CQ

W2FX

APRIL, 1946

The Radio Amateurs' Journal

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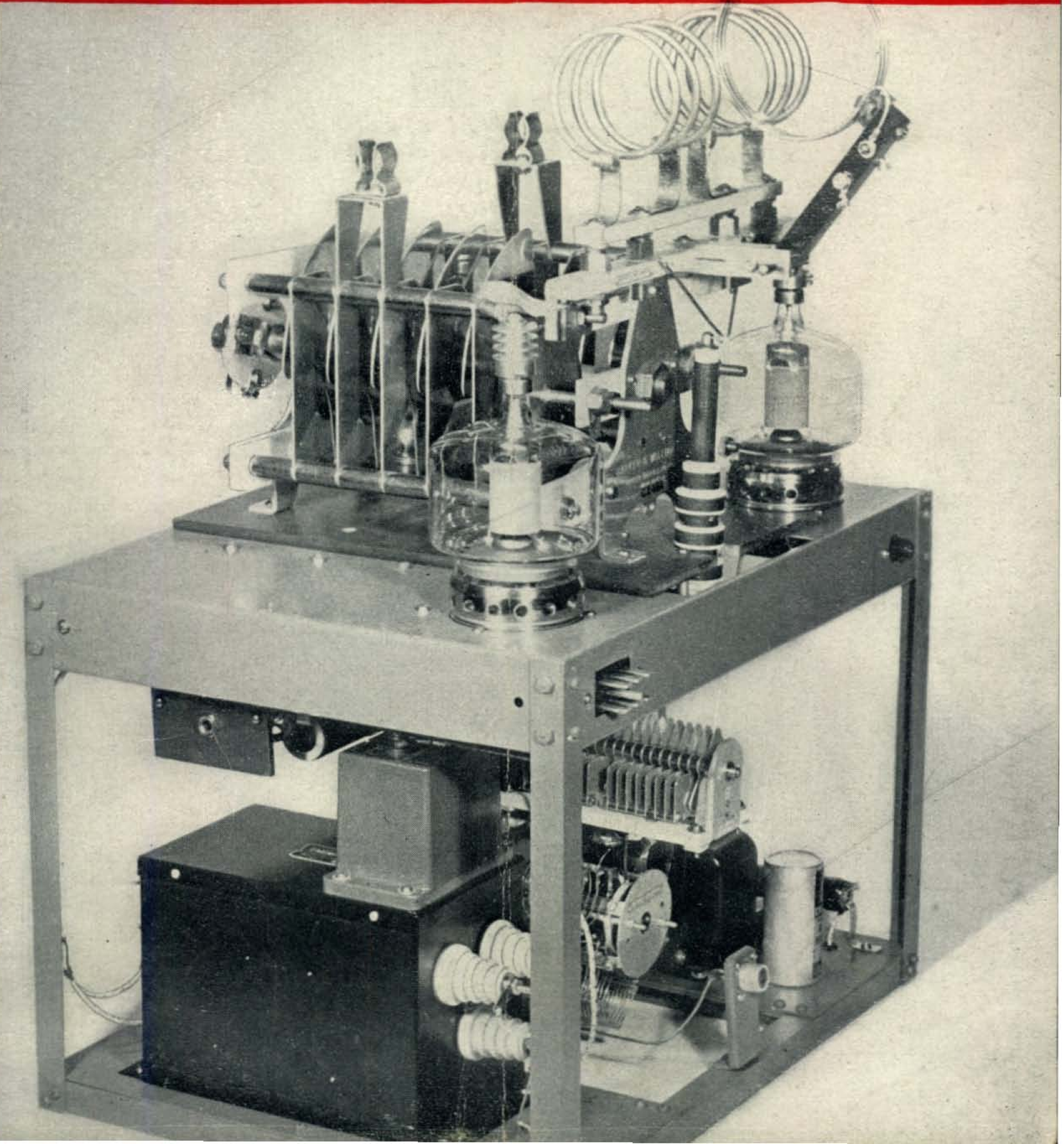
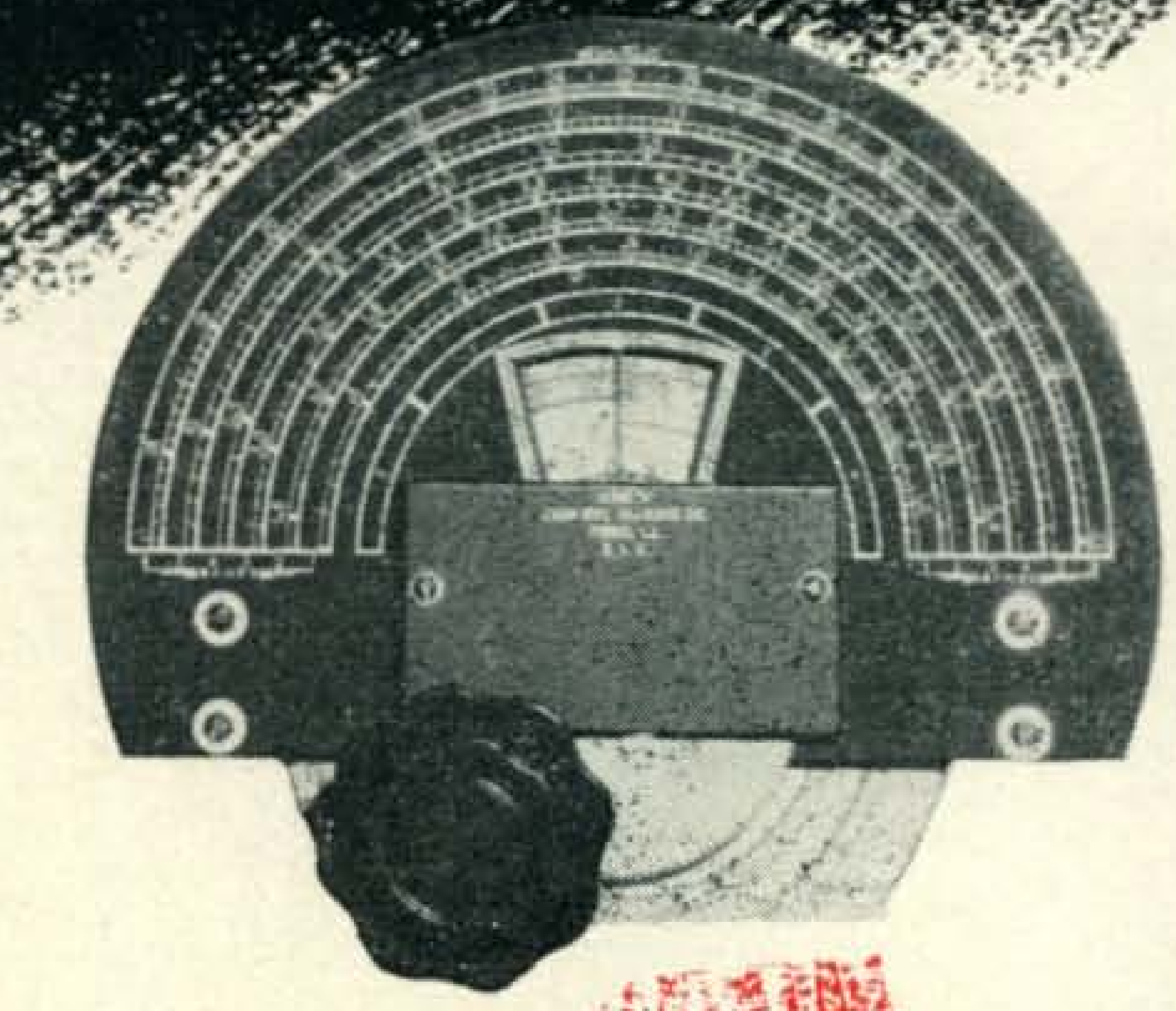


RME *Announces* CAL-O-MATIC

TWO SPEED TUNING AND CALIBRATED BANDSPREAD



The RME 45 is now available with two outstanding improvements — Cal-O-Matic two speed tuning and calibrated bandspread.

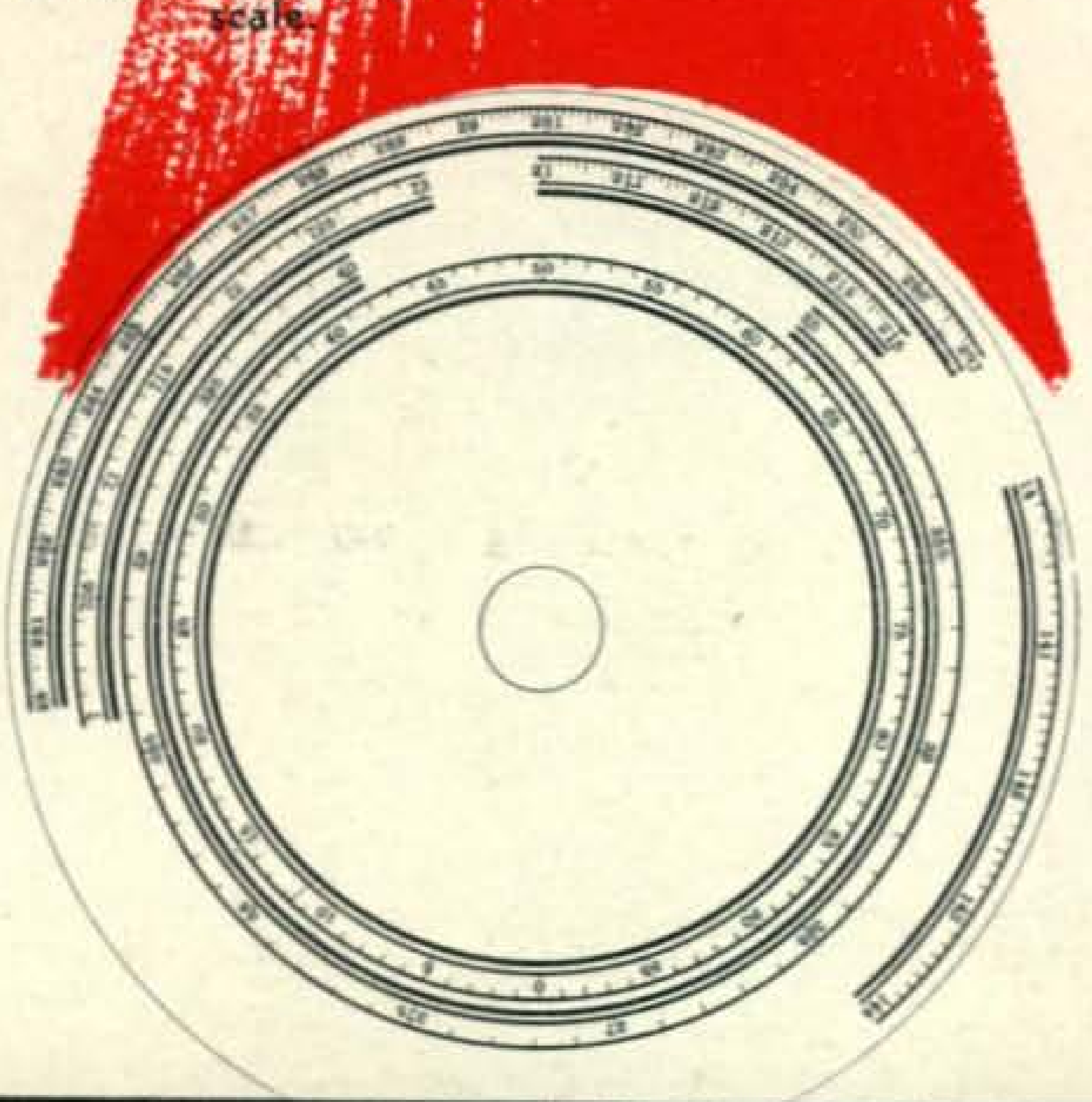
Two speed tuning: "Tunes fast to cover the band. Tunes slowly to find the station." This is accomplished by a dual drive control mechanism which provides approximately five revolutions of a smaller knob to one revolution of the larger knob. Phone as well as CW operators will like the effortless way in which the small knob gives them the peak of a signal with the crystal filter in. Cal-O-Matic tuning, that's what RME engineers have termed this system. It enables automatic tuning and calibrated bandspread to go hand in hand. That also means better calibration of the entire frequency range of the receiver without any further adjustments — once the receiver comes out of the test room!

You'll like the new bandspread scale on the RME 45. Not only are the 3.5 mc., 7 mc., 14 mc., 21 mc. and 28 mc. amateur bands calibrated — but the scale also carries arbitrary divisions from 0-100. These make logging on any frequency both easy and accurate.

Spread? There's plenty! The 20 meter band, for example, takes up three inches on the dial. The large knob turns 2¾ times and the small one turns nearly 14 times when tuning from 14,000 to 14,400 KC. You'll find that Cal-O-Matic tuning provides the maximum in mechanical and electrical efficiency!

The two speed dial and calibrated bandspread scale provide the maximum in mechanical and electrical efficiency!

View of the translucent calibrated bandspread scale.



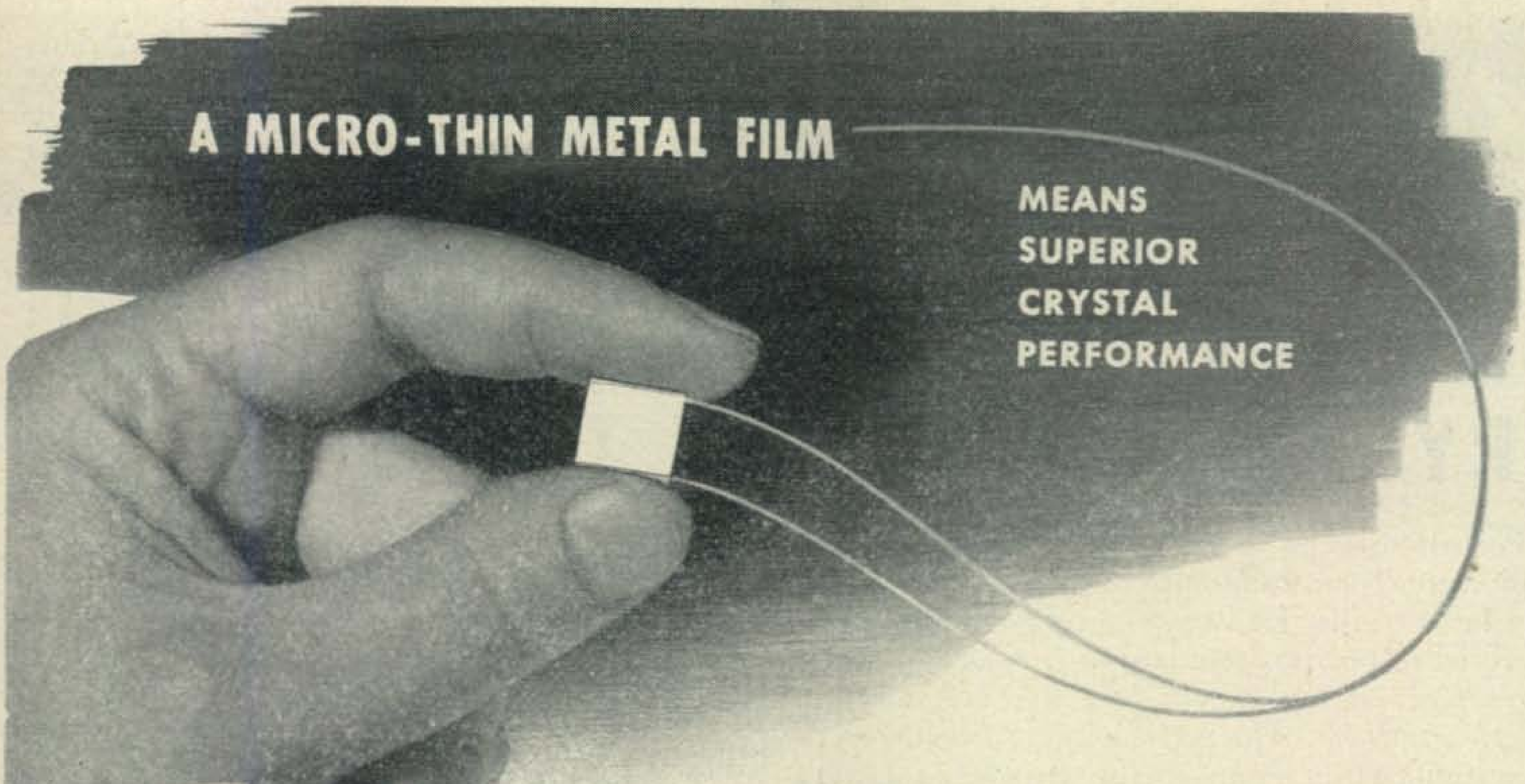
Specification Sheet on Request

TIME WILL TELL

RME FINE COMMUNICATIONS EQUIPMENT

RADIO MFG. ENGINEERS, INC.

Peoria 6, Illinois U. S. A.



First for amateur frequencies...

BLILEY TYPE AX2 PLATED CRYSTALS

We are justly proud of the technical accomplishments represented in the AX2 *plated* crystal. Its advanced development and pace-setting design again demonstrate Bliley's leadership in the manufacture of crystals for amateur frequencies.

Primary electrodes in the AX2 *plated* crystal unit consist of a micro-thin metal film which is deposited directly on the major surfaces of the quartz crystal by evaporation under high vacuum. This film exhibits extremely high adhesion to the crystal and can almost be considered as a chemical bond to the quartz. Since the crystal is chemically cleaned before plating the film provides a coating which protects the crystal surface against contamination.

Secondary electrodes, under spring pressure, are used to clamp the crystal in position and to provide a medium for thermal dissipation.

Under rigid comparative tests with unplated crystals, AX2 *plated* crystals show—

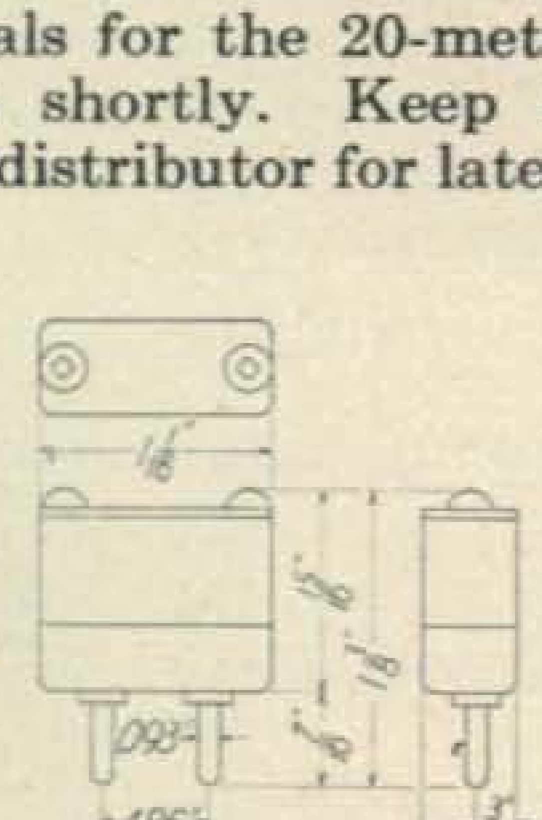
—better grid current stability over a wide temperature range.

—improved frequency stability under high drive conditions.

—substantial improvement in keying characteristics.

Type AX2 *plated* crystals, for the 40-meter band, are available now from your Bliley distributor—frequency selection from stock at $2.80 each. Prices and information on type AX2 *plated* crystals for the 20-meter band will be released shortly. Keep in touch with your Bliley distributor for latest information.

Bliley CRYSTALS



BLILEY ELECTRIC COMPANY, UNION STATION BUILDING, ERIE, PENNSYLVANIA, U. S. A.

TEMCO ANNOUNCES

A 75/100 Watt Sensatio

Series GA MULTI-FREQUENCY VFO and CRYSTAL PHONE—CW TRANSMITTER

For those who prefer and appreciate fine equipment Temco announces a new line of custom built quality transmitters designed and engineered to peerless standards—*featuring maximum frequency flexibility* and *unusual operational simplicity*. Unexcelled in craftsmanship, these units range from 75 to 750 watts *output* and operate within the 3.5, 7, 14, 21 and 28 megacycle amateur bands but are also available for operation on any five harmonically related bands for other forms of communication.

As a result of standardized engineering Temco has developed a basic 75/100 Watter which in itself provides a complete multifrequency radio telephone and telegraph unit. For power output ratings in excess of 75/100 watts, this basic unit serves as an exciter for a series of power amplifiers of 150 to 750 watts output.

No Additional Expense For Signal Shifting Unit

An exceptionally stable Variable Frequency Oscillator plus direct crystal control makes it *unnecessary to employ any external equipment* to obtain the frequency flexibility needed as greater channel congestion occurs.

The VFO tuning dial and final amplifier plate circuit adjustment dial *are the only tuning controls required throughout any one frequency band*. Changing from VFO to crystal control is accomplished from the front of the panel by a three position switch. The transmitter accommodates two crystal holders affording operation on two crystal controlled frequencies.

All Tuning Adjustments Are External

In changing frequencies it is only necessary to set the band switch—plug in the correct final amplifier coil unit—set the VFO dial to the desired frequency or select the desired crystal and tune the final amplifier plate circuit to resonance.

Thus when using crystal control the transmitter becomes a one dial unit inasmuch as *the crystal oscillator does not require any tuning whatsoever*.

For telegraph operation, break-in keying of the VFO and buffer stage is accomplished by the grid block method thus insuring distinctive clear-cut, clickless keying.

The speech amplifier input is designed to use a high impedance crystal or dynamic microphone. Three meters measure final amplifier grid and plate current and modulator plate current. Four separate power supplies are provided. All controls are at the front and the entire design permits ready accessibility to all components and provides for minimum space requirements so that the unit can be placed in any convenient location adjacent to receiving equipment.

