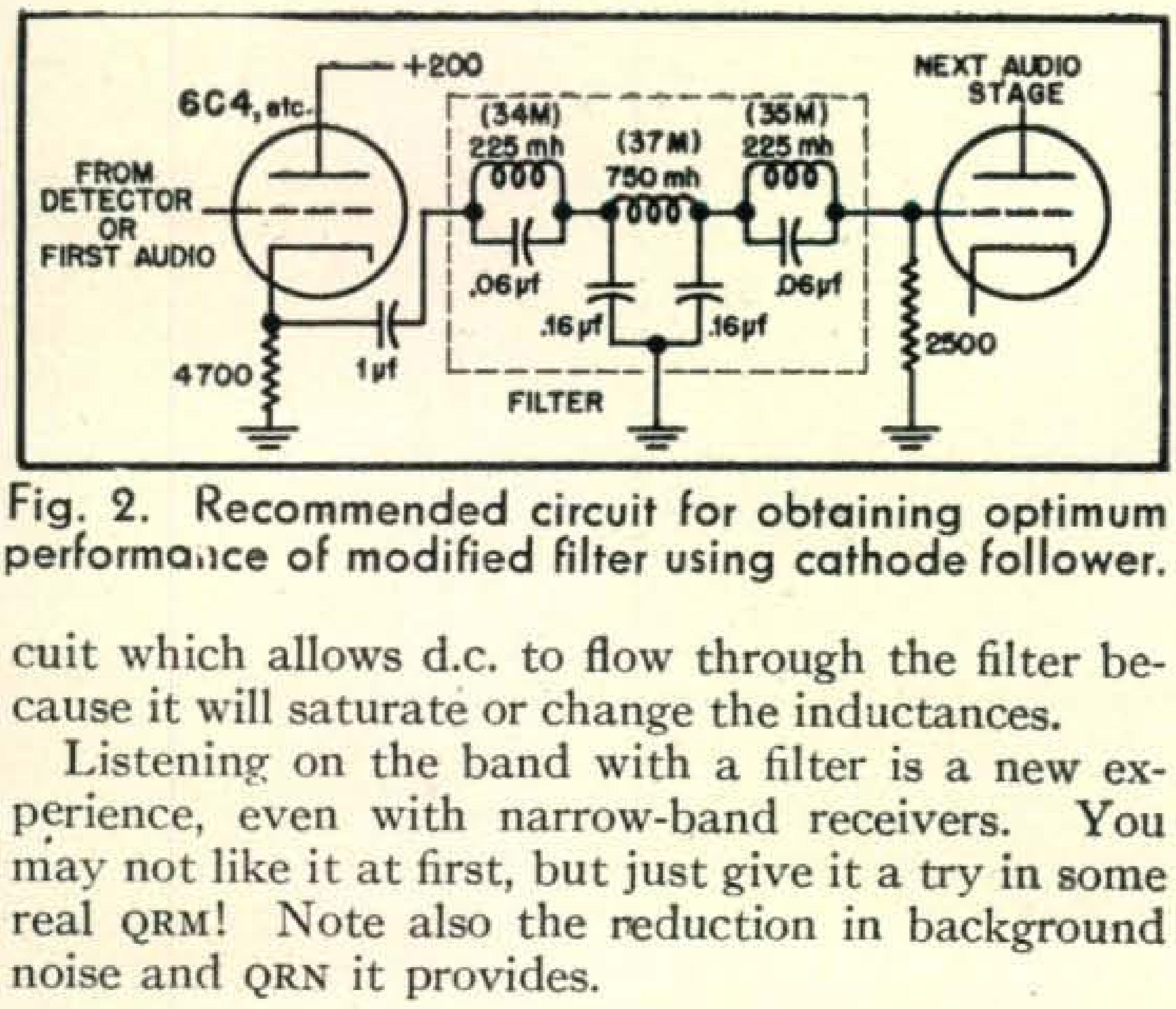


Fig. 2. Recommended circuit for obtaining optimum performance of modified filter using cathode follower.

Listening on the band with a filter is a new experience, even with narrow-band receivers. You may not like it at first, but just give it a try in some real QRM! Note also the reduction in background noise and QRN it provides.

SCRATCHI

(*from page 10*)

antennas between tower legs. This same ham are using 872A toobs as rectifiers for bias supply. I are unable to see final stage on acct. all high power stuff are in concrete sub-basement 25 feet down so are keeping toobs cool from Arizona sun. Also this are to keep F.C.C. inspector from noseying around. The situayshu. are such in this town that the b-c stations are running to the amateurs when they are not having the parts they want or they are blowing there last spare toob.

Last place we are visiting our host is passing out cactus juice as freely as DX man giving out 599X reports to choice DX. Scratchi are not wanting to appearing impolite, so result is Scratchi are finally passing out also. Next morning Hon. Head are feeling same size as $1.49 surplus toob. I are able to attend prize drawing, and are even winning nice pair of earphones. I are planning to try them on when Hon. Head are back to normal size and quits throbbing.

Yours respectively,
Hashafisti Scratchi

DE LUXE REGENERATIVE RECEIVER

(*from page 37*)

need be observed in this portion of the receiver, and no difficulties should be encountered.