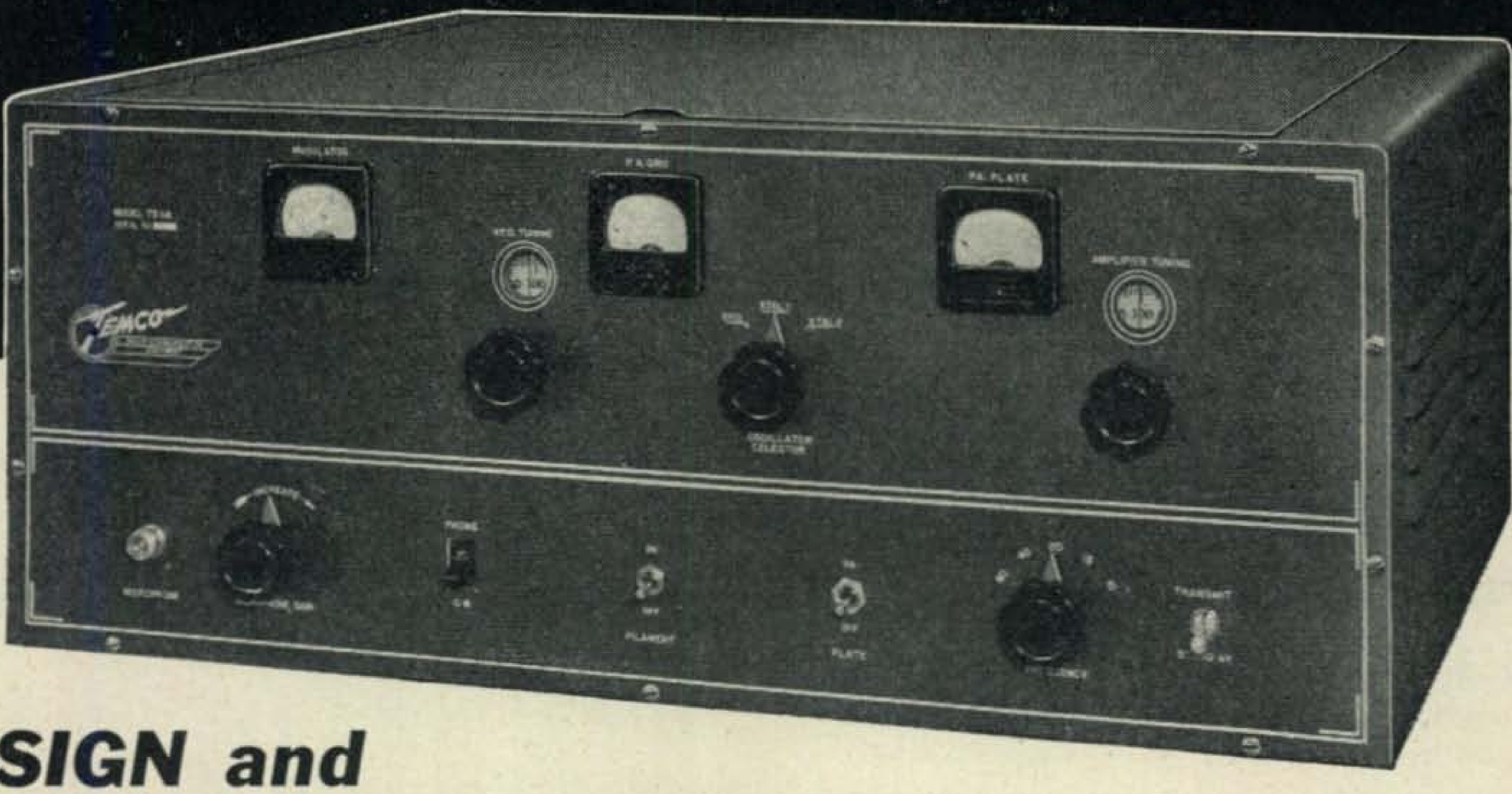
With Mike, Key and Antenna You're ON THE AIR

The Model 75/100 GA is designed to give a most conservatively rated power output of 100 watts on CW telegraphy and 75 watts on telephone. All Series GA transmitters are furnished *complete with one set of tubes and coils for five band operation*. In addition a built-in relay transfers antenna from transmitter to receiver. The only accessories needed are a microphone, telegraph key and antenna installation.

See your dealer for complete information or write directly to Temco.

TEMCO
RADIO COMMUNICATION EQUIPMENT

TRANSMITTER EQUIPMEN
MANUFACTURING COMPANY, INC.
345 Hudson St. • New York 14, N. Y



DESIGN and ENGINEERING FEATURES

Rated Output Power: 75 watts on radio telephone—100 watts on radio telegraph.

Frequency Range: 3.5—7—14—21—28 m.c. amateur bands. (Other harmonically related bands within the range of 2 to 30 m.c. can be supplied on special order.)

Type of Modulation: High level Class AB_2.

Modulation Capabilities: 100%.

Emission: A-1 and A-3.

Input Level: From high impedance crystal or dynamic microphone, level of approximately—55 db.

Audio Frequency Response: ± 2 db from 200 to 6000 c.p.s.

Noise Level: —45 db below 100% modulation.

Audio Distortion: Less than 8% at 85% modulation.

Frequency Control: Variable frequency oscillator or crystal control with positions for two crystals.

Front of Panel Controls: VFO dial—Final amplifier tuning dial—VFO or crystal selector switch—Exciter band selector switch—Audio gain control—Filament power switch—Plate power switch—Transmit-standby switch—Phone—CW switch.

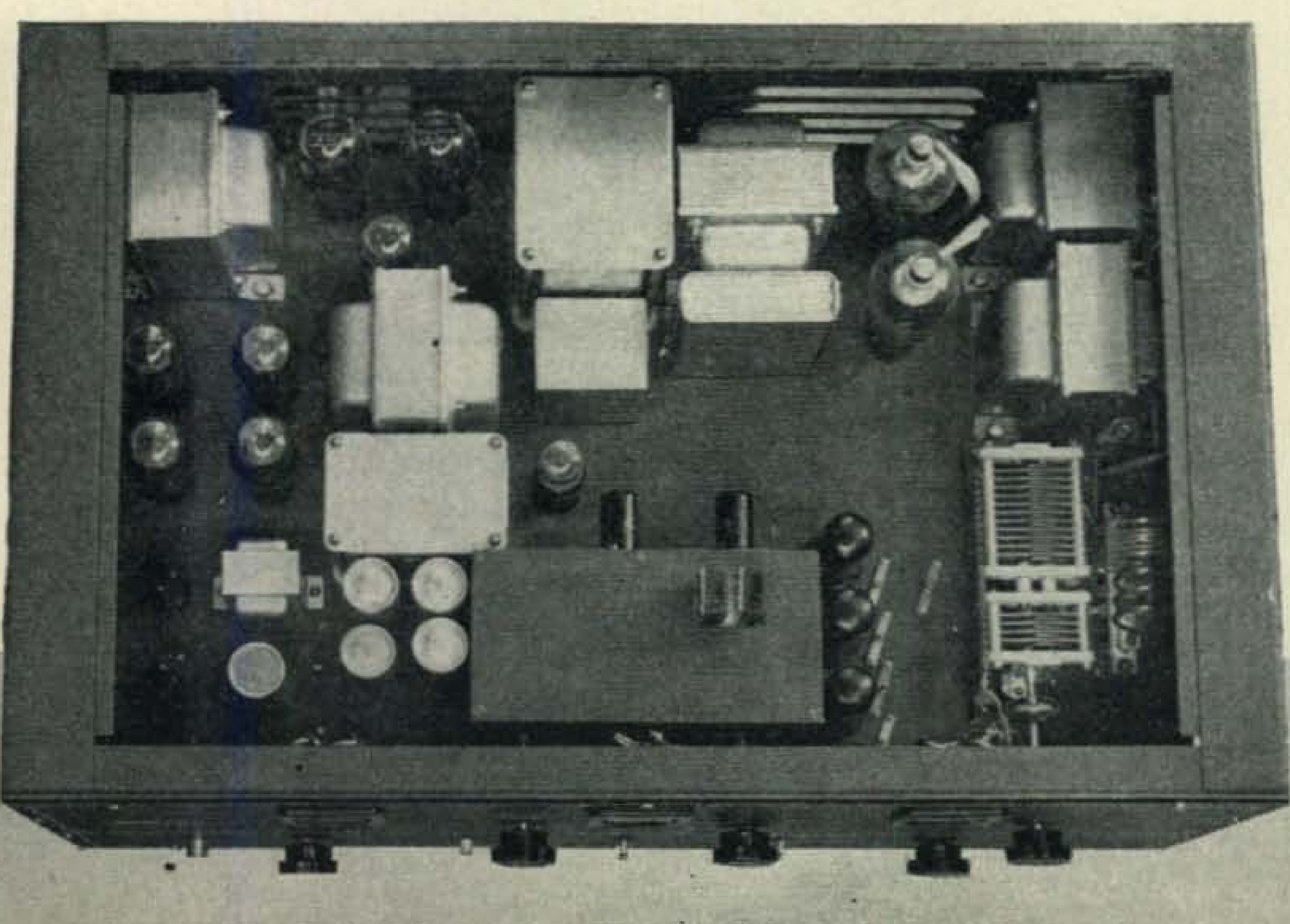
Metering: PA grid current—PA plate current—Modulator Plate current.

Tube Complement:

Type	Function
1—6J5	VFO
1—6AC7	Class A amplifier or crystal oscillator
1—6L6	3.5 m.c. buffer or 7 m.c. doubler
1—6L6	14 m.c. doubler
1—6L6	21 m.c. tripler
1—6L6	28 m.c. doubler
1—814	Final amplifier
4—6L6s	Class AB_2 modulators
1—6J5	Modulator driver
1—6SJ7	Speech input
2—866	High voltage rectifier
2—5Z3	Low voltage rectifier
1—80	Low voltage rectifier

Power Consumption: Approximately 400 watts.

Power Factor: Approximately 90%.



Measurements: Approximately 29" wide, 20" deep, 13" high.

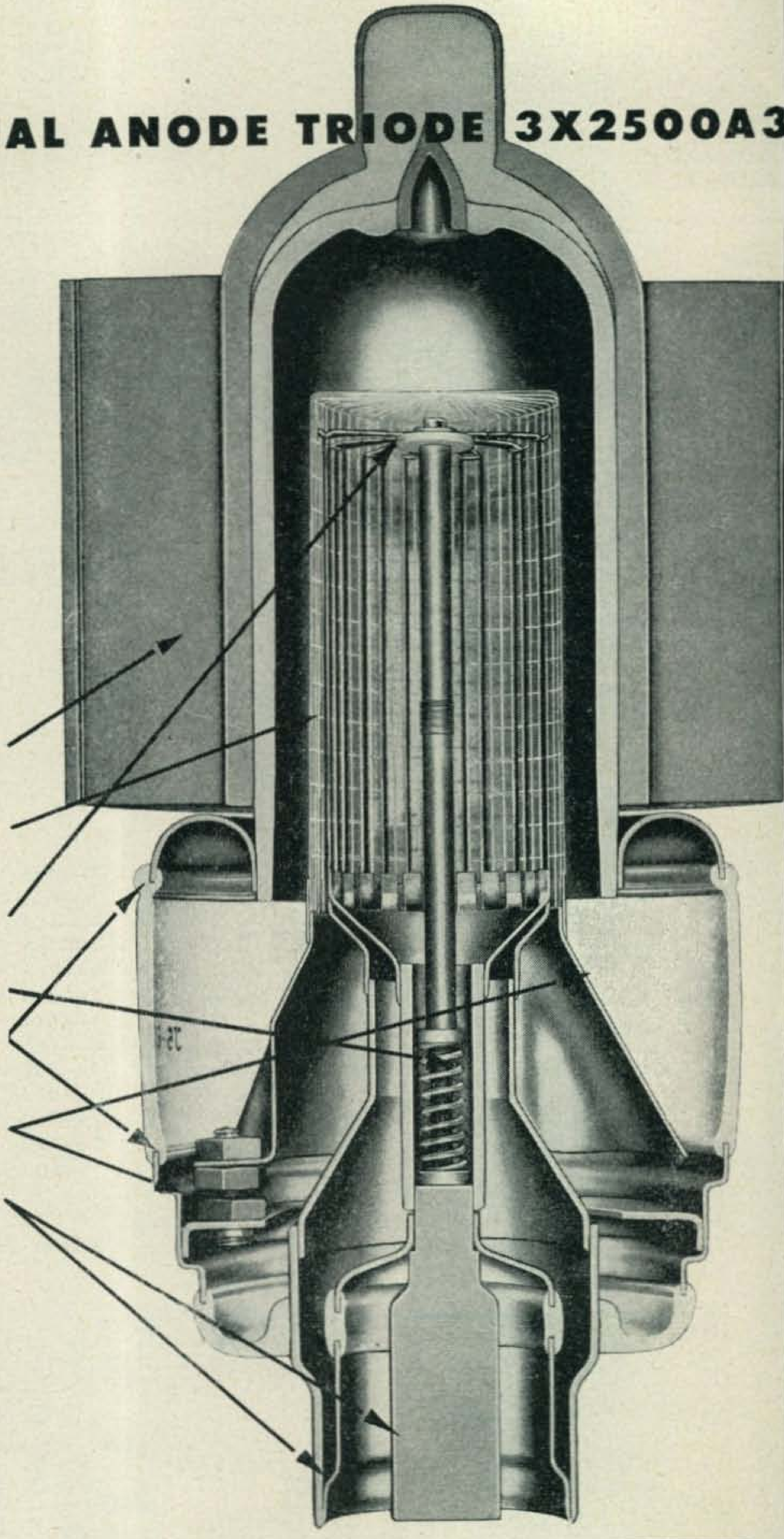
Power Source: 110-115 volts 50/60 cycles AC.

DEALERS

...interested in carrying this line of custom built quality Temco Series GA Transmitters are invited to write for details of this interesting franchise. Several excellent territories still open to live wire merchandisers.

Eimac TUBES — THE COUNTERSIGN OF DEPENDABILITY IN ANY ELECTRONIC EQUIPMENT

NEW EIMAC EXTERNAL ANODE TRIODE 3X2500A3



Rugged mechanical construction
Outstanding electrical efficiency

In the new 3X2500A3, Eimac engineers have developed a highly efficient external anode triode which, in Class C service, delivers up to 5 KW output at a plate voltage of only 3,500 volts. The mechanical design is radically simple, incorporating a "clean construction" which gives short, low inductance heavy current connections that become an integral part of the external circuits at the higher frequencies.

The external anode, conservatively rated at 2500 watts dissipation, has enclosed fins so as to facilitate the required forced air cooling.

Non-emitting vertical bar grid does not cause anode shadows ordinarily created by heavy supports in the grid structure.

Thoriated tungsten filament. Note unusually large filament area, and close spacing.

Filament alignment is maintained throughout life of the tube by special Eimac tensioning method.

New glass-to-metal seals do not have the RF resistance common to iron alloy seals, nor the mechanical weaknesses of the feather-edged types.

Grid ring terminal mounts a cone grid support which acts as a shield between plate and filament.

A coaxial filament stem structure forms the base of the tube. This makes possible proper connections to the filament lines.

Grid and filament terminal arrangements make it possible to install or remove the 3X2500A3 without the aid of tools.

The new mechanical and electrical features of the Eimac 3X2500A3 external anode triode make it valuable for use on the VHF as well as low frequencies. More complete data and information yours for the asking.

FOLLOW THE LEADERS TO

Eimac TUBES REG. U. S. PAT. OFF.

EITEL-McCULLOUGH, Inc., 1123-N San Mateo Avenue, San Bruno, Calif.

Plants located at: San Bruno, Calif. and Salt Lake City, Utah

Export Agents: Frazar and Hansen, 301 Clay St., San Francisco 11, Calif., U.S.A

TYPE 3X2500A3 — MEDIUM MU TRIODE

ELECTRICAL CHARACTERISTICS

Filament: Thoriated Tungsten	
Voltage	7.5 volts
Current	48 amperes
Amplification Factor (Average) 20	
Direct Interelectrode Capacitances (Average)	
Grid Plate	20 μμfd.
Grid Filament	48 μμfd.
Plate Filament	1.2 μμfd.
Transconductance (i_B=830 ma., E_B=3000 v.)	20,000 μmhos

1123

CQ
The Radio Amateurs' Journal

JOHN H. POTTS, *Editor* SANFORD R. COWAN, *Publisher*

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Vol. 2 No. 4 **APRIL, 1946**

COVER

The Lazy Kilowatt. PP Eimac 4-250A tetrodes in a novel final amplifier built around the B&W CX variable capacitor and HDL coils, which will loaf along at a full kw on c.w. or phone. The driver is a single 807. A complete description of the transmitter will appear in a forthcoming issue of *CQ.*

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SILVER "VOMAX"

Of construction and quality unmatched by meters selling at far higher prices . . . giving performance exceeding that of three separate instruments costing nearly four times its price . . . it is no wonder we are told that "VOMAX" is today the standard of comparison.

"VOMAX" is new . . . different . . . and outstandingly superior . . . because it is a brand new post-war v.t.v.m. . . . and truly universal. With "VOMAX" you can measure every voltage required in radio servicing . . . even in the design laboratory. Not only does it enable you to measure d.c. and a.c. voltage at meter resistance so high as not to effect the circuit being measured, but "VOMAX" at last lets you measure a.f. and r.f. voltages from 20 cycles to over 100 megacycles . . . resistance from .2 ohms through 2,000 megohms is "duck soup" with "VOMAX" . . . as is direct current from 50 microamperes through 12 amperes.

Add to all this new visual dynamic signal tracing . . . direct measurement of every voltage from receiver antenna to speaker voice coil . . . and you know why many government departments, serious industrial, radio engineering, university research laboratories . . . and service technicians by the thousands clamor for "VOMAX".

"VOMAX" makes you the master, no longer the victim, of tough service problems. Your favorite jobber . . . among nearly 500 progressive SILVER distributors all over the country . . . can give you prompt delivery from his regular monthly allotment . . . if you order now . . for only $59.85 Net.

ADVANCE ANNOUNCEMENT—Model 904 Capacitance—Resistance Bridge will go into production in April. With ±3% accuracy over the tremendous range of a fraction of one mmfd/ohms through One Thousand mfd/megohms. Model 904 at last gives the serious service technician laboratory accuracy and range—in the new, post-war instrument matching "VOMAX" for only $49.90.

OVER 35 YEARS OF RADIO ENGINEERING ACHIEVEMENT

McMurdo Silver Company

1240 MAIN STREET, HARTFORD 3, CONNECTICUT

"The Standard of Comparison"

Measures EVERY Voltage

1. Brand new post-war design . . . positively not a "warmed-over" pre-war model.
2. More than an "electronic" voltmeter, VOMAX is a true vacuum tube voltmeter in every voltage resistance db. function.
3. Complete visual signal tracing from 20 cycles through over 100 megacycles by withdrawable r.f. diode probe.
4. 3 through 1200 volts d.c. full scale in 6 ranges at 51. and in 6 added ranges to 3000 volts at 126 megohms input resistance. Plus-minus polarity reversing switch.
5. 3 through 1200 volts a.c. full scale in 6 ranges at honest effective circuit loading of 6.6 megohms and 8 mmfd.
6. 0.2 through 2000 megohms in six easily read ranges.
7. − 10 through + 50 db. (0 db. = 1 mw. in 600 ohms) in 3 ranges.
8. 1.2 ma through 12 amperes full scale in 6 d.c. ranges.
9. Absolutely stable—one zero adjustment sets all ranges. No probe shorting to set a meaningless zero which shifts as soon as probes are separated. Grid current errors completely eliminated.
10. Honest, factual accuracy: ± 3% on d.c., ± 5% on a.c., 20 ∾ through 100 megacycles, ± 2% of full scale, ± 1% of indicated resistance value.
11. Only five color-differentiated scales on 4⅞" D'Arsonval meter for 51 ranges (including d.c. volts polarity reversal) eliminate confusion.
12. Meter 100% protected against overload burnout on volts ohms db.
13. Substantial leather carrying handle. Size only 12⅜" x 7⅜" x 5⅝".

Send postcard for free catalog of measurement and communication equipment.

. . . Zero Bias . . .

Latest frequency information at press time . . . April 1st, in the continental United States only, the frequencies 3700 to 4000 kc are open for c.w. work. 3900 to 4000 kc may be u°ed for phone if the station has a Class A license and is operated and controlled by a Class A operator. Effective at this time, 27,185 to 27,455 kc is authorized for amateur use for AQ, A1, A2, A3, A4, and FM voice and telegraph. By the provision for AQ unmodulated carrier this becomes the only band below 144 mc on which amateurs may employ duplex voice work. 235 to 240 mc is open to all amateurs in the U.S. and Canada for A1, A2, A3, A4, and FM, c.w. and phone. Effective April 1, in Canada only, the whole band 3500 to 4000 kc is opened, power limited to 50 watts in 3500 to 3700 kc portion and provided no interference is caused U.S. military services. Phone permitted only between 3900 and 4000 kc until U.S. releases whole band, at which time 3850 to 4000 kc phone will be authorized VE's.

On the evening of February 19th, 1946, Norman Corwin, radio writer and producer, was awarded the "One World" trip around the world for his contributions to the ideals of international unity as visualized by the late Wendell Willkie. The award is patterned after Willkie's globe-circling flight which inspired his now famous book "One World". Mr. Corwin is not a ham—in fact in his profession he might resent the application of the term—but the idea of one world is of interest and concern to every radio ham.

Perhaps in the not too distant future some proud DX man will be the recipient of the Willkie around-the-world ambassadorship. Perhaps one day some persistent and ambitious ham will circle the globe as the representative of the people of the United States. With all the talk about speed of travel and the shortened distances in an air age no means of communication approaches the speed of radio waves. The radio world is truly small!

Hams—both old and new—who so ably assisted in winning the war aboard ships, in the foxholes, in planes, and in war plants, wherever radiomen were needed, now have the opportunity to continue their service to help gain and hold the peace for all the world.

On what more common ground can man meet man than that of common interest? On what more common basis of friendship can man meet man than in actual two-way communications? In what better fashion can man seek man than that of a QSO from home to home?

To encourage amateur radio is to encourage better international relations and understanding. Already hams from all over the world are in daily communication. Additional international communication frequencies for the amateur may pay dividends of incalculable value to everyone. Technical achievements and service to their community, today the most important activities of the ham, might become insignificant if hams are able to contribute toward creating one world, for it may well be one world or none.

BCL Complaints

A local ham on 10-meter phone received several BCL complaints of interference. Nothing unusual in this by itself, but the neighbors of this amateur tore down his beam and intimidated his family. With the housing shortage what it is he had no alternative but to get off the air. Though over five weeks have passed since his rig was dismantled, he still receives BCL complaints from tenants in the apartment building. The point is that these people *are* receiving interference in their broadcast sets, but it isn't from any ham.

With the start of volume production on household switches, automobiles, oil burners, and electrical appliances of all types, the subject of eliminating radio interference produced by them is very timely. Now is the ideal time to have all manufacturers fix their products so they will not cause radio interference. As a move initiated by hams it might soon run into rough sailing, but on behalf of broadcast listeners, short-wave listeners, FM and television users, *and* the ham, it might gain considerable support. National legislation which would forbid the sale in interstate commerce of automobiles and electrical appliances which cause radio interference is not too much to hope for. The slight additional cost to the manufacturer could be passed on to the consumer who is, after all, the ultimate beneficiary of such a program.