Coils

The plug-in coils are wound on ¾" polystyrene forms, Amphenol 24-5H. Since the L/C ratio is very large, it is difficult to give exact coil data. Stray capacities of the circuit form a large portion of the total tuning capacity, and these capacities can be expected to vary with each individual construction. For this reason a procedure for aligning the coils is given rather than complete coil data. The 20-meter coils require approximately 15 turns spaced over a ½" winding length, using No. 22 single enamel wire. When initially wound, the feedback coil tap is made at the second turn from the bottom, and one or two extra turns given the entire coil. The leads are wedged into the coil form pins in a temporary manner using small scraps of wire. Only the oscillator coil is wound, and temporarily a one megohm resistor or an r-f choke connected across the r-f coil connections. The smoothness of regeneration is checked first, and if the action is sharp and sudden when the control is advanced, fewer turns are used on the feedback section of the coil. The tube should oscillate easily throughout the tuning range of the coil, and as a rough guide, the tube should break into oscillation with approximately 35 volts on the screen. Oftentimes, the smoothness of regeneration can be increased by experimenting with the size of the grid leak, grid condenser combination.

After regeneration is reasonably smooth, the coil is pruned to cover the proper frequencies. This is easily done by setting the receiver in an oscillating condition and tuning in the signal on a nearby all-wave receiver. A signal generator is of assistance, but not essential, in checking the coil frequency. Once the frequency is found, it is a simple matter to remove turns until the ham band is exactly centered on the tuning dial. A tuning wand is a helpful item in adjusting the inductance.[1] If the iron-core end moves the frequency in the desired direction, additional turns are needed. The eddy-current copper end reduces the inductance and coil turns are removed if this end locates the proper frequency.

Once the detector coil is pruned, it is soldered. It is wise to do this quickly, and a quantity of water for immediate pin quenching will help prevent the polystyrene from melting due to the heat conducted by the pins. The r-f coil is a duplicate of the detector coil, the trimmer condenser serving to accurately align the two stages. The r-f coil is somewhat

[1]Tomer, "Miniature 2-Meter Superhet," *CQ*, Aug., 1948, p. 19.

easier to wind, since there is no feedback tap.

This procedure is followed for each range that it is intended that the receiver cover. The 10-meter coil will require approximately half the number of turns that the 20-meter coil requires. The 40-meter coil will have about double the number of 20-meter turns, and the 80-meter coil double this amount.

This cut-and-try procedure is a bit more time consuming than winding coils according to a table, but with high L/C tuned circuits where the exact value of C is unknown, it is the only way of assuring that the coils track and cover the proper frequency range. Time spent on the coil adjustments is repaid in improved results from the completed receiver.

If all these suggestions are followed in the construction of the receiver, no trouble should be experienced in getting the set to operate. However, for best results, some minor adjustments and checks should be made on the finished receiver.

With the gain control fully on and the noise suppression control in the off position, there should be no audible hum in the speaker. If hum is present, ground the chassis directly to a good earth ground connection. It may also be possible to remove any audible hum by by-passing each side of the a-c line to the chassis with .1-μf condensers. Be sure that the shielded audio leads are bonded to the chassis, and the metal shell connection (pin 1) of the first audio tube is also tied to the chassis.

The regeneration should be smooth and gradual, and can be adjusted by varying the size of the grid leak-grid condenser combination and the position of the coil tap. The regeneration control by-pass should be large enough to remove any noise when the control arm is rotated. In operation, the regeneration control is set just below the point of oscillation for modulated signals, and just above the oscillation point for reception of c-w signals.

The finished receiver makes a compact neat-appearing unit which is characterized by excellent performance and ease of adjustment far superior to that provided by the average set of its type.

MATCH THE BEAM

(from page 43)

either side of center. The cable is coupled to the transmitter final through a two turn coil.

Once the approximate coil has been installed and the radiator shortened, the correct impedance is found by temporarily employing the services of another ham who is handy with a pair of alligator clips. While the helper periodically moves the clips along the turns of the coil the transmitter final is retuned for resonance while watching the plate current load for a maximum. Once the maximum has been found and hence the correct match to the antenna the clips should be removed and the feed line soldered directly to the coil. If no maximum is noted it may be that the coil is too small. If too much coil remains after the maximum has been found it will generally be best to remove some of the turns, lengthen the radiator slightly and start all over again. On some occasions it will be noted that the taps are not equidistant from the center of the coil. This indicates that some unbalance exists between the two halves of the radiating section. An attempt should be made to correct this and the antenna retuned for correct matching once again.

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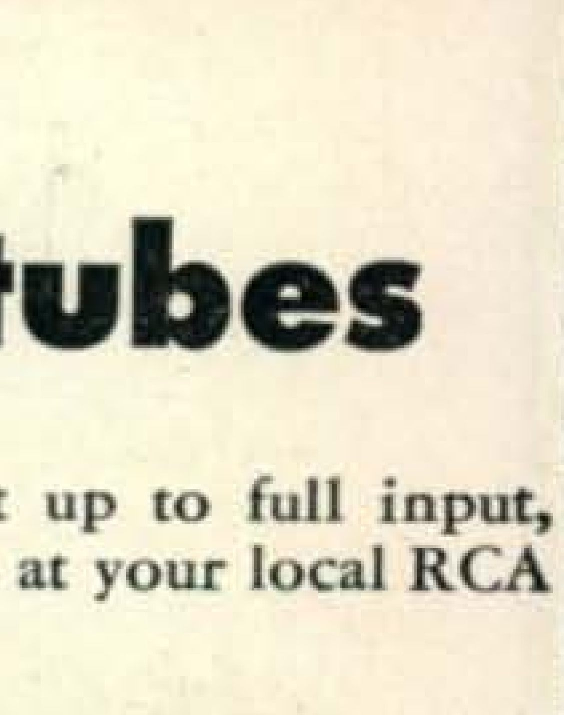

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