Promoting such a piece of legislation is not a simple task, but the amateurs represent a tremendous group of consumers who are well equipped technically to make the first step. Through the RMA Amateur Committee, by pressure on public officials, and through a vigorous campaign in local papers by individual amateurs and radio clubs, freeing the air from much radio interference might soon be a reality.

Already a Big Success!

TAYLOR TB-35

BEAM TETRODE

The Wizard Tube!

ACTUAL SIZE

$10.00

FOR SALE AT ALL LEADING RADIO PARTS DISTRIBUTORS

- ***35 Watts Plate Dissipation***
- ***Tantalum Plate and Grids***
- ***No Neutralization***
- ***Easy Drive***
- ***Nonex Glass***

FREQUENCY LIMITS

Full Input	250 MC
Half Power	400 MC

GENERAL CHARACTERISTICS

Fil. 6.3. Volts (Thoriated Tungsten)	2.75 Amps.
Amplification Factor	65
Mutual Conductance	2750
Grid to Plate Capacity	.2 MMF
Input Capacity	6.5 MMF
Output Capacity	1.8 MMF

4 Prong UX Base—Plate Lead at Top
Size: 4-7/8″ by 1-5/8″ Maximum

TYPICAL OPERATION

D.C. Plate Volts	1500
D.C. Plate Current	110 MA
D.C. Control Grid Volts	— 300
D.C. Control Grid Current	15 MA
D.C. Screen Grid Volts	375
D.C. Screen Grid Current	22 MA
Driving Power	4.5 Watts
Power Output	130 Watts

Write for Complete Technical Data Bulletin

Taylor HEAVY CUSTOM BUILT DUTY Tubes

TAYLOR TUBES INC., 2312-18 WABANSIA AVE., CHICAGO 47, ILL.

Narrow Band

FM TRANSMITTER FOR 10

R-F exciter and amplifier showing layout of low voltage power supply, exciter coils, and final amplifier

A highly successful 360 watt FM transmitter

JACK J. BABKES, W2GDG

The NARROW BAND FM transmitter described in this article is designed for the amateur who wants to get the most for his money. It is based on a discussion printed in March *CQ* of several simple methods of producing narrow band FM, and how to maintain frequency control. The complete transmitter is housed in an enclosed rack measuring 43¼ x 22 x 18 inches. Standard components are used throughout. Without the FM feature the transmitter is a well built medium power c.w. rig.

Circuit Design

The transmitter starts out with a 7F7 speech amplifier resistance coupled to the 7C7 reactance modulator. The oscillator is a 7V7 electron coupled oscillator operating with its grid circuit on 80 meters and doubling to 40 meters in the plate. It will be noticed in the schematic *Fig. 1*, that the suppressor is tied directly to B+. It was found that by using this arrangement, the plate circuit did not "pull" the grid circuit as much as that experienced in the conventional type of ECO. The 7V7 drives a 7C5 which is used as doubler to 20 meters. The first 7C5 feeds another 7C5 that doubles to 10 meters and drives the 813 final.

The automatic frequency control network starts off with a 7J7 used as a mixer and feeding the 7A6 discriminator. A small amount of r.f. is taken from the oscillator and is fed to the 7J7 mixer. This produces a beat frequency with the crystal oscillator. The output voltage from the 7A6 discriminator is then filtered and fed to the reactance tube. The audio component is tapped off from the discriminator and is resistance coupled to the 7A4 tube which feeds the deviation meter and monitor jack for the head set.

A 5U4-G tube is used for the low voltage audio power supply, the reactance modulator, and the r-f exciter. The 5U4-G also furnishes the 813 final with screen voltage. A pair of 5R4-GY tubes is used for the high voltage power supply. In the author's transmitter there are 10 indicating meters. The builder, however, may omit most of them and use only what is actually essential. For example, a 0-50 milliammeter may be connected to a plug and a jack be used in the various r-f circuits. The only additional meters required are a 200 microammeter with a zero center for the automatic frequency control circuit and a rectifier type voltmeter having a 1,000 ohms per volt resistance for the deviation meter. As shown in the schematic, there are 500 ohm ½ watt resistors connected across each meter in the oscillator and the two 7C5 doubler stages. This provides a method for return when the meters are disconnected. There is one socket, which is the outlet for the exciter meters, and an additional six prong socket for the 813 final and voltage meters.

Construction

The entire r-f unit, final amplifier, speech and modulator sections and the low voltage power supply are mounted on a standard

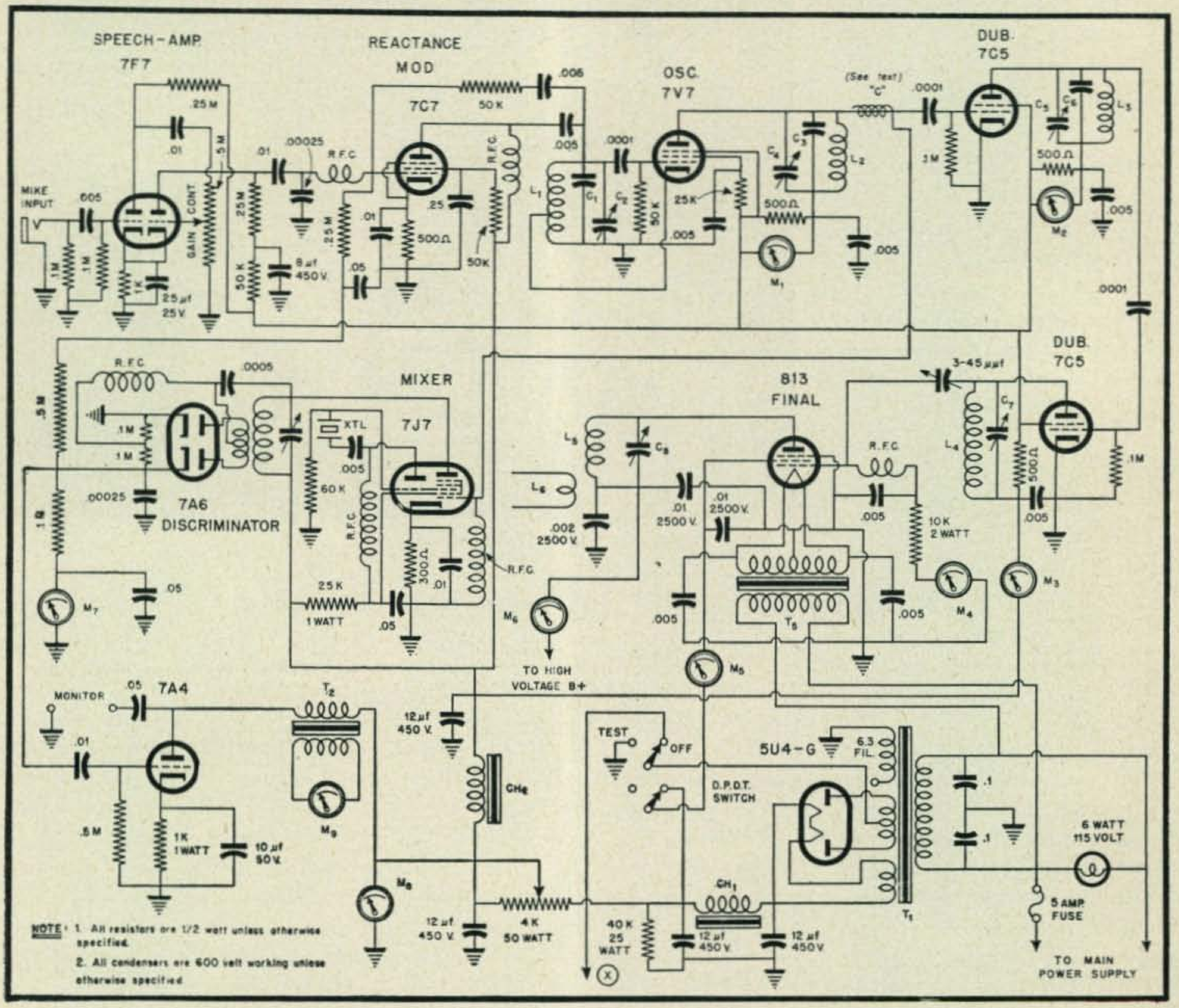


Fig. 1. Circuit diagram of FM transmitter. Parts used are as follows–

C1—.0001 silver mica 2.5%

C2, C4, C5, C7 to 50 $\mu\mu$f variable, Hammarlund APC-50 or equivalent.

C3—.0001 mica

C6—.00005 mica

C8—9-37 $\mu\mu$f, Millen #12936 or equivalent.

T1—Low voltage power transformer—350 volts each side of center tap at 145 mils—5 volt at 3 amps, 6.3 volts at 4.5 amps, Thordarson T—70R62 or equivalent.

T2—3 to 1 audio interstage transformer, Thordarson T—14A92 or equivalent.

T3—High voltage power transformer 1600 volts each side of center tap at 200 mils.

T4—10 volt 5 amp filament transformer, Thordarson T-19F95 or equivalent.

T5—10 volt 8 amp filament transformer with center tap, Thordarson T-64-F14 or equivalent.

L1—32 turns #24 enamel wire close-spaced on ¾" O. D. polystyrene form tapped at the 12th turn from ground end.

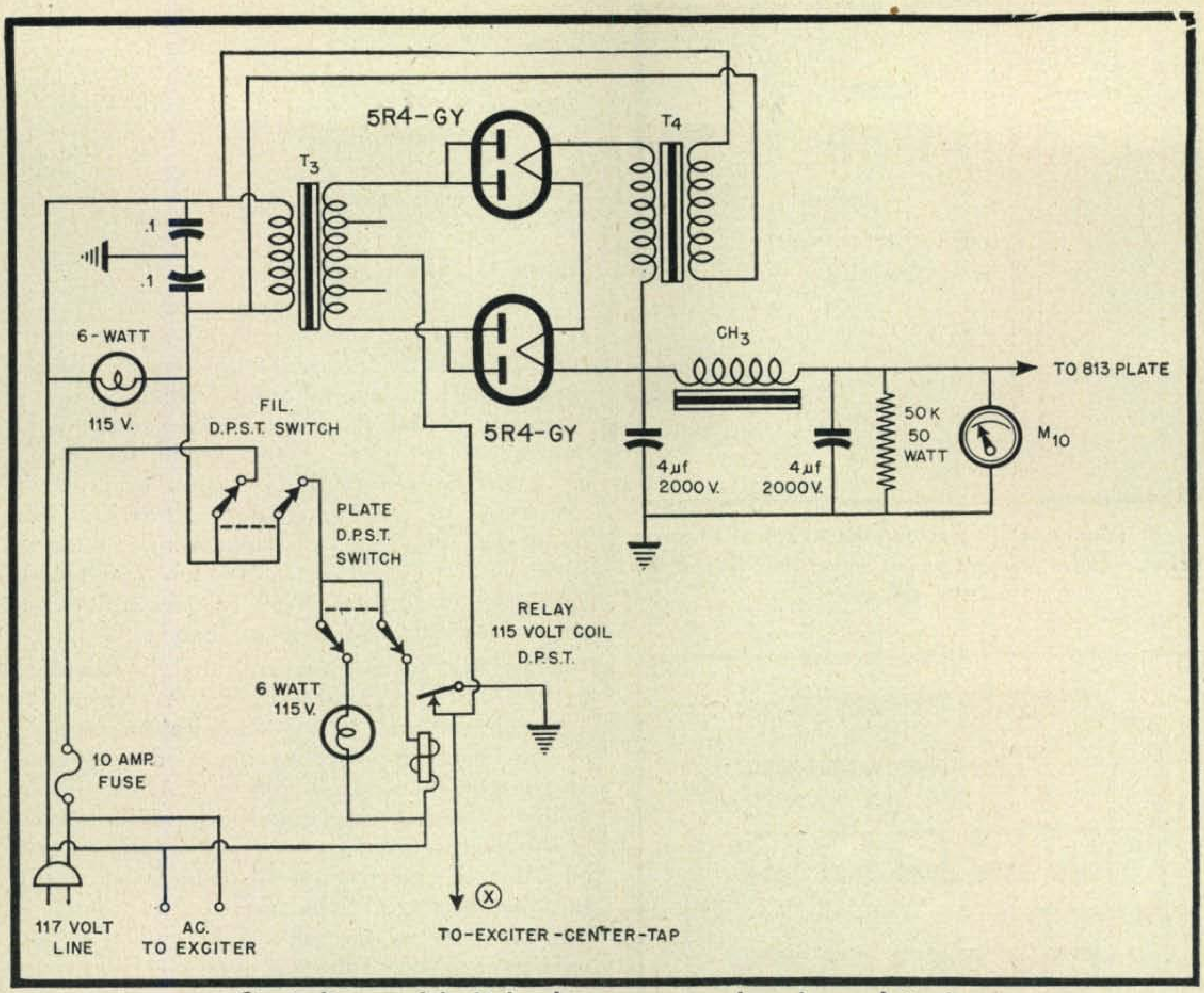
L2—28 turns of #24 enamel wire spaced to occupy 1½" on a ½" O. D. polystyrene rod.

L3—13 turns of #24 enamel wire spaced to occupy ¾" on a ½" O. D. polystyrene rod.

L4—9 turns of #20 enamel wire spaced to occupy 1" on a ½" O. D. polystyrene rod.

L5—4 turns of #8 copper wire spaced to occupy 3".

L6—Link to match transmission line. See Text.



Circuit diagram of the high voltage power supply and control circuits

heavy duty chassis measuring 17″ x 13″ x 3″ The r-f exciter coils are mounted in i-f cans measuring 4″ x 1 7/8″ x 1 3/8″ and may be obtained from almost any radio supply house. This type of construction permits short leads and eliminates the trouble of mounting variable capacitors all over the chassis.

Capacitor *C* is a piece of hook-up wire twisted around the 7V7 oscillator plate lead five to six times. All coils are wound on ½″ polystyrene coil forms and coated with polystyrene coil dope. The small variable capacitors are supported with #12 bus bar, mounted inside the can and locked from the top with #4-40 binding head machine screws. The chassis is drilled for ¼″ holes, fitted with rubber grommets through which the leads from the coil assembly feed through to their respective terminals.

All coils except the 7C5 doubler ten-meter plate coil are mounted in the i-f cans. The 7C5 doubler coil is mounted alongside of the variable capacitor between the 7C5 tube and the 813 tube socket. The automatic frequency control discriminator transformer is a standard broadcast i-f with a center tapped secondary and capable of tuning to 270 kc. With reference to *Fig. 1* again, it will be noted that a 500 $\mu\mu$f capacitor is connected from the center tap of the secondary to the plate lead on the primary. This capacitor is mounted inside the discriminator transformer assembly. The socket for the 813 final tube is recessed below the chassis, supported on four brackets made of aluminum or any other suitable material measuring 1¾″ long by 3/8″ wide and having two ½″ long bends, as shown in *Fig. 2*. The associated bypass condensers that make up the final amplifier circuit should be arranged as shown in the photos. This is very important if the 813 is to operate normally. No neutralization is required if this layout is followed.

The variable condenser for the final amplifier is mounted on four polystyrene rods which are drilled and tapped for #6-32 screws at both ends. These standoffs are made from ½″ O. D. stock and each is 4″ long. Directly behind this variable capacitor is mounted a small feed-through insulator which carries the high voltage B+ to the rotor. In addition there is a .002 μf, 2,500 volt (working) capacitor con-

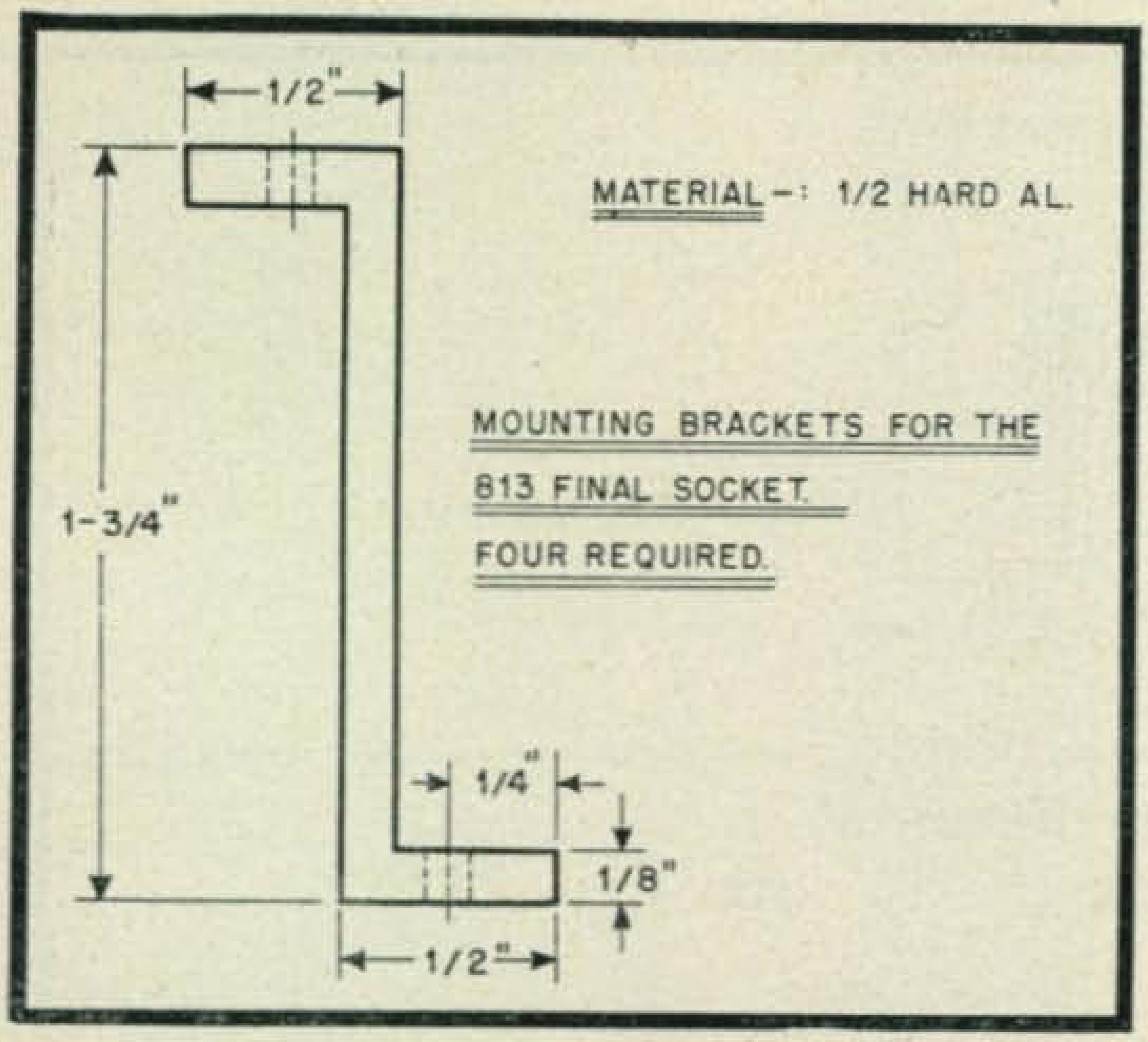
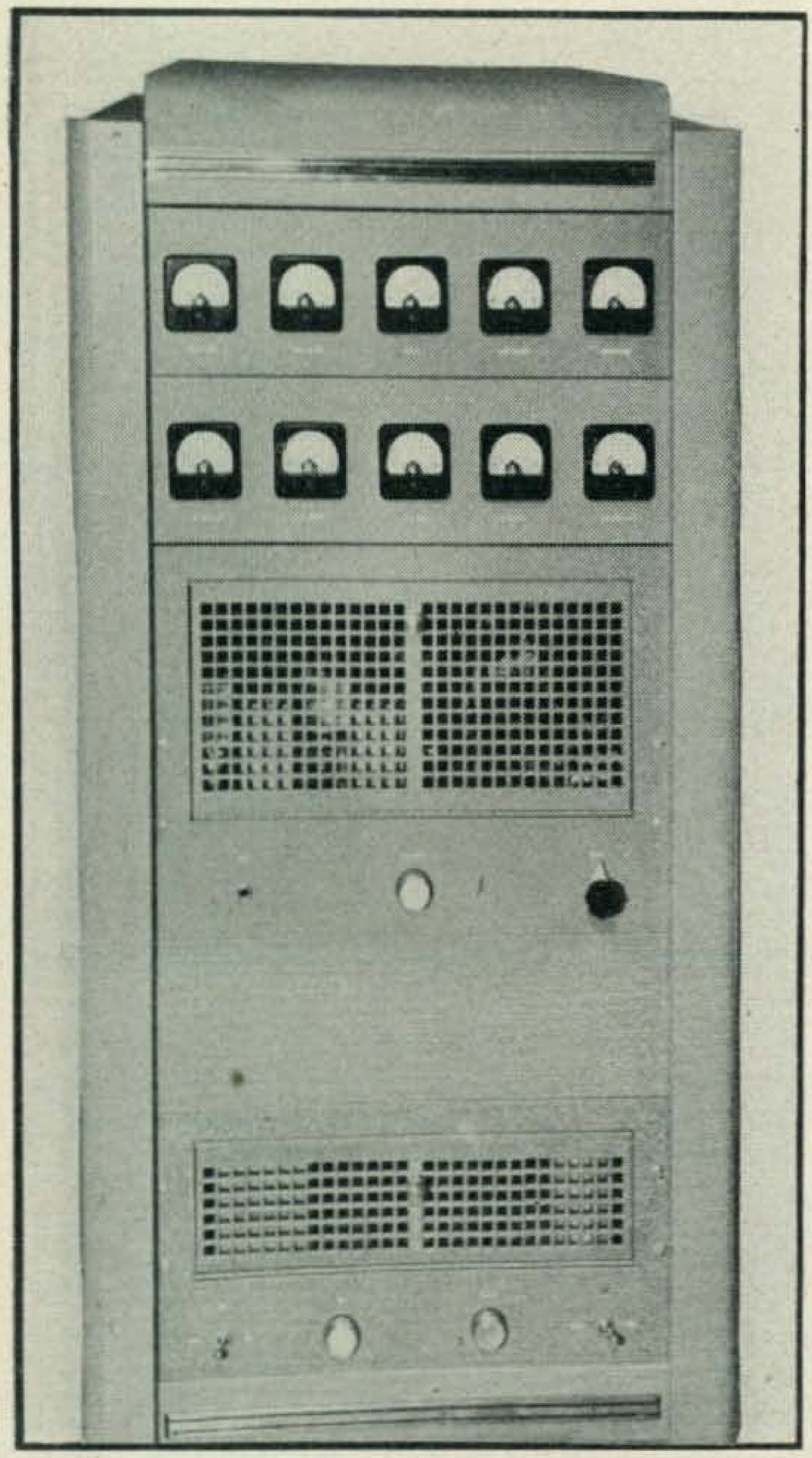


Fig. 2. Mounting brackets for the 813 final amplifier socket. These brackets permit good shielding of the final tubes



Complete transmitter is rack and panel mounted. Hinged front panel doors permit access to tuning Controls and tubes from the front of rack

nected from the rotor to a solde. lug. If desired, a plug-in coil arrangement may be substituted to facilitate multi-band operation. The high voltage supply is the familiar brute force system, built on a heavy duty chassis measuring 17″ x 11″ x 2″. All power connections between units are made with standard plugs.

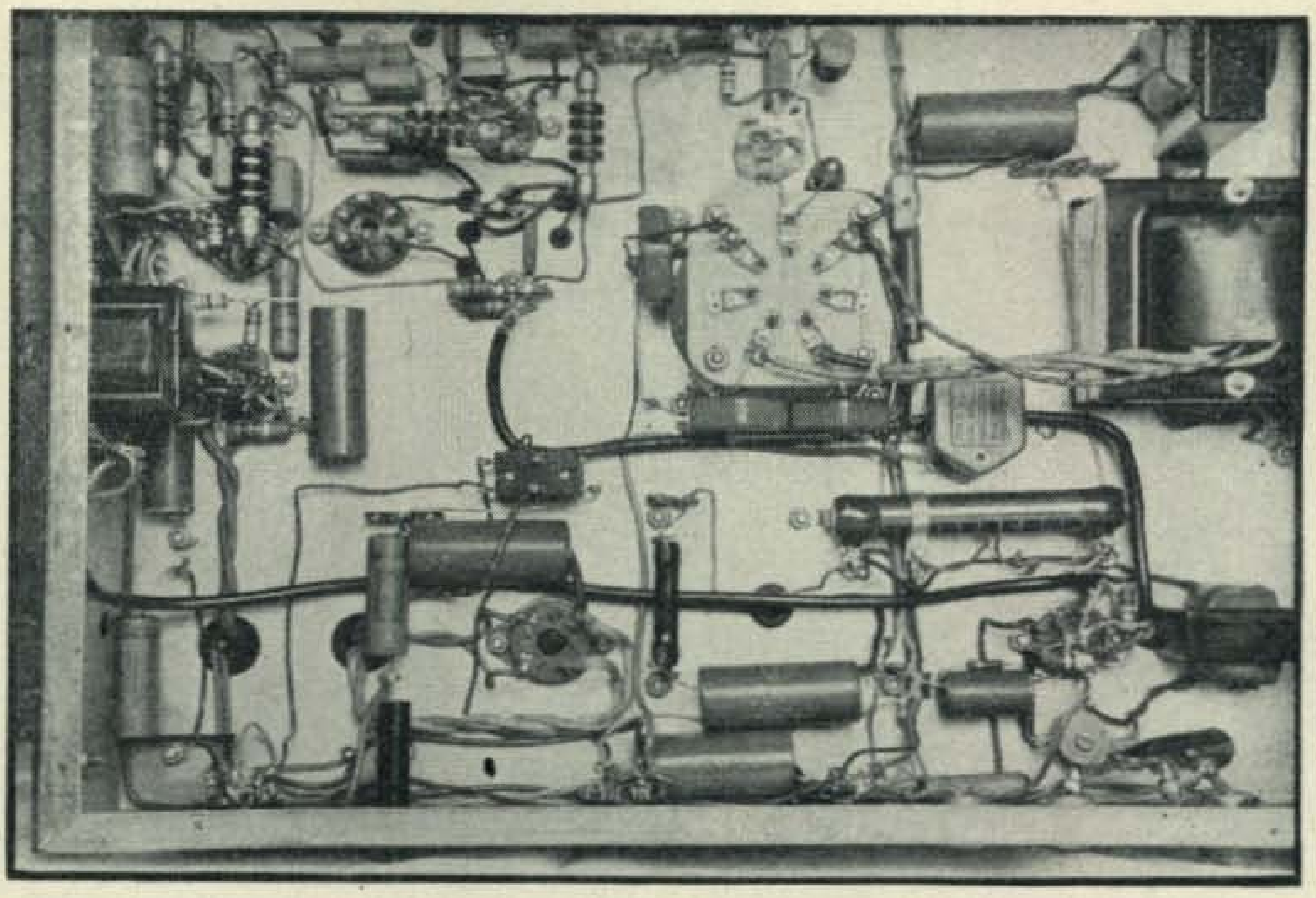
Tuning Up The Transmitter

After having checked the transmitter for any possible flaws and shorts, put all tubes in except the 813 final and the 5R4-GY rectifier tubes. Next, select a crystal which added to the frequency of the discriminator transformer and doubled to 10 meters falls within the limits of 28,950 kc and 29,700 kc. For example, if we decide to use a crystal of 7,010 kc., this frequency plus the discriminator frequency, which is 270 kc, equals 7,280 kc. The fourth harmonic of this frequency equals 29,120 kc, which is within the 10-meter band

The only test equipment that is required to check the performance of the transmitter is a conventional AM communication receiver and an audio oscillator having good waveform. Disconnect the output of the AFC system from the reactance tube and connect the return of this grid to ground. Keeping the gain control off, tune the receiver on 40 meters and adjust the oscillator grid condenser until a beat is heard. This is the second harmonic of the oscillator. Now, tune the oscillator plate circuit for a minimum dip, which should be very distinct, showing resonance. It will be noticed that when first bringing the plate circuit to resonance, a slight shift in frequency will occur. This should be corrected by readjusting the Ogrid circuit. nce this is done, there will be practically no shift when adjusting the plate circuit again.

The 7C5 doublers are tuned up in the conventional manner. Next, plug in the crystal and observe the zero center microammeter. It will be found that by adjusting the secondary trimmers, it is possible to cause the meter to deflect on either side of zero center. If the meter should read more on one side than the other, the primary should be adjusted to produce a reasonable average reading on either side. Then adjust the secondary trimmer until the meter reads zero indicating resonance of the transformer and zero output voltage. If, on the other hand, a zero center microammeter is not available, a substitute method may be used.

Plug a pair of head phones into the monitor jack and adjust the secondary for maximum volume, that is, set the gain control about one third the way open, and either feed in an audio signal from the audio oscillator or



Bottom view of r-f chassis showing layout of components. For maximum efficiency this plan should be carefully duplicated

speak into the mike. Then adjust the primary on the discriminator to see if the quality is "clean cut". Connect back the reactance modulator to the discriminator output and slowly adjust the oscillator grid condenser following the signal with the receiver. It will be noted that if the polarity is correct, very little change in frequency will be obtained. Should the polarity be reversed, the signal will jump to another frequency. If this happens, simply reverse the leads from the 7A6 cathode or the leads to the plates, whichever is easier. Another method of checking to see how the AFC is working, is to place your hand near the r-f choke in the plate circuit of the reactance modulator. There should be very little change in frequency.

Now, set the audio oscillator to approximately 1 kc and the audio gain control to a little less than one quarter the way open. Tune the receiver to ten meters (if the receiver has a bandwidth control, it should be set in the broad position). Observe the center frequency before applying any modulation. The gain control should be adjusted and the receiver detuned to one side of the carrier and the number of kilocycles off resonance should be noticed. Next, detune the receiver to the other side of the carrier and if the reactance tube is linear, it will be possible to receive with equal volume and clarity in tone on both sides. If this is not obtained it shows that the reactance tube is not linear, and by adjusting the cathode bias or screen voltage it will be found that a linear swing can be obtained. Since small changes in wiring capacity and layout affect the linearity of this type of modulation, it is essential to run this test.

At this stage, the microphone should be plugged in and the gain control adjusted to a point where either sideband occupies about 2 to 3 kc when modulating. Under these conditions the deviation meter may be calibrated to show under actual modulation what the percentage is, or the deviation. Next, place the 813 tube in its socket, but before applying plate voltage readjust the plate circuit in the ten meter 7C5 doubler stage. (This is to compensate for the input capacity of the 813.) Finally, at reduced plate voltage (around 700 to 800 volts) tune the 813 final to resonance. Caution: It is of the utmost importance never to operate this final at maximum plate voltage when there is no load attached so as to prevent permanent damage to the 813 screen. Once this is accomplished, hook up the antenna and increase the plate supply to its rated voltage.

A one turn link coil mounted alongside the plate coil is used for coupling to a 75 ohm coax cable. As various combinations of antennas and transmission lines may be used, no particular system is shown. It should be remembered that when shifting frequency the preceding stages should be tuned up carefully to prevent any cutting of sidebands at the output frequency. No difficulty should be encountered in getting this type of transmitter to function properly. The following is an actual set of meter readings taken under normal operating conditions:

Oscillator plate	5-7 ma
First 7C5 doubler	13.5 ma
Second 7C5 doubler	15 ma
813 grid current	6-7 ma
813 screen current	25 ma
813 plate current loaded	180 ma
Low voltage to all speech, modulator, and r-f exciter	225 volts
813 screen	340 volts
813 plate	1,800 volts

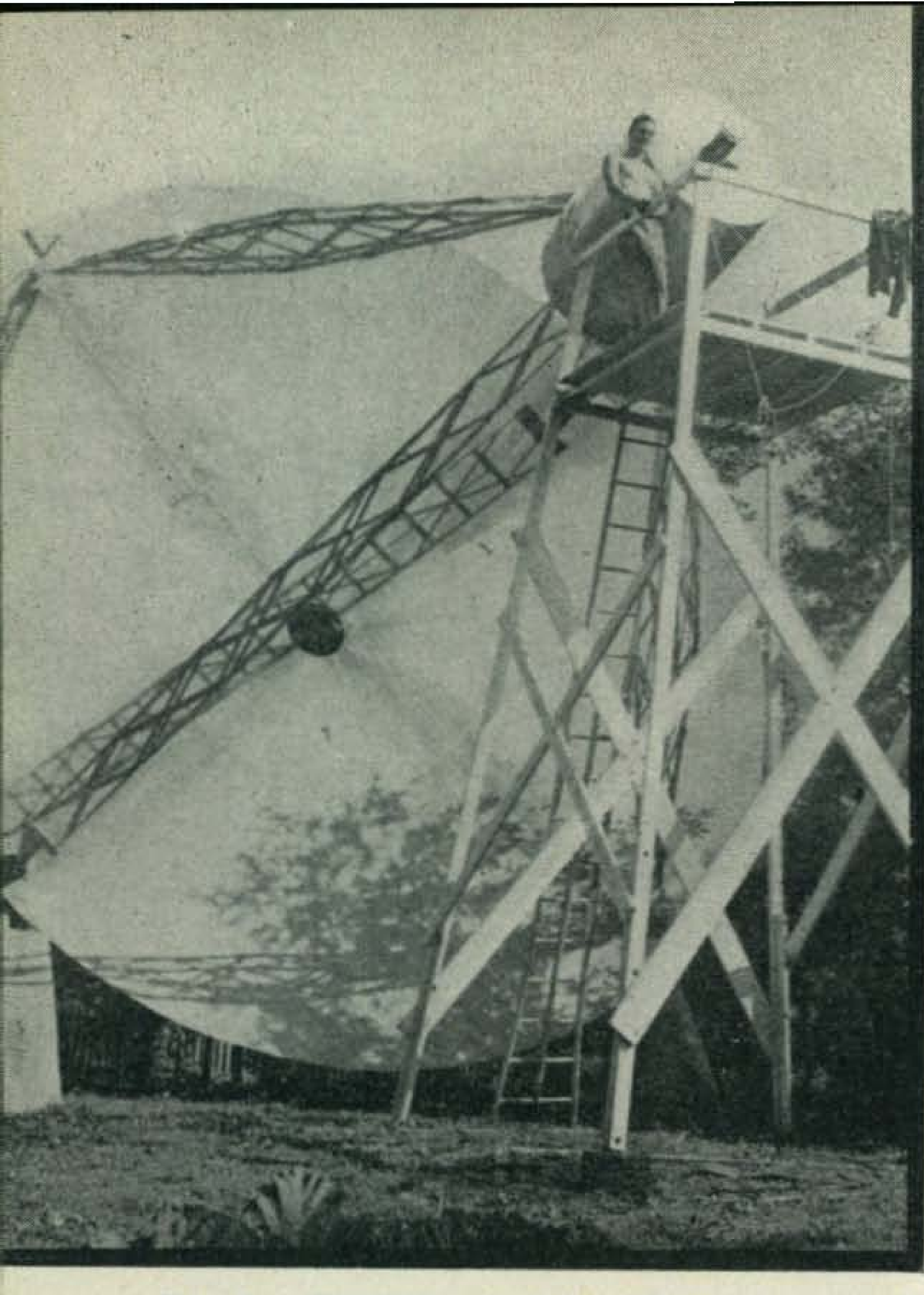


Fig. 3. W9GFZ's parabolic reflector measures 31 feet in diameter and has a focal length of 20 feet. The receiver is mounted in the oil can affair at focus

SUNSPOTS,

OLIVER PERRY FERRELL

SHOULD ANYONE ever be so inclined to attempt a bibliography of the original discoveries of the radio amateur, it would probably consume volumes. Actually, since the day of the inception of radio communication, practically every one of the important additions to our knowledge of the art and practice of radio, has had an amateur somewhere in the background. Although the majority of people forget the part amateurs have played and think only of the individual who has formulated the final words or the final theory, we earnestly hope that such will not be the case in the recent announcement of "solar-static."

Solar Static

Solar-static reached the international headlines for several days after the appearance on January 29 of the exceptionally large sunspot group on the eastern limb of the sun. Four days later a notably intense solar flare rose from the group and a synchronous radio fadeout occurred on all frequencies above 5.0 mc between 0400 and 0600 EST. The four day warning interval had permitted certain radio tests to be prepared and shortly before the radio fadeout the "hiss," or solar-static to the amateur, had appeared.

Those of us who weathered the early 5 and 10 meter DX days of 1935-36 can well remember G6DH, D. L. Heightman and the hiss. Winner of the Powditch 28-mc transmitting trophy, G6DH was a sparkplug in getting things going on 5 and 10. The radio receiver constantly patrolling between 10.0 mc and 60.0 mc had acquainted Heightman with just how things should sound to be normal skip or otherwise. Observing certain harmonics meant a good DX day for 10. Hearing the Berlin television transmitter on 7 meters indicated the possibility of a good DX session on 5. About the only phenomenon in these wavelengths that G6DH couldn't quite fit into the picture was the so-called hiss.

At first it was thought that the hiss was a sign of short-skip just around the corner. Then it seemed connected with the aurora, but finally, Heightman pinned it down to a strictly daylight phenomenon and a sign of a sudden fadeout of radio signals in the short wave bands. G6DH communicated his observations to Professor E. V. Appleton, the discoverer of the E region. Appleton studied them thoroughly and proposed a direct sunspot correlation (1).

Publication of the preliminary research note by Appleton started an avalanche of similar reports. J. S. Hey obtained permission from the British Air Ministry to publish some notes on the "hiss" which had occurred in 1942 (2). Hey stated that on the afternoon of February 26, 1942, British communications and radar CHL stations between 4 and 6 meters had been disturbed by an abnormally high static level. On the following day when the high hiss level persisted, high angle VHF radar equipment had taken azimuth and elevation angles which indicated that the hiss was definitely of solar origin.

Correlation of the radio frequency hiss and sunspots is also claimed as an Australian discovery. Scientists; Pawsey, Payne-Scott and McCready say restricted (JAN Confidential) reports of the solar hiss were filed by Australasian investigators in 1941 (3). In October 1945, these three radio physicists set up 40 half-wave dipoles with a plane reflector capable of being focused on the sun shortly after sunrise and shortly before sunset. With a 150-mc receiver having a noise

SOLAR AND COSMIC STATIC

Receiving and transmitting conditions are influenced by sunspots, solar and cosmic static. Understanding basic causes and results of this phenomena will not only increase operating efficiency, but can also further scientific investigations pioneered by hams

factor of 9 db and a square-law output meter, recordings of the hiss level agreed remarkably well with the total sunspot areas at that time.

Solar hiss radiation in the radio frequency spectrum is an unexpected, though not a complete surprise. Southworth of Bell Telephone Laboratories (4) had observed in the summer months of 1942 and 1943, a small but measurable amount of microwave energy coming directly from the sun. This energy which is something like thermal agitation, had appeared in the output of a conventional double-detection receiver working at centimeter wavelengths. The theory of the hiss is extremely complicated and involved, but generally unless the Planck formulas and quantum considerations are way off, the amplitude or field strength of the hiss should agree quite closely with accepted "black-body" theory. This is better illustrated in *Fig. 1*. Resolution or detection of black-body radiation at frequencies below 10 centimeters is a question of tremendous power gains and extremely low background levels. In this instance *Fig. 1* possibly fails to convey the overall difference in the amounts of radiation between the visible wavelengths and those in the micro-wavelengths. Should the distribution of black-body radiation be plotted on a linear scale where the relative amount of 3000-mc radiation was represented by one inch, the peak of the energy in the visible spectrum would be somewhere over two hundred yards away from the page. The right-hand column of *Fig. 1* may serve to clarify the tremendous power gains and receiver sensitivities necessary to detect solar

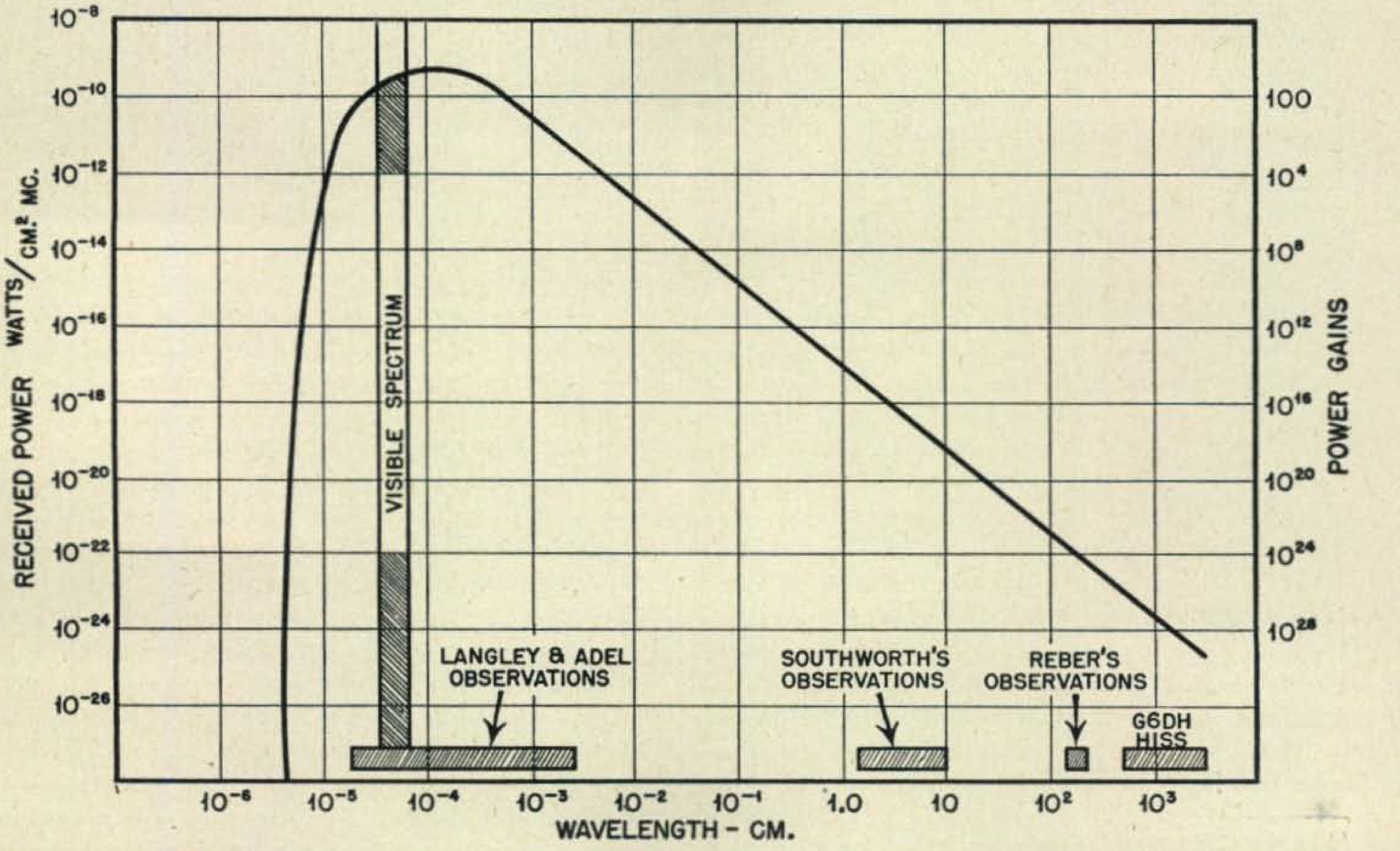


Fig. 1. The radiation curve of the sun, a near perfect black-body electromagnetic radiator, from Southworth's calculations. Unusual departures must occur above 10 cm to account for the G6DH hiss. The left side scale is the amount of received power at 92,000,000 miles. The right side scale is the relative power gains in the receiver or antenna to equal the energy level of red light

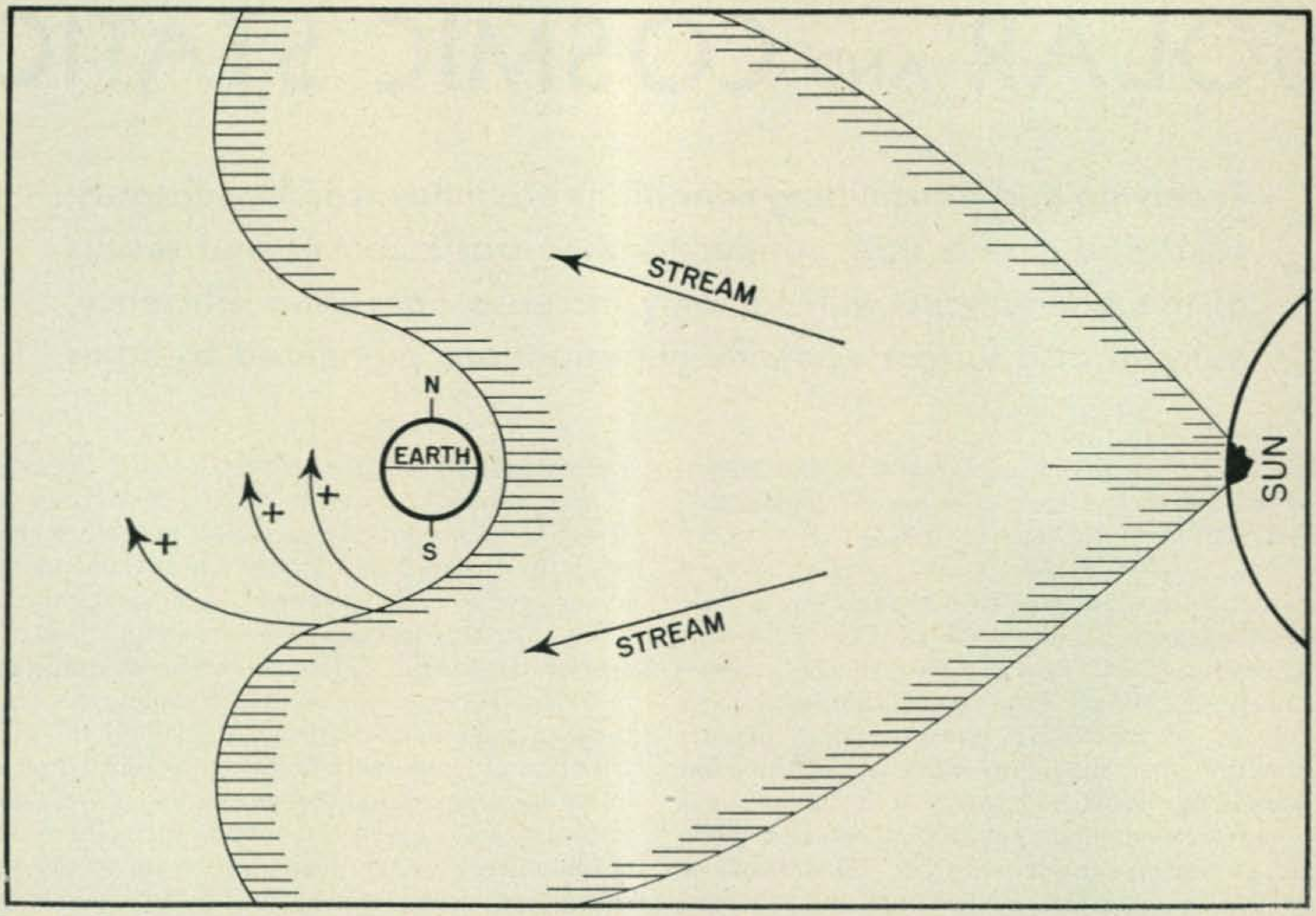


Fig. 4. Radiation of the corpuscular stream with the particles in position of the first or positive phase of the ionospheric storm

radiation. Unusually violent departures from this graph must occur to make the hiss audible in the 20 meter band.

Cosmic Static

The hiss of solar origin must not be confused with the hiss of extra-solar or galactic origin discovered by Jansky (5). As a method of thunderstorm prediction, Jansky during a study of the directional characteristics of lightning atmospherics, reported an unusual static level of about 20.6 mc[1]. This static like the solar hiss which is difficult to distinguish from the set noise, did not come from the thunderstorm areas. Instead it tended to make a horizontal clockwise rotation around the earth every 24 hours. Although the static was 0.39 microvolts per meter in strength, Jansky continued his observations and in 1933 was able to state that static source must be extraterrestrial. Later(6), it became apparent that the total amplitude of the static was proportional to the total star number along the azimuth the antenna was directed and was actually picking up radio signals from certain regions of the so-called Milky Way. Looking again to *Fig. 1*, we may easily see the greatly increased strength of the static, if not one, but millions of stars were radiating at near black-body temperatures. Of course, if this were true and the stars in the Milky Way radiated sufficiently in the radio wavelengths to be intercepted hundreds of thousands of light years away, it should have a blinding visible intensity far greater than the sun. Since this is not the case, Jansky and others, conclude that either some stars radiate pronouncely above 10^{-1} cm, or radio wave penetrating-light obscuring particles of dust and matter lie in the void of space between the solar system and the nearest stars.

In 1937, Grote Reber, W9GFZ, became interested in the Jansky static and attempted to measure any radiation reaching the earth's surface at 3300 mc. Although this meant a greatly increased amplitude of hiss or static from the 20.6 mc tests (*Fig. 1*), the receiver sensitivity at this "then" very high frequency became a prohibiting factor. Better results were obtained on 900 mc, but finally the huge parabolic reflector in *Figs. 2* and *3* was constructed for 160 mc. Reber quickly found the same static and approximate locations as reported by Jansky. Slowly sweeping and recording the static level from the various sections of the Milky Way, Reber in 1944 had identified the source as being in the constellation of Sagittarius (7, 8, 9).

[1]The fact that the Jansky Cosmic Static was received only on 14 meters is often misleading. Quite probably the static could be received as well on 10 or 40 meters as on the cleared channel, Jansky through necessity, chose to use.

The Sunspot and the Ionosphere Storm

Somewhat apart and distinct from both the solar hiss and the cosmic static are the theories of sunspot radiation and the ionosphere storm. While no adequate theory has been devised to explain all the effects or the cause of ionosphere and magnetic storms a very close correlation between sunspots and magnetic and radio disturbances has been known and observed for many years. However, the great weakness of this theory is that not all sunspots give rise to disturbances and not all radio disturbances can be associated with visible sunspots.

Most of the present theories of the ionosphere employ the action of a corpuscular electronic stream of particles or radiation given off by the sunspot. In the laboratory this can be demonstrated quite accurately, even to producing a miniature aurora display about the north and south poles of a magnetized sphere representing the earth. As the earth is a highly magnetized body, streams of charged particles will be deflected (as in an electromagnetic cathode-ray tube) by the magnetic lines of force which extend out about 500,000 miles from the surface. If a stream of particles is intercepted by the earth (see *Fig. 4*) the paths of the particles must follow certain laws to produce the various shapes and intensities of aurora. A Norwegian scientist, Doctor Carl Störmer, in considering this, inverted the problem, and by careful study of the auroral arcs and draperies has been able to mathematically calculate the paths of the particles in space from this data[2]. *Fig. 5* is a photograph of Dr. Störmer's final model representing the paths of the corpuscular particles as they reach the magnetic field of the earth. In this instance the earth is a pinhead at the intersection of the three right angles in the left center of the model.

One of the most singular phenomenon of the great ionosphere storm in favor of the corpuscular theory is the variation of the direction and intensity of the earth's magnetic field. Although the overall intensity may vary considerably from storm to storm, the directional qualities are quite pronounced and first swing upwards into the positive phase of the storm. Physicist Chapman believes the corpuscular stream must consist of both positive ions and negative electrons to account for this phase of the storm (see *Fig. 6*). As the stream first intercepted one side of the magnetic field of the earth, the field would become unbalanced. As the stream envelopes the earth the second phase or the negative phase would begin. This phase accounts for the disturbance of the telegraph lines through the circulation of a huge ring current in the ionosphere, while the positive phase accounts for the radio disturbances when the ionosphere reflecting layers become distorted and disappear.

For many years the greatest argument against the corpuscular theory was lack of evidence, besides the aurora, that corpuscular radiation did actually exist. Supporters of the theory, however, continued their research, and in the last three years have produced two other pieces of evidence of the corpuscular stream. One involves another discovery in which the amateur played an important helping hand—the radio fadeout. For a decade it has been established that the fadeout is caused by a strong flare of ultra-violet light around the sunspot areas. Many believed that at that same instant the corpuscular stream was also radiated, and traveled not as fast as light, but by the force or radiation pressure at about 1000 km per second. Thus, sometimes 20 to 30 hours elapsed between the radio fadeout and the beginning of the positive phase of the ionosphere

Fig. 2. The W9GFZ reflector for listening in on the cosmic static on 160 mc. It is an exampleof top-notch amateur experimental work

[2]Greatest weakness of the Störmer calculations was employing the hypothesis that the stream is only of one sign (positive or negative). Many other researchers say this is impossible and the stream would disintegrate in space before reaching the earth.

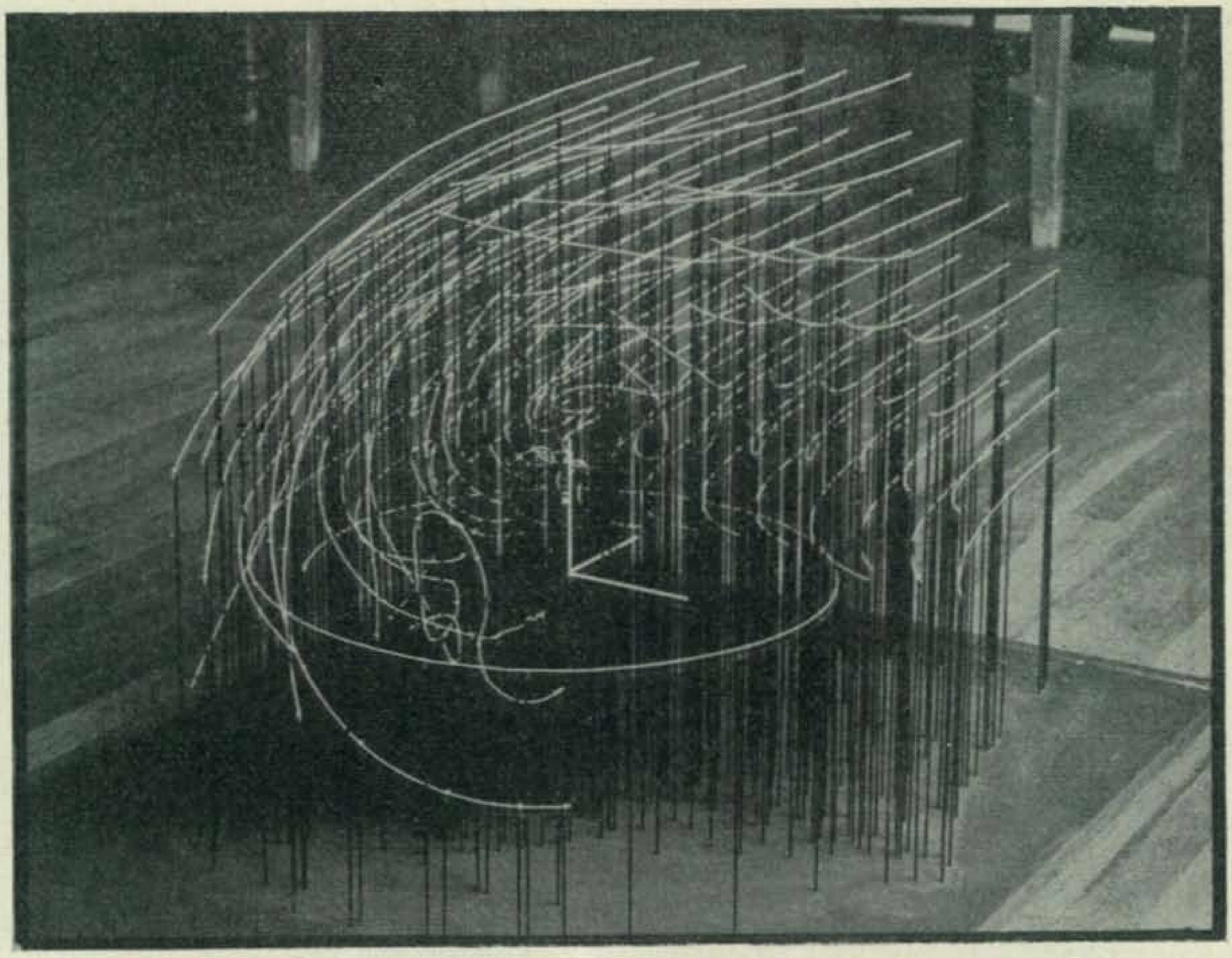


Fig. 5. Model of the paths of the corpuscular particles causing the ionosphere storm.

(Photo taken in the Oslo, Norway laboratory of Dr. Carl Störmer by Dr. Clyde Fisher)

storm. H. W. Newton (10) in 1943 examined the solar flare and magnetic or ionospheric storm relationship carefully and was able to establish a corpuscular travel time of 21 hours and 30 minutes.

In 1944 the Mount Wilson astronomers made a spectroscopic study of certain sunspot areas before and during an intense magnetic storm. At the wavelengths of the H and K lines there was a positive indication of an absorption band approximately 12 A° wide. Since the extension of this band was toward the violet (higher frequencies) it served to identify a radiation velocity of something near the sunspots of about 800 km per second, which agrees quite closely with Newton figures of the corpuscular travel time.

Possible Radio Amateur Identification

A possible method of verifying the corpuscular theory of ionospheric storms may be another amateur discovery. It is suggested that the long delayed echoes in the short-wave bands, originally discovered by Jorgen Hals may be accounted for in taking into consideration, reflection from the streams of electrified particles millions of miles away between the earth and the sun.

The latest long delayed echo fits remarkably well into this proposition. During the violent ionospheric and magnetic disturbance of March 1, 194 El. R. Hill, W3FEG (Rehoboth, Delaware)heard W5EBB (New Orleans, La.) calling W3HUY in the 14-mc phone band. As W5EBB signed, W3FEG noticed a weak signal near the same frequency also calling W3HUY and after several seconds realized that it was the exact repeat of W5EBB's original transmission. Mr. Hill estimated the delay by repeating to himself the transmission as he remembered it and found the echo to be about 22 seconds delayed.

The problem of the solar hiss and the corpuscular theory of ionosphere storms should be very interesting from the amateur's viewpoint. The number of long delayed echoes which have been reported from year to year, is dropping steadily, due to the continuous type of transmission of most short-wave stations and the crowding of the bands. Many amateurs will undoubtedly spend years working DX and never once intercept anything unusual or extraordinary. Yet, the amateur bands and the intermittent break-in operation are the last hunting grounds for the long delayed types of echoes.

V-H-F and microwave radiation is a problem, the surface of which has just been scratched. At 5000 mc the intensity variations of the background hiss level is a matter of thermal equilibrium with the room in which the receiver and antenna are located. If the receiver is entirely enclosed, along with its antenna the background level will rise considerably. Outdoors with the antenna pointed at the open sky the level will be nearly as low as it is possible to get it. Aiming

[*Continued on page 63*]

PRACTICAL VS. THEORETICAL ANTENNAS

JAMES J. HILL, W2JIH

Every mail brings increasing requests for more antenna data. In an effort to answer all the problems presented, and practically every ham has two or three of them, Jim Hill, W2JIH joins the staff of CQ as Contributing Antenna Editor. With an MA in EE, W2JIH is an Electronics Engineer with Dielectric Products Co. and President of Bown-Hill Engineering and Manufacturing Co. As an outstanding consultant and research engineer specializing in antennas and RF switches, Jim Hill possesses a rare combination of engineering know-how and amateur ingenuity.

TODAY, THE GENERAL trend of the average amateur is to spend more time on radiator problems and less time and money on transmitting problems. In most cases it is paying dividends. Innumerable articles and books have been written on antenna systems and transmission feed systems, but very little attention has been paid to the application of the theoretical knowledge to the simple practical construction of them. In subsequent issues of *CQ* we plan to outline the theory of high-frequency antenna systems, both new and old, and to convert them wherever possible to simplified mechanical details so that they may be erected by one or more neighboring hams, using a minimum of tools and equipment.

Since the frequencies above 28 mc are now the principal ones open to amateur communications, we will devote our attention first to antenna data for these operating frequencies. Much valuable time and money has been spent on the construction and matching of antenna systems with various types of transmission lines, matching transformers and complicated phasing networks. This may easily be done in a well equipped laboratory, but the average amateur is limited in knowledge and means. For this reason, *CQ* will attempt to interpret some of these theoretical problems into practical simplified antenna systems.

Simplified Matching

Perhaps the most successful and simplified of matching transformers has been the so-called "Johnson Q" system—a method of matching a ½ wave dipole to an open line of infinite length. The introduction of the *Amphenol Twin 300 Line* has opened a new field for simple antenna construction and feeding. Nominal impedance of a folded ½ wave dipole is approximately 300 ohms. This center impedance of 300 ohms lends itself to simplified feeding for the standard, inexpensive Twin 300 line.

Why a Folded Dipole?

A folded dipole antenna has another important advantage over a single dipole—it is broad-band and if cut to the center of the operating frequency range, will cover the complete band with little or no noticeable loss or change in field pattern either at the high end or at the low end. By utilizing the Twin 300 for a ½ wave radiator, shorting both ends and feeding at the center of one leg of the dipole, a good ½ wave folded radiator is realized.

This folded dipole should be fed with Twin 300 line. The center of the folded dipole shunt may be operated at ground potential, permitting the construction of a simple ½ wave radiator as shown in *Fig. 1*. The field of this antenna is such that the strongest radiated lobes are broadside, front and back. By rotating the dipole only 90°, a general coverage or circular field pattern may be obtained. *Fig. 2A* illustrates a simple but inexpensive and effective method of antenna rotation for bi-directional radiators.

Future Plans

This introductory article to the Antenna Department contains valuable data for amateurs

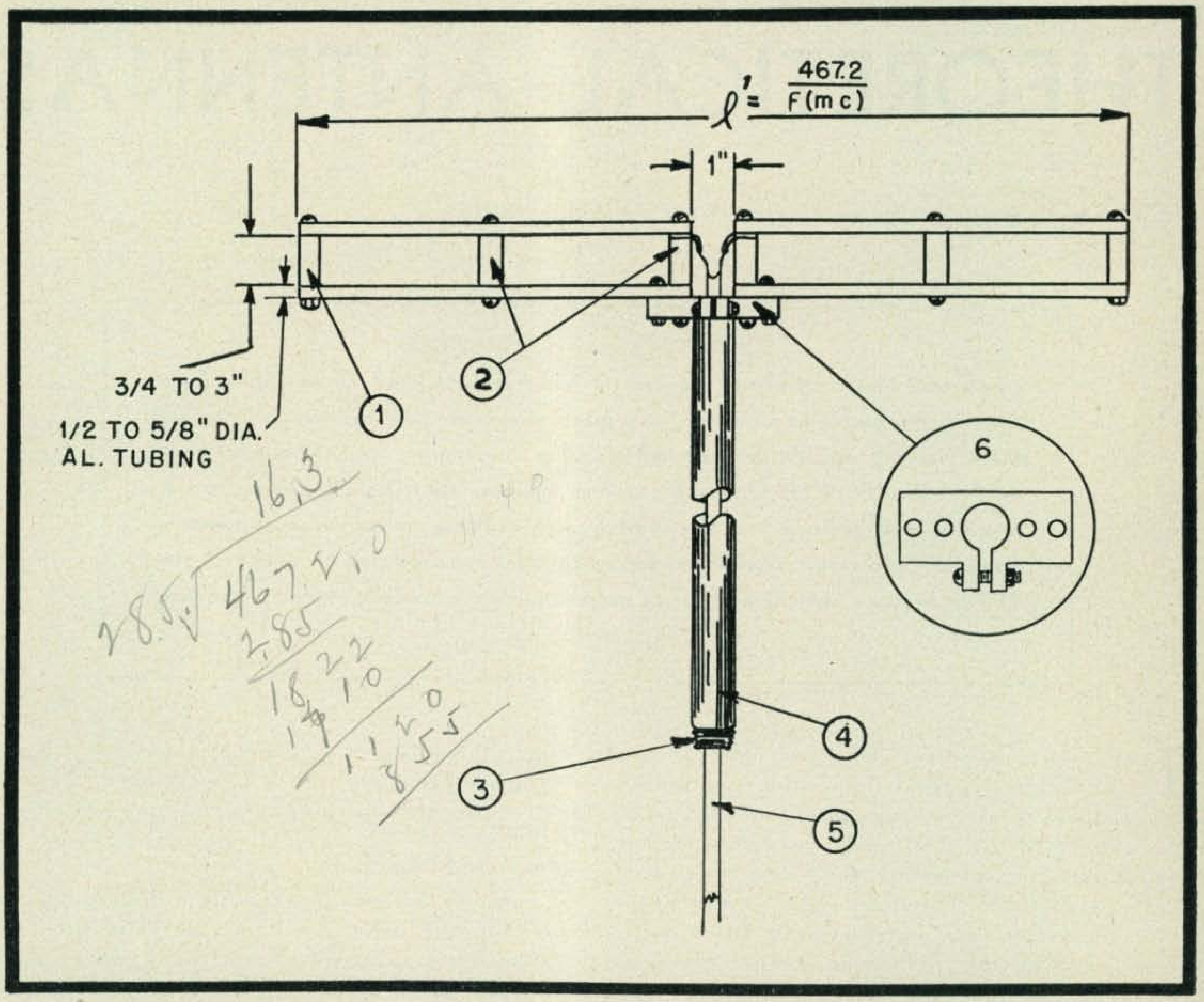


Fig. 1. A simple assembly for those who prefer to work in metal and who have facilities for obtaining small metal parts, such as the metal shorting spacers at the ends and the metal mounting bracket, No. 6. Although the sketch may look complicated, it is simple and uses a minimum of parts. The supporting tube, No. 4, may be directly mounted on top of a standard size steel mast or may be clamped with U bolts to the side of any wooden structure or tower. It may be rotated 90° by allowing the U bolts to have a little play. This type antenna makes a neat, efficient folded dipole and does not spoil the appearance of any home.

1. Metal spacer bolt and nut assembly acting as a short for the folded dipole ends.
2. Ceramic spacers tapped and threaded at each end.
3. Pipe tap (size depending upon O.D. of supporting tube used).
4. Supporting pipe (copper, brass, aluminum or steel) with at least 1" inside diameter—length unimportant.
5. Twin 300 cable is soldered to soldering lugs mounted beneath the split dipole tubing as shown in sketch. This cable may be fed through the center of the supporting tube and spaced with circular cardboard or bakelite slotted discs.
6. This shows the assembly of the metal element supporting piece. Its dimensions are not critical, but it should be rugged enough to support the weight of the aluminum dipole elements and their associated spacers and insulators. It should be made of ¼" to ½" brass or steel and may be clamped to the supporting pipe as shown in sketch. The center hole should be of such a diameter that it fits snugly around the supporting tube, No. 4. The four smaller holes are used to mount the bottom dipoles into the center supporting insulators and the supporting plate.

who have been having matching problems or for those who want to get the most out of the simplest radiating system. Each article in the series will cover *completely* and from the *practical* operating standpoint the most interesting and progressive amateur skywires. Many problems, such as correct heights for proper angle radiation, vertically and horizontally polarized systems, parasitically directed arrays, and simplified effective matching methods will be fully discussed in early articles.

You need not be an antenna expert to have first-rate arrays of your own. From this simple radiating system to some mighty tricky all-band beams (that don't require an acre of ground) you will find antennas that work—the main theme of the Antenna Department.

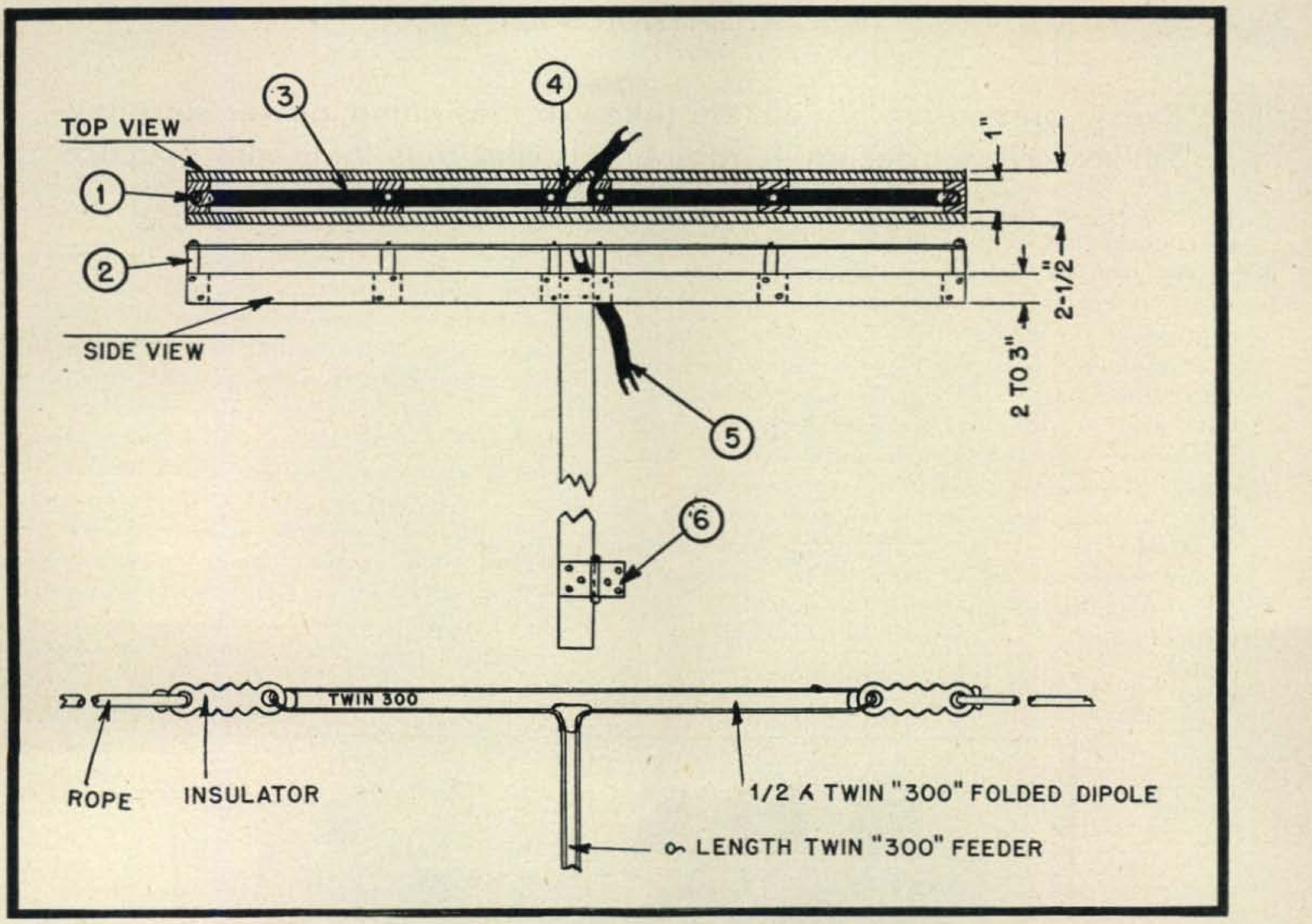


Fig. 2A. (upper) Method of making a simple folded dipole using the Twin 300 cable shunted at the ends as the folded dipole radiator. The supporting structure is of wood. This type of construction will appeal to those who are more adept at wood working than they are at metal working. The dimensions of the mounting frame are shown in the sketch; however, any variation from this does not affect the electrical operation. The supporting structures may be constructed similarly to the cross arm, thus giving a light but rugged support for the dipole. The hinges should be heavy enough to support the weight of the antenna plus any wind load which may develop. By rotating this antenna 90°, the old problem of null end effects becomes a thing of the past.

1. Twin 300 radiator cable shorted at ends and affixed to a ceramic supporting insulator, No. 2, by means of a standard screw and washer.
2. Ceramic supporting insulators from ¾" to 3" long.
3. Twin 300 cable ½ wave length long shorted at both ends.
4. Connection of Twin 300 ohm feeding line to the Twin 300 ohm folded dipole radiator. One side of the twin 300 ohm radiator, No. 3, is opened at the center and soldered to a similar Twin 300 ohm feed line of infinite length.
5. Twin 300 ohm feeding cable of infinite length may be attached to wooden mast or may be left swaying.
6. Two rugged door hinges for mounting the dipole supporting mast (3 x 3 or 2 x 2) to a house or to another mast. This method of mounting allows the dipole to swing 90°, giving a general coverage with a circular field pattern.

Fig. 2B. (lower) Twin 300 cable used as a folded dipole radiator but mounted in the old fashioned method; namely, supported by two glass insulators at each end as shown in sketch. This type of construction lends itself to indoor attic mounting or mounting between two trees, two poles, or any similar objects which are separated by a great distance

Design and Characteristics of SAFE POWER SUPPLIES

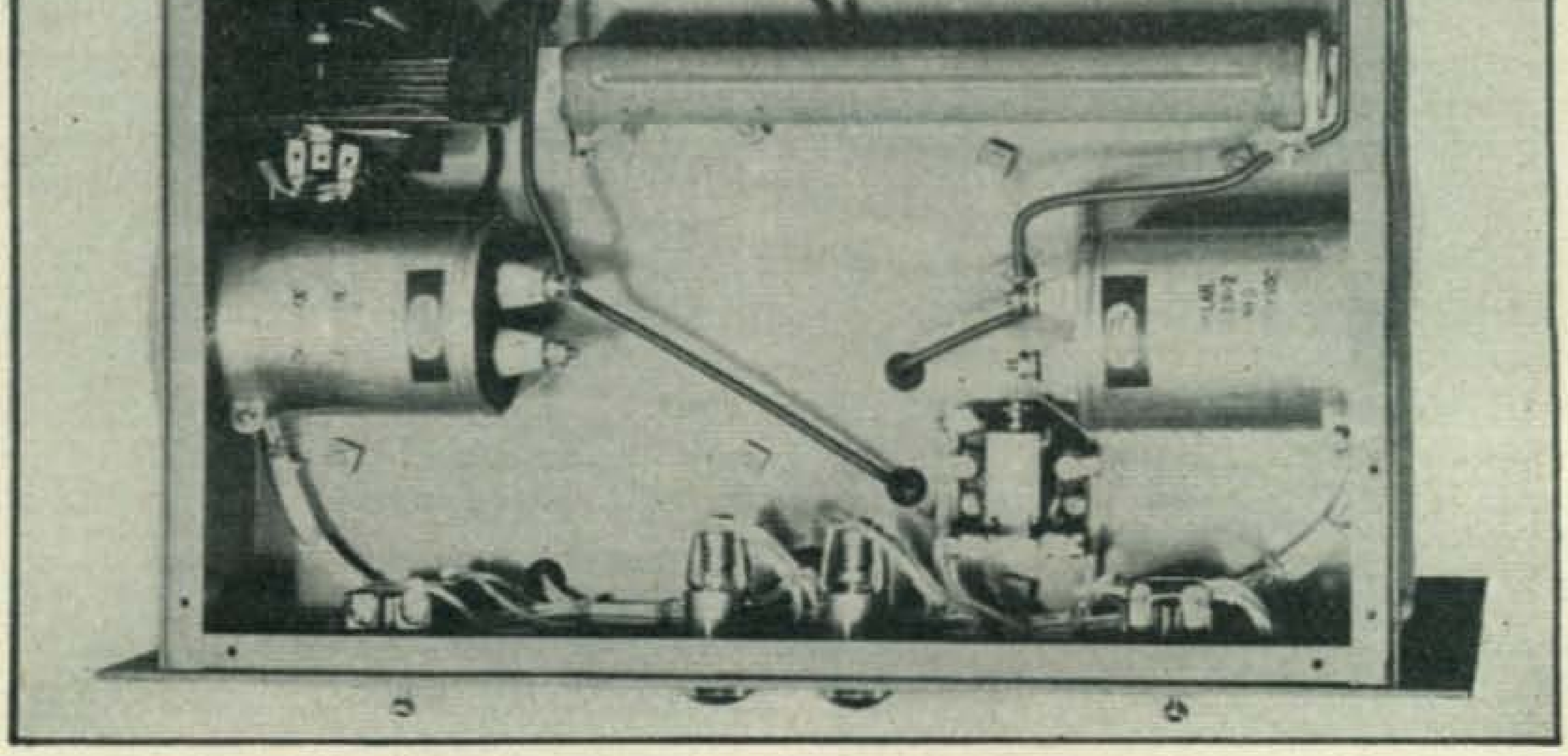
A. L. PRESTON, W9LN

Every precaution should be taken in designing power supplies. W9LN reviews design fundamentals and puts them into practice

SUPPLYING HIGH VOLTAGE direct current for transmitting tubes is one of the less difficult and complex problems of radio transmitter design. Yet fundamental principles are often overlooked or disregarded in the construction of such units. This neglect soon causes the operator unending trouble in the form of carrier hum, poor modulation characteristics, frequent breakdown of parts and so on, until corrected. In some instances an actual fire hazard or exposed high voltage connection has caused even more disastrous results. Some of the more important design considerations of high voltage power supplies with a discussion of a well-designed unit now in operation are covered in the following paragraphs.

Design Considerations

The first considerations in designing any power supply are the voltage and current ratings of the tube or tubes to be supplied. In low voltage supplies, up to approximately 400-500 volts, the problem is simplified in that few special insulation precautions need be taken. Most standard receiving parts such as chokes, transformers, plugs, tube sockets, etc. are adequate to withstand low voltages. Standard electrolytic condensers may be used in the filter system provided a suitable bleeder resistor is used to prevent voltage surges under no-load conditions. However, the current ratings of all parts used are equally important in low voltage or high voltage supplies. More filter



Complete absence of haywire in wiring supply is a fundamental rule of gocd design. The bleeder is kept clear of other components which might be effected by heat will be required at the lower voltages to reduce the a-c ripple component of the rectified voltage to an acceptable level. The values given in *Fig. 1* will be found satisfactory in most instances.

The bleeder resistor (*R1*) should be chosen to draw approximately ten per cent of the rated current of the power supply. In addition it should have a power rating well above the resistor dissipation limits at this current to prevent excessive heat with a possible burnout. Power dissipation in the resistor is determined by squaring the voltage and dividing by the resistance (simple Ohms law).

Slightly higher voltage will be obtained if the swinging choke (*L1*) is eliminated from the circuit, but in addition to the loss of its filtering action, poor regulation may result with a varying load. When mercury vapor rectifiers are used, the swinging choke is desirable to prolong tube life.

In medium and high voltage power supplies, other factors must be taken into consideration. All parts, including chokes, filament transformers condensers, tubes, tube sockets, and connecting plugs, must be adequately rated for voltage insulation as well as current-carrying capacity. Overload protective devices become, an absolute necessity to prevent expensive tube and part replacements as well as dangerous supply line overloads in the event of excessive current drain or short circuit conditions. These devices may be in the form of fuses or circuit breakers in the supply line itself, overload relays or high voltage fuses in the high voltage center-tap circuit, or preferably both.

Mechanical Layout

The mechanical arrangement of parts must be carefully planned to insure ample spacing between the high voltage wiring and low voltage filament, primary and control circuit wiring and cables. If the various parts are mounted on the chassis with neat appearance being the only consideration it is often found, upon beginning to wire the unit, that it is impossible to allow adequate spacing between wires carrying high voltages and wiring or other units at or near ground potential. It is then necessary to shift parts or leave a situation in which a line voltage surge may cause an expensive and troublesome flash-over. Fortunately, most power supplies have comparatively few parts and it is usually a simple problem to locate them properly if a little time is spent giving consideration to the above factors before starting actual construction.

The most important consideration when working with high voltages is the possible danger to the operator presented by exposed high voltage after the unit is placed in operation in the transmitter. Under no circumstances should it be possible for the operator to come in contact with the high voltage during the course of adjusting or operating the transmitter. If high voltage points are exposed on either the r-f or power supply units, interlock switches should be placed in the rack so that the high voltage primary circuits are opened before the units are made accessible to the operator for tuning or adjustment. Remember also, that high voltage filter condensers if not properly discharged by the bleeder resistor are capable of retaining a fatal charge for long periods of time after the primary power has been turned off. In case of a burned-out bleeder (a common occurrence) high voltage may still be present in the transmitter, even though the interlock switches are open! Make certain that all condensers are discharged by shorting them with an adequately insulated screwdriver or rod before touching any circuits where the high voltage is likely to be present.

750 watt supply. Note the safety connector for HV, safety caps on the rectifiers, and 20 amp circuit overload relay which protects the entire transmitter. Safety sockets for the 866A's are added insurance against voltage breakdown

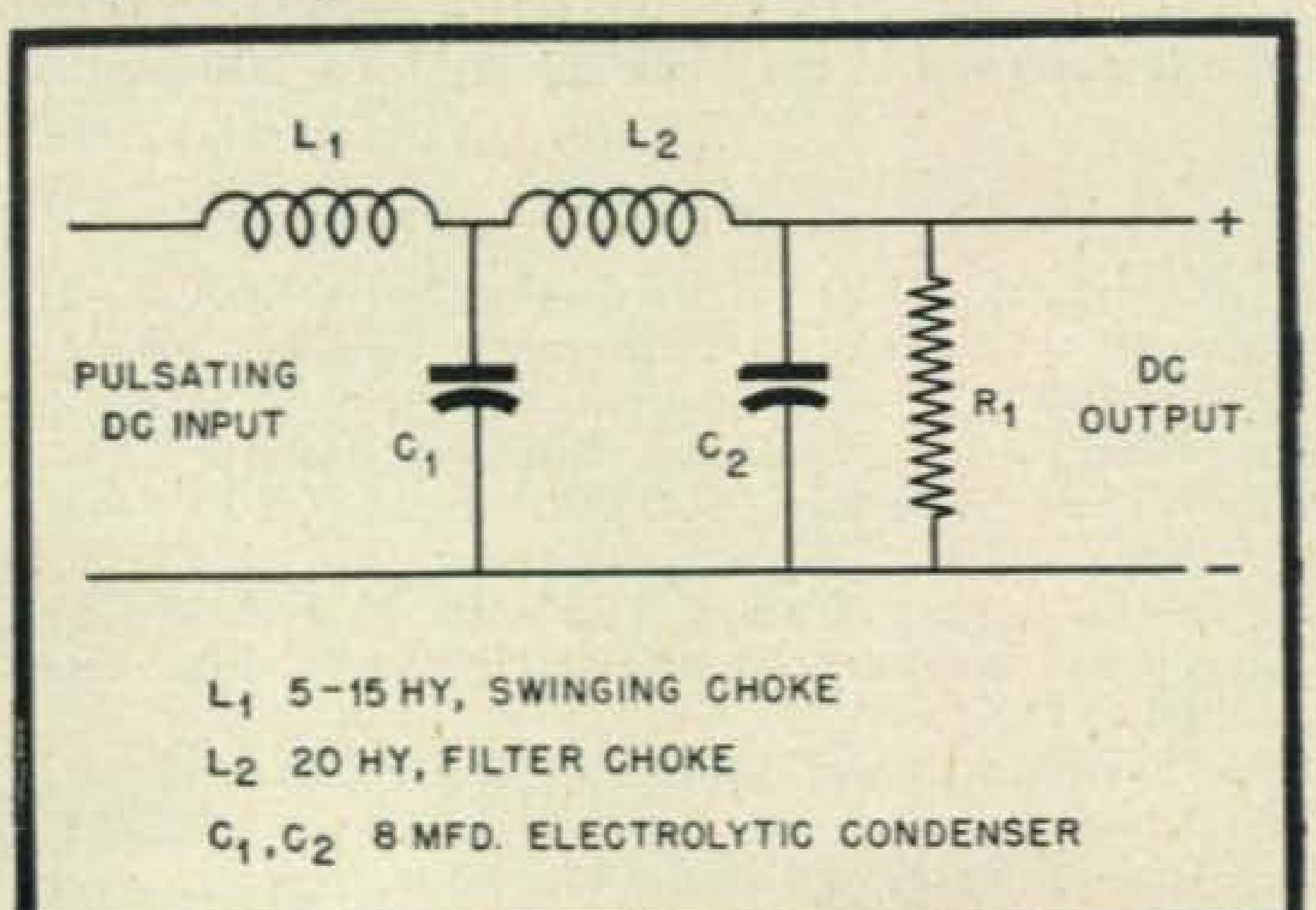


Fig. 1. Typical low voltage power supply circuit. Values are not critical

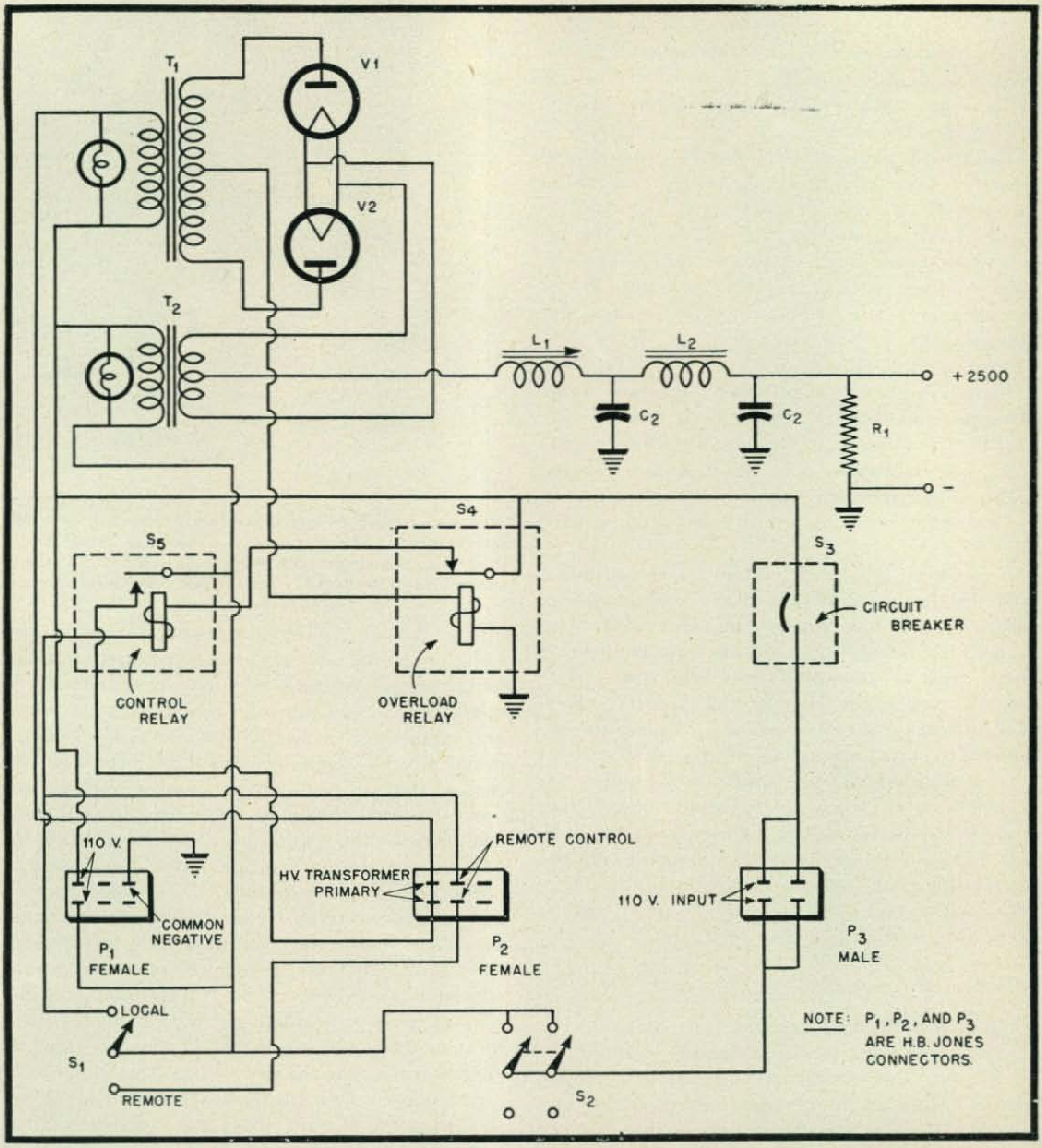


Fig. 2. Typical high voltage power supply. Control circuits are more complicated than the supply itself. This unit is designed as the plate supply for a 700 watt c.w. transmitter. Filter condensers can be returned to primary CT before overload relay if initial current surge exceeds relay rating

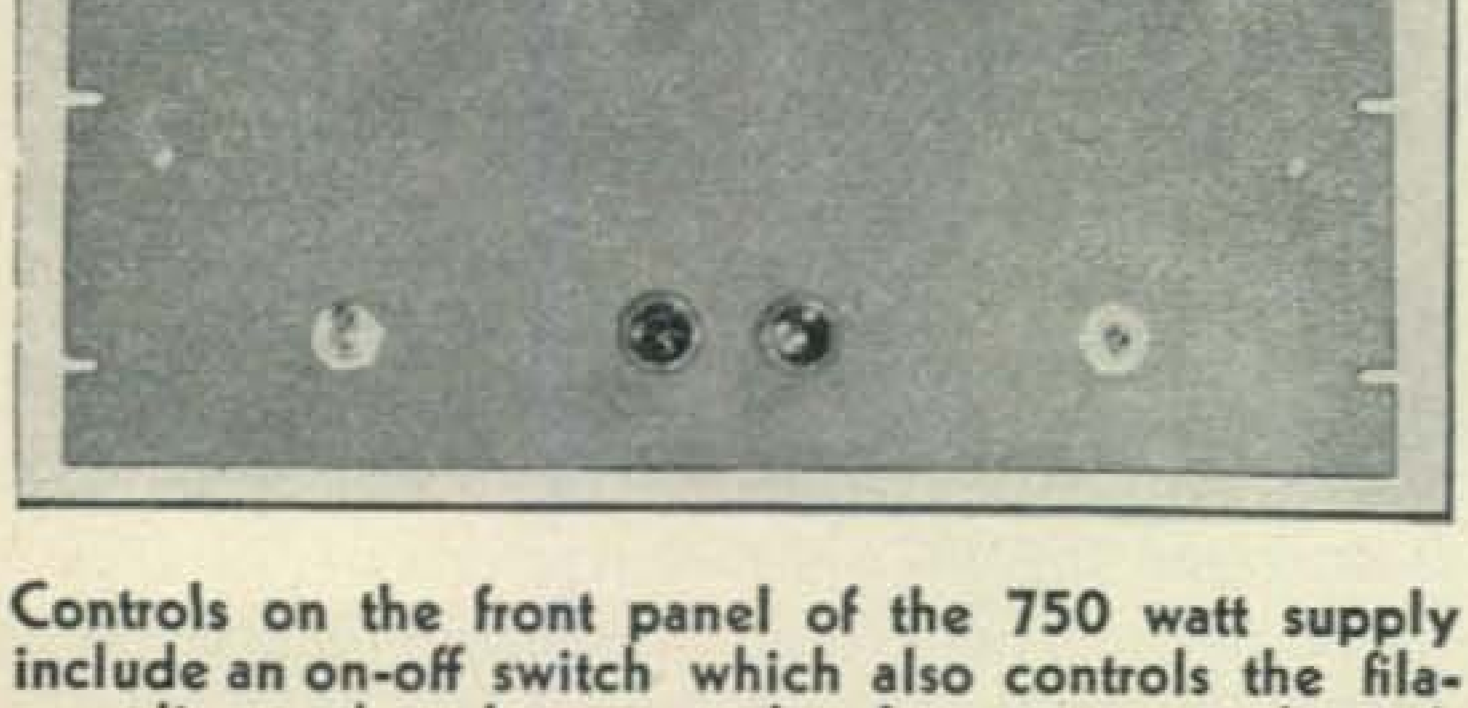
PARTS LIST

C_1, C_2—2 μf, 3000 volts working, Solar XOC30-2
L_1—Swinging choke, 5-20 henries, 500 ma, Stancor C1405
L_2—Filter choke, 8 henries, 500 ma, Stancor C1415
R_1—Bleeder resistor, 100,000 ohms, 200 watts, IRC HOA
S_1, S_2—Switches, 10 amps, 125 volts, H & H 3/4 hp
S_3—Circuit breaker, 20 amps, 120 volts, Heineman 01411RS
S_4—Overload relay, 500 ma, Ward Leonard 507-513A
S_5—Control Relay, 20 amps, 110 volts, Ward Leonard 507-549
T_1—Plate transformer, 2500 volts, 300 ma, Stancor P8034
T_2—Filament transformer, 15 amps, 2.5 volts, 10,000 volts insulation, Thordason T19F82
V_1, V_2—Rectifier tubes, General Electronic 866A
Chassis, 17" x 11" x 4", heavy duty type, Parmetal 15217
Chassis mounting brackets, Parmetal SB713
Connectors—P_1, P_2—Female, Jones S-406-AB
P_3—Male, Jones P-404-AB
2 Female, Jones, S-404-CCT
1 Male, Jones, P-406-CCT
Dial lights, 110 volt
Panel, 15¾", Parmetal G6608
Tube socket, General Electronics Mykroy high voltage 866 type
Safety Caps 866 type, Millen 36001

Typical High Voltage Supply

A typical medium power high voltage supply recently completed is shown in the accompanying photographs. This supply, designed to provide an output of 2500 volts at 300 ma is constructed for standard rack mounting, is easy to construct and incorporates several worthwhile safety features. Since the unit may serve the newcomer as a model for medium and high power supplies, its construction will be described in detail.

The chassis is a standard heavy duty 4" x 1" x 17" one-sixteenth inch steel base attached to a type one eighth inch steel front panel 15¾" high. The 866A rectifier tubes, high voltage transformer and chokes utilize all available space on the top of the chassis. Filament transformer, filter condensers and other small parts are located on the underside. Low voltage and control wiring is segregated in the laced cable extending around the perimeter of the underside of the chassis and spaced well away from all high voltage wiring and connections. The wire used in the high voltage circuits is solid hard-drawn copper with flexible plastic insulation capable of withstanding 20,000 volts. Where it is necessary to make connections above the chassis to the choke coil terminals, this insulation is augmented by rubber grommets which provide one-eighth inch of rubber as additional insulation and protection for the wire insulation against chafing on the edges of the holes. The rigidity of the solid wire itself allows routing of the leads away from the chassis at all other points. As the unit is to be mounted in an enclosed cabinet incorporating reliable interlock switches it was considered permissible to utilize exposed high voltage connections above the chassis.



Controls on the front panel of the 750 watt supply include an on-off switch which also controls the filament line to the other stages; local-remote control switch for the high voltage primary and a 500 ma overload relay reset

Control Circuits

Electrically, the circuit is conventional in most respects. A control relay rated at 15 amps is used to close the primary of the high voltage transformer. This allows the unit to be remote controlled without the necessity of running heavy primary wires to remote control circuits, permitting remote operation with any type of light duty switch. The control relay is interlocked with the overload relay which is in turn connected in the high voltage center tap circuit. If the rated overload relay current of 500 ma is exceeded it will automatically open the control relay. The reset knob located on the front panel provides a safe, easy method of returning power to the transmitter. The high voltage transformer primary is brought out to the rear chassis connector to make it readily accessible. With this feature it is a simple matter to insert a variac or a resistor and switch combination in the primary to lower output voltage for tuning or reduced power operation.

To provide primary circuit overload protection a 20 ampere circuit breaker is located on the rear of the chassis and is connected in series with the incoming 110 volt power cable. This provides protection for the entire transmitter. The switches used are H & H ¾ HP safety type double-pole double-throw. They are so constructed that they will not throw past the center "off" position until the pressure on the handle is completely released for an instant. Two separate actions are thus required to throw the switch from the "local" operate position to the "remote" operate position—providing a desirable safety feature at no extra cost. The two switch sections are connected in parallel to provide single pole action with a rating of 20 amperes for the master power switch. The local-remote switch need actually be very small, but for panel symmetry matching units were employed.

Construction Steps

As a guide for building this or a similar unit the following steps were used for actual construction.

1. Complete design, including placement of units, circuits and wiring, was first laid out.
2. All holes were spotted and drilled on both chassis and front panel.
3. When completed the entire chassis was given a light spray of enamel to conceal the inevitable scratches and mars inflicted during drilling and cutting. This process is not at all difficult (a large size fly spray being used by the author) and if care is used in the subsequent mounting and wiring operations, the completed job will have a commercial appearance.

[*Continued on page 63*]

A natural for amateur emergency operation. This Army AN/GRC-9 operates on phone or c.w. and covers the 40 and 80-meter bands

Army Surplus Radio Materials

Pilgrim's progress of an ex-army officer in re-equipping his shack from the war surplus stockpile

LIEUT. COL. DAVID TALLEY, Sig. Corps Res., W2PF-WLNA

LIKE A GREAT MANY other amateurs, the writer, at the outbreak of war, sold his receiver and transmitter (both were of commercial manufacture) to the Signal Corps. Most of the remaining station equipment was sold or loaned to various war training agencies by the XYL while the OM was overseas. During the past four years, the author had many opportunities to observe the operation of various Army ground radio and radar apparatus, especially while in the European Theater of Operations. This led to much meditative planning for the new post-war amateur radio station, incorporating everything from an automatic rotating antenna that would pickup an answer to a CQ to the super-duper-automatic transmitter for calling. For, from a more practical view point, we had visions of utilizing a SCR-399 or a modified SCR-506 to cover the HF amateur bands (20, 40 and 80 meters), an SCR-508 for the 10-meter band and maybe a SCR-522 on the 144-mc range. These radio sets were used by the thousands during the war so it seemed reasonable to assume that the hams, especially veterans of World War II, would be able to buy them at a nominal sum from the government. (To date, this is still a very erroneous assumption).

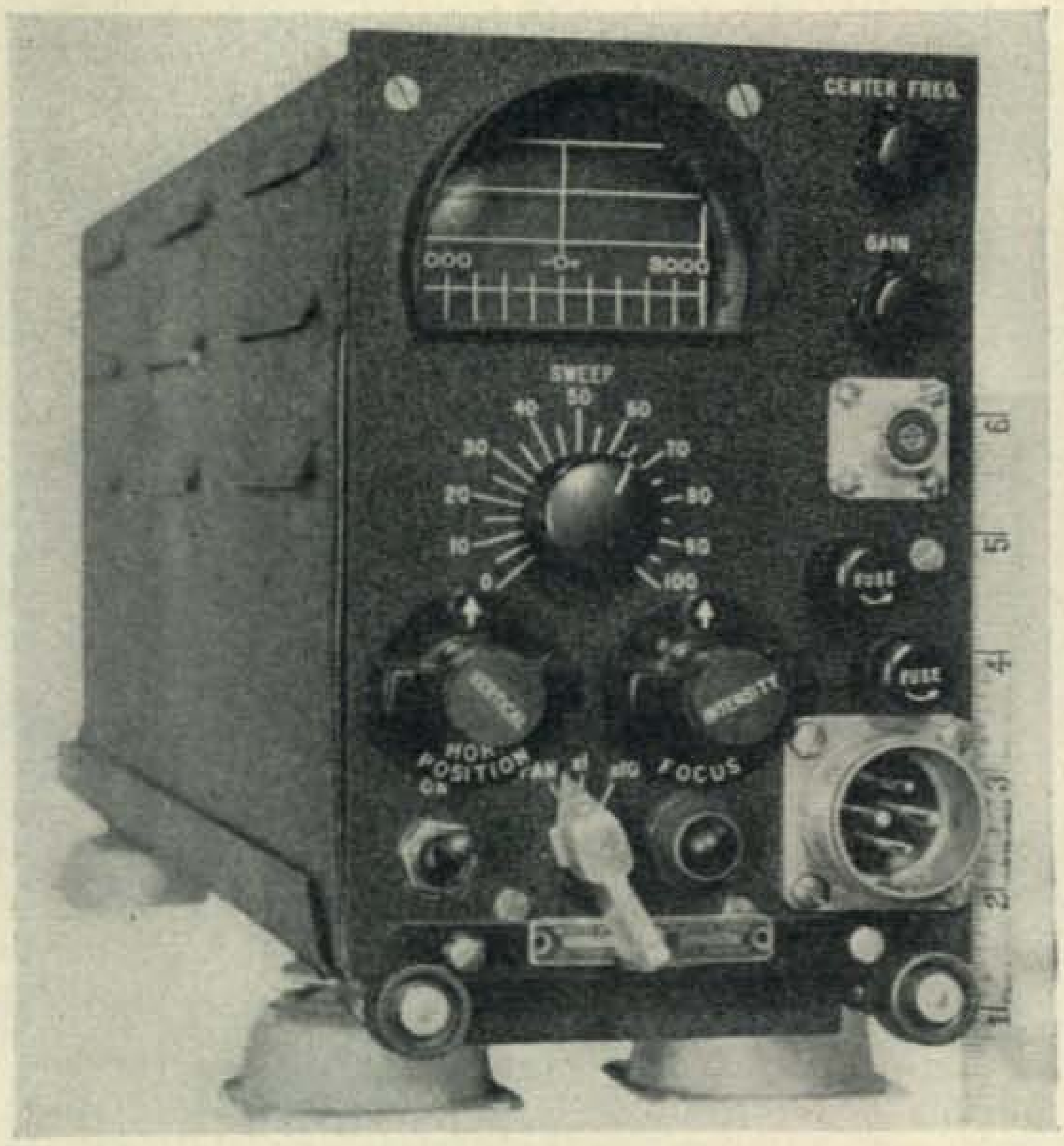
There was a succession of events starting with VE Day—then VJ Day, the end of the war, beginning of reconversion, the opening of the 2½-meter band and lastly, for the present, the opening of all amateur bands above 28 mc on November 15th, 1945. The writer returned to the U. S., was demobilized and all set to resume his amateur radio activities—without a rig. All of us have heard that surplus military equipment, especially radio parts, would be on the market in large quantities, and that war veterans would have priority in purchasing said apparatus. But, like most rumors, the facts are otherwise. The following is a summary of the author's experiences in this connection, which no doubt has been duplicated by many other amateurs and veterans.

RFC Sales Agency

Letters were written to the RFC Sales Agency inquiring about the purchase of surplus radio equipment such as receivers, transmitters, test apparatus and parts. Form letters were received in reply, which referred one to the manufacturers of said equipment as the latter were agents for the RFC in the disposal of surplus radio material. Letters and visits to some of these manufacturers soon adduced the fact that they had a quantity of parts for sale, such as capacitors, resistors, binding-posts, chassis, coils, knobs, dials, etc., but no receivers, transmitters or complete units. Postage was again spent on letters to the RFC Sales Agency office pointing out the above but once more we were referred to the manufacturer—the same "passing the buck" game or "merry-go-round."

In the midst of all this ado, newspaper advertisements and the "grapevine" reported that surplus radio sets and parts were being sold at a few radio stores and companies around New York City. Little time was lost in making visits to these places. It was found that the radio equipment on sale was from the old and obsolete SCR-268 radar set which had been designed and built around 1939-1940. The apparatus included oscilloscope, keying unit, receiver and miscellaneous bits and pieces. The oscilloscope had a 5-inch cathode ray tube but the whole thing weighed over a 100 pounds. It requires an external sweep circuit for operation. The price of $45.00 seemed OK for this component, but it was not an operating or complete unit *per se*. An additional investment of from $10 to $20 would be required to make it function (this refers to parts alone, not labor). The keyer unit, essentially a half-wave rectified power supply to handle about 11,000 volts, was priced at about $60. This seemed a bit high unless one were to dismantle

Panoramascope Type T-200 Army BC-1031 which can be utilized without any modification for panoramic reception in conjunction with standard communication receivers



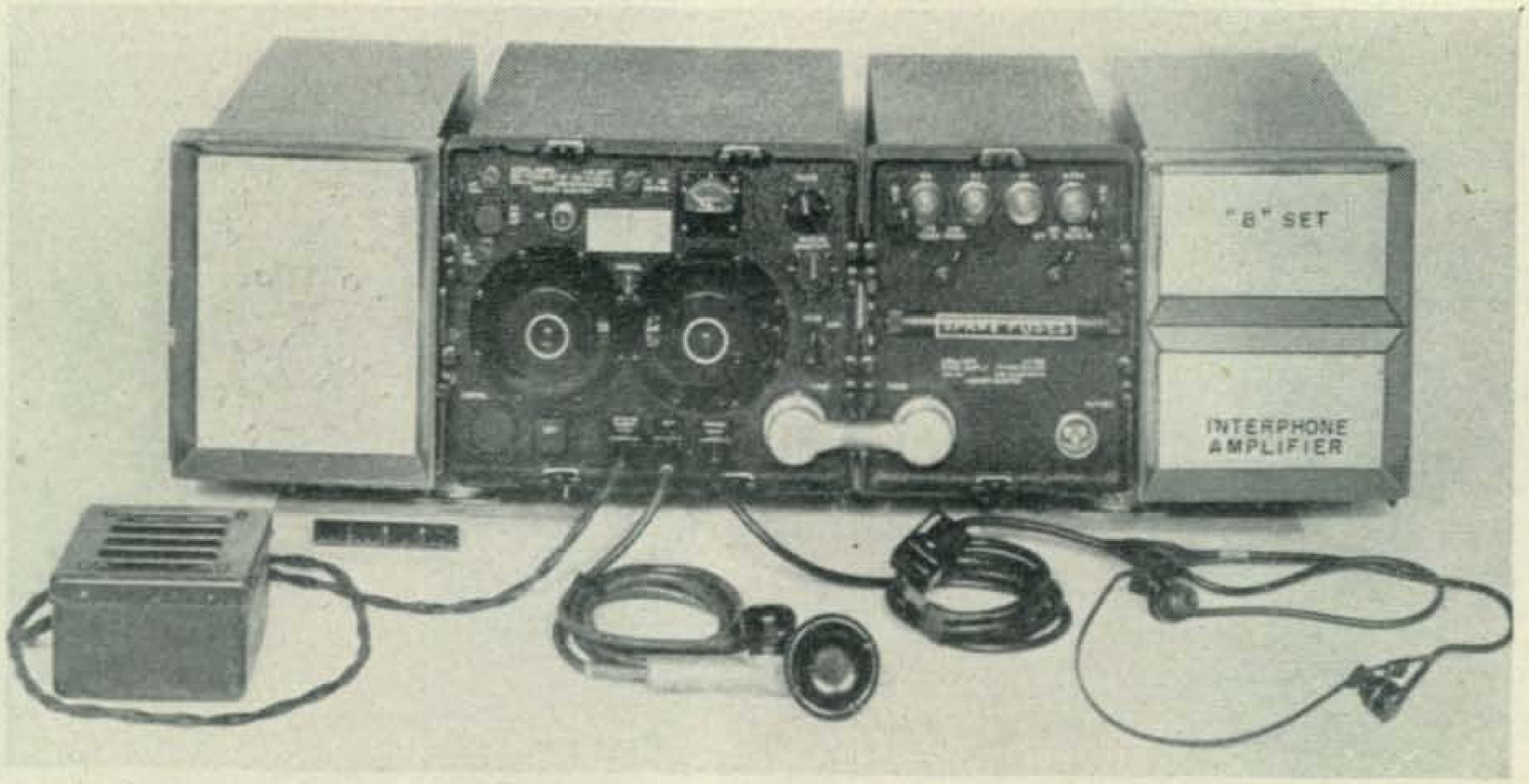
Aircraft type panoramic adaptor AN/APA38. This unit is of the type that cannot be modified for ham use without changing all coils as well as the power supply

the equipment and use or sell the transformer, capacitors, resistors, tubes, etc. It was definitely not a bargain. The most promising component was the receiver unit, originally a superheterodyne fixed-tune receiver for the 190-250-mc range, which included four 20-mc i-f stages. This receiver has possibilities for the 144-mc amateur band, but was price-tagged at about $30.00 which is not a good buy considering the fact that additional parts and labor would be required before the receiver could be used in the VHF amateur region.

A Frequency Meter

In another store, we were reliably informed that short-wave oscillators were on sale. After an inspection the "oscillator" turned out to be components of the Signal Corps SCR-211 heterodyne frequency meter (BC-221 is the main part or meter itself). This frequency meter which covers a range from 150 kc to 20,000 kc was being sold for $20 without the calibration book, batteries or case. The price with the calibration book was about $10 higher. This book is quite necessary unless one is willing to recalibrate the meter utilizing signals from WWV or some other comparable laboratory standard. This is an excellent buy and, as to be expected, these wavemeters were selling like hot cakes. Someone returned a frequency meter because it did not work. The salesman gave him a cash refund and immediately resold the meter to the next man in line. It was definitely a buying crowd.

Headphones were another item that interested



Variations of this RT-67(XC-1)GRC-5 frequency-modulated transmitter-receiver (vibrator power supply) will operate on the FM portions of the 6 and 10-meter bands

us. In one agency, a Signal Corps type HS-23 high-impedance headset sold for $1.75. In another store, the same phones were priced at $1.95 plus 10c extra for each of the MC-162A rubber ear cushions. The phones, equipped with the PL-54 plug, which will fit any standard phone jack, are an excellent purchase at these prices.

Also, in this shop, there were several boxes of Army crystals, type FT-243. These crystals are ground for the 5,000-kc to 8,000-kc range for use with the SCR-510 and SCR-610 FM field radio sets. The cost was only $1.00 each and your reporter selected a few in the 7,000-7,300-kc range for future 40-meter operation. Subsequent investigation revealed that these crystals were manufactured in the early part of the war before specifications called for etching the crystal surface to the specified frequency. It had been found that unetched crystals aged and tended to stop oscillating. They also would change frequency after being cleaned. Well, one cannot lose more than a $1.00 on this investment.

Communications Receivers

We rushed over to an establishment where rumor had it communication receivers were on sale. The receivers were of the BC-312 type used in some of the Army field sets—the SCR-193 and SCR-399, which operate from a 12-volt battery source, a small dynamotor supplying the plate voltage. This receiver only tunes from 1,800 to 18,000 kc and some models include a crystal filter. One can hardly go wrong at the price of $40.00, although converting to 115 volts a-c operation would involve an additional investment of about $20 or more, not including labor. Your scribe decided to await the sale of the BC-342 model which works from 115 volts a-c mains. (He is still waiting.)

A few BC-779 receivers, better known as Hammarlund Super-Pros, were available at some amateur radio apparatus distributors. However, these particular Super-Pros were made to Signal Corps specifications and cover the *150-400*-kc and the 1,500-20,000-kc bands only, which leaves out the proposed 21-mc and the present 10-meter bands. It is possible, of course, to convert this receiver for operation on the broadcast band and from 20,000 to 30,000 kc in place of the 150-400-kc range, but the cost would probably be as much as the original price.

From sources believed reliable, we were informed that the large Army depots, such as the Signal Corps depot in Philadelphia, were bulging with radio gear of all descriptions, a great deal of which had been returned from overseas. It appeared that these supplies had been kept in stock and were never issued or used in the field. They are still on hand in the depots over here—just gathering dust—while thousands of amateurs stand eagerly around waiting for their release. It is highly probable that by the time such surplus stocks are finally liquidated the price will be only slightly below the pre-war cost, so that few items will be worth buying, especially if one can purchase post-war designed and manufactured equipment at comparable cost.

Smaller War Plant Corporation

Amateurs who are World War II veterans can apply to the Smaller War Plant Corporation office in their city or county for a certificate to buy such surplus military equipment at the wholesale price directly from the manufacturer or RFC Sales Agency. It is necessary that one be in the radio repair, test, sales, manufacturing or similar business to procure these certificates. Under the present regulations, the Smaller War Plant

[*Continued on page 61*]

Getting on the

SUPER-HIGH FREQUENCIES

HENRY J. GEIST, W3AOH

The c.w. magnetron is one answer to the amateur's UHF needs. Tubes presently being developed are designed so that the magnetron with its associated radiator can be mounted as part of a parabolic reflector. Microwave relay stations utilize this system. Succeeding issues of CQ will present further data on microwave communication, along with constructional details.

THE NEW FCC allocations in the microwave spectrum confront the amateur with many transmitter, receiver and antenna problems. A half-wave antenna at 10,000 megacycles is only .33 inch long, and similar dimensional considerations affect the entire rig! The first and basic consideration is the tube complement.

The efficiency of many pre-war vacuum tubes drops off as the frequency approaches 100 megacycles. With the operating frequency increasing, the capacity between electrodes by-passes the radio frequency very effectively. In short, the tube starts functioning as a condenser. The damping effect of the tuned circuits at UHF is also an important limiting factor. The time required for electrons to travel from cathode to

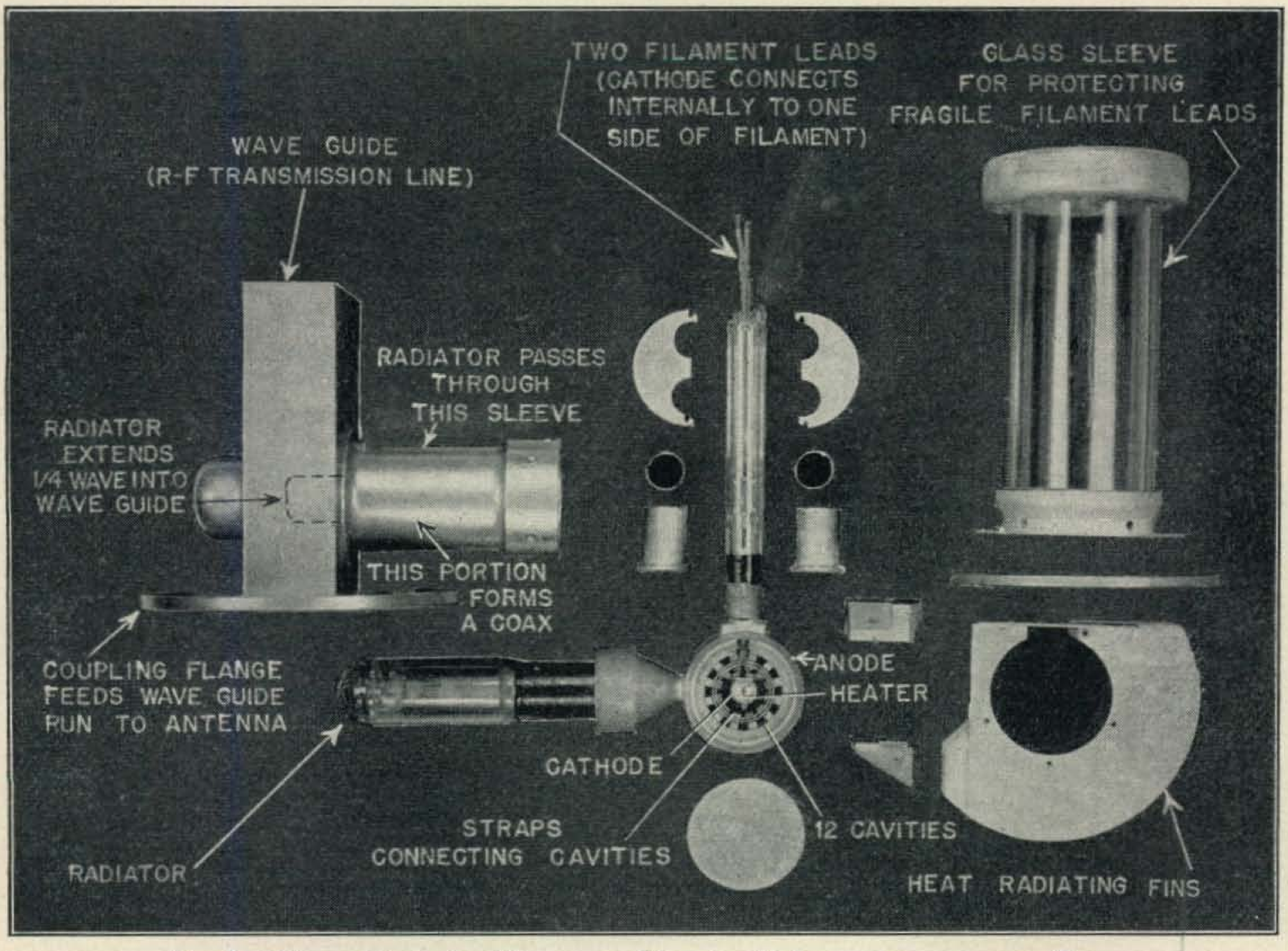


Fig. 1. "Blow up" of a fixed-frequency, 12-cavity, high-power magnetron oscillator

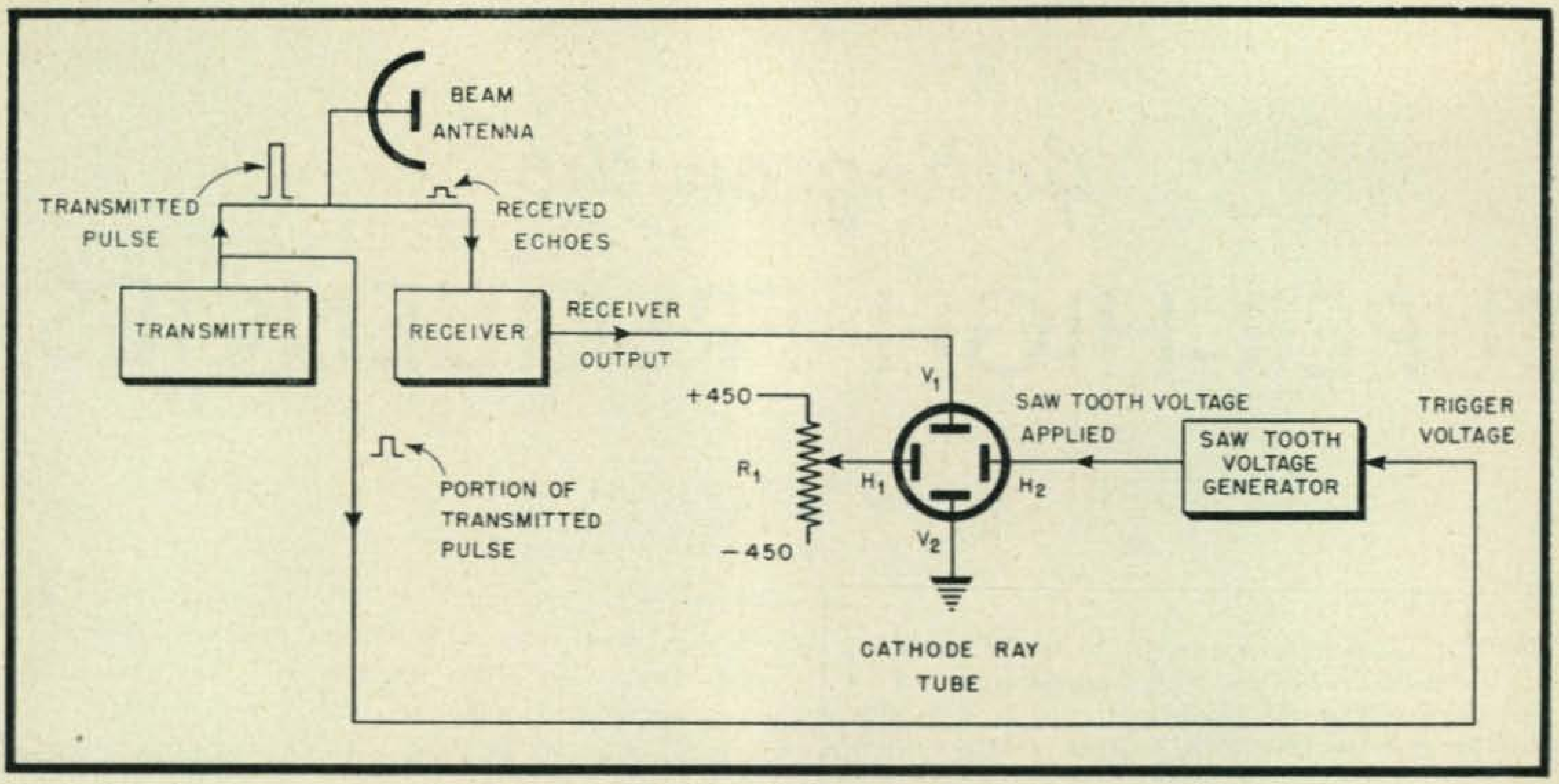


Fig. 2. Block diagram of a simplified radar system

grid and plate, known as electron transit time, is about one one-thousandth of a millionth of a second. While this may seem unimportant, it approaches and sometimes equals the cycle time of the radio-frequency current with a resultant and undesirable phase shift.

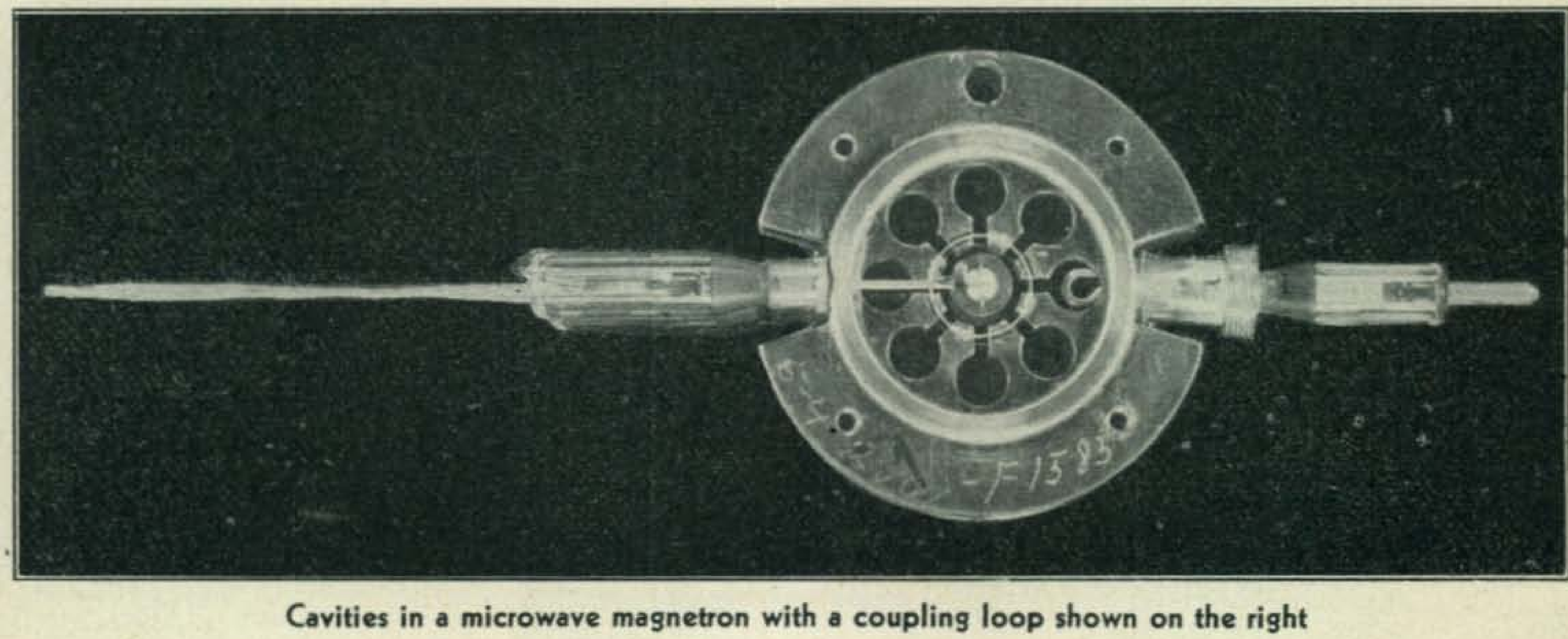
Special UHF Tubes

A few of the ordinary pre-war vacuum tubes did operate at frequencies as high as 300 megacycles. These were triodes having low inter-electrode capacities, close spacing to reduce transit time, high amplification factor and a low plate resistance. Some of the above requirements conflict. Low inter-electrode capacity postulates wide spacing, while short transit time requires close spacing. Tubes striking a happy medium should be selected.

The "acorn" vacuum tubes were developed for ultra-high operation. Physically small, the tubes have a very low inter-electrode capacity and an extremely short transit time. Efficiency is further enhanced by bringing out the tube connections via short wire pins sealed in the glass envelope. The "door-knob" tube is a transmitting "acorn" operating at considerably higher powers. The frequency limitation is around 700 mc.

The Magnetron

During the war, radar and communication systems operating at 500 mc and higher, used magnetron oscillators. In all cases, the oscillator operated directly into the antenna system—r-f amplifiers being impractical. This meant that oscillators had to be developed with extremely high outputs and still maintain reasonable frequency stability. A few low-powered portable radars used the "lighthouse" tube, which along with other types, such as the klystron series, will be discussed in a later article.



Cavities in a microwave magnetron with a coupling loop shown on the right

The manifold advantages of the magnetron may be tabulated as follows:

1. The oscillator is the output stage.

2. Efficiencies up to 60% are achieved.

3. Two types are manufactured—one for radar (*Fig. 1*), operating around 16,000 volts with outputs up to 1 megawatt (1,000,000 watts), and a c.w. design, for c.w. and phone, with powers from 2 watts to 5 kw. One particular type, operating around 1,500 volts with an output of 70 watts, can be beamed with a step-up of 20 db to an equivalent antenna power of 1,155 watts.

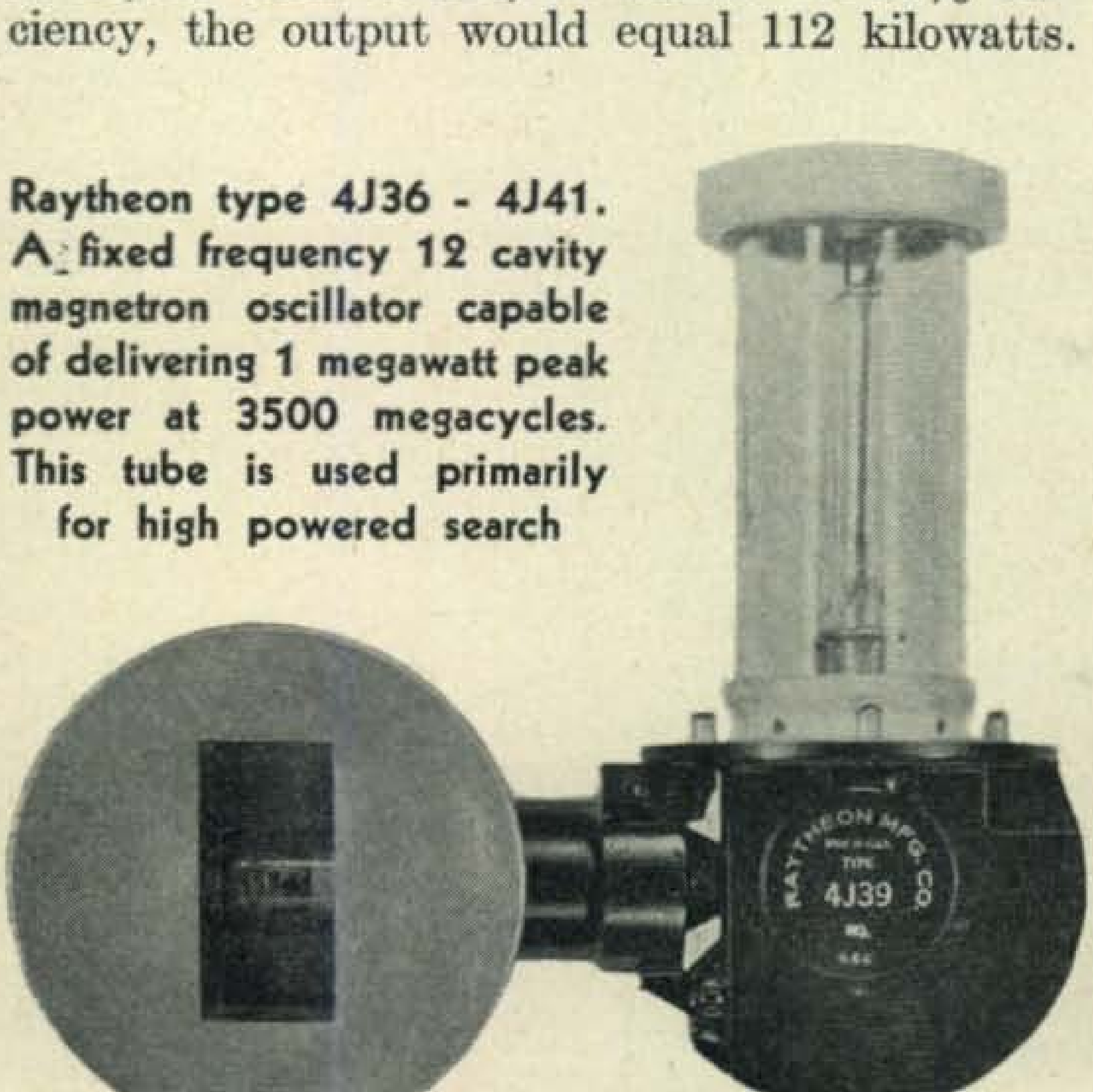
4. Frequency can be varied by changing the plate voltage.

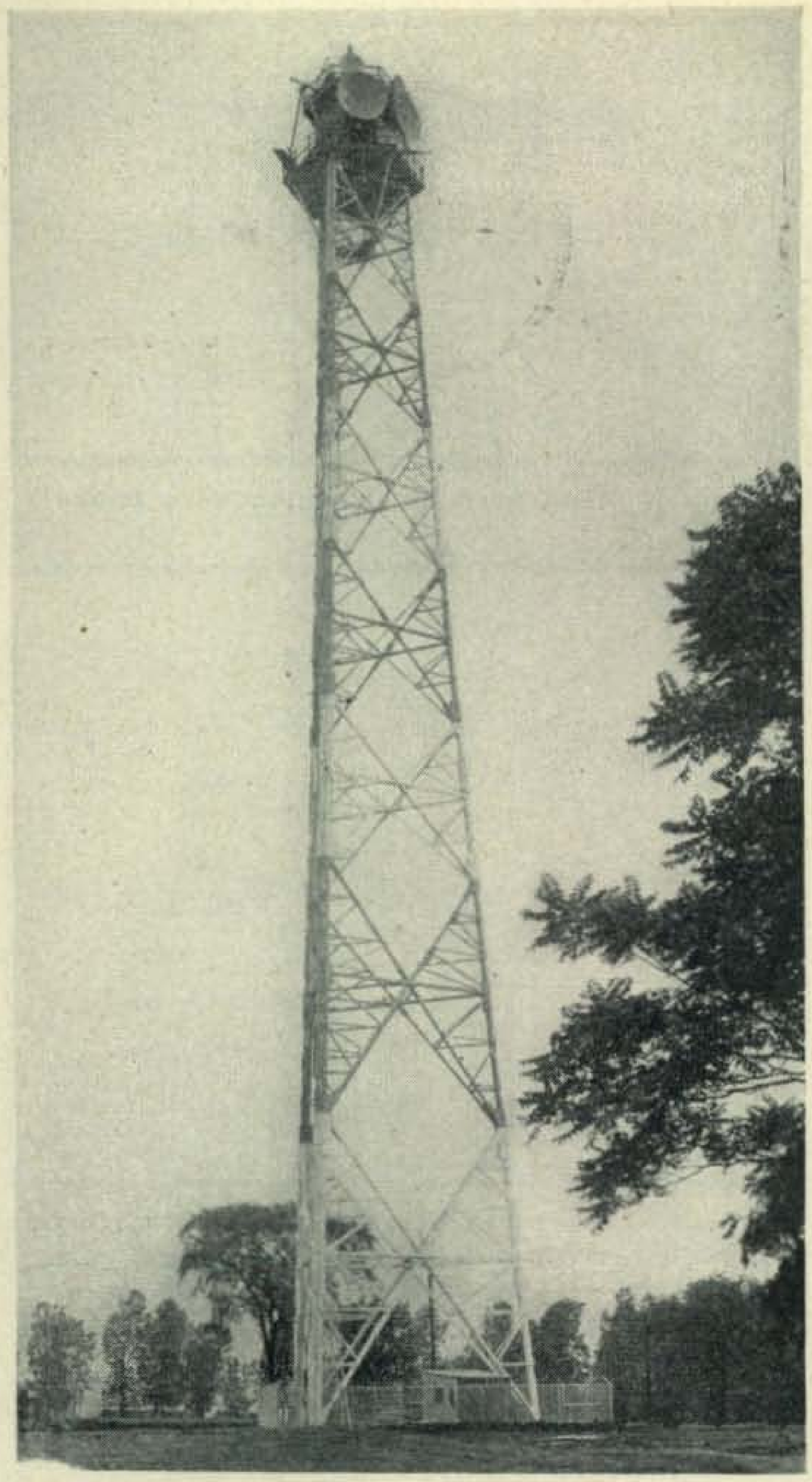
The Pulse-type Magnetron

The theory of operation provides additional data as to the tube's application in amateur radio. The pulse type magnetron has little amateur application, especially on c.w. or phone. Operating characteristics require high plate voltages and average plate currents in the vicinity of 15 to 25 amperes! Furthermore, tubes with such a high order of peak output can radiate only for a very short duration. (This brings to mind the pre-war ham rigs where tubes were often operated at such high plate voltages that it was impossible to hold down the key. To tune the final, the plate potential had to be halved. The story goes that one amateur asked another to QRS only to receive the reply, "No can do—it would require longer dashes and the final won't take it!")

In radar, terrific peak powers are generated for only a very short time. The magnetron is turned on for 1 microsecond (1/1,000,000 of a second), and during that instant the plate current on a medium powered magnetron will be 14 amperes at 16,000 volts or 224,000 watts. At 50% efficiency, the output would equal 112 kilowatts.

Raytheon type 4J36 - 4J41. A fixed frequency 12 cavity magnetron oscillator capable of delivering 1 megawatt peak power at 3500 megacycles. This tube is used primarily for high powered search





PTM antenna installation of microwave radio relay system developed by Federal Telephone and Radio Corp. Elaborate arrays provide for maximum signal gain, essential for reliable communications with the low power involved

In a distance-measuring device considerable power must be radiated so that small surfaces will reflect enough energy for a receiver to detect.

Referring to *Fig. 2*, the "dot" of the cathode-ray tube, when the transmitter is off, is pulled over to the left by applying a positive potential to H_1 through R_1 The instant a 1-microsecond pulse is transmitted, a portion of the transmitted energy starts the saw-tooth generator oscillating to produce a single cycle. This linear voltage rise moves the spot across the face of the tube. At the same instant the saw-tooth voltage is started, the 112-kw pulse is beamed by a parabolic reflector with 20 db gain. Any objects in the path of this beam will reflect energy a number of microseconds later, depending on distance. If the r-f pulse travels at 186,000 miles per second, its travel time in one microsecond is 327 yards.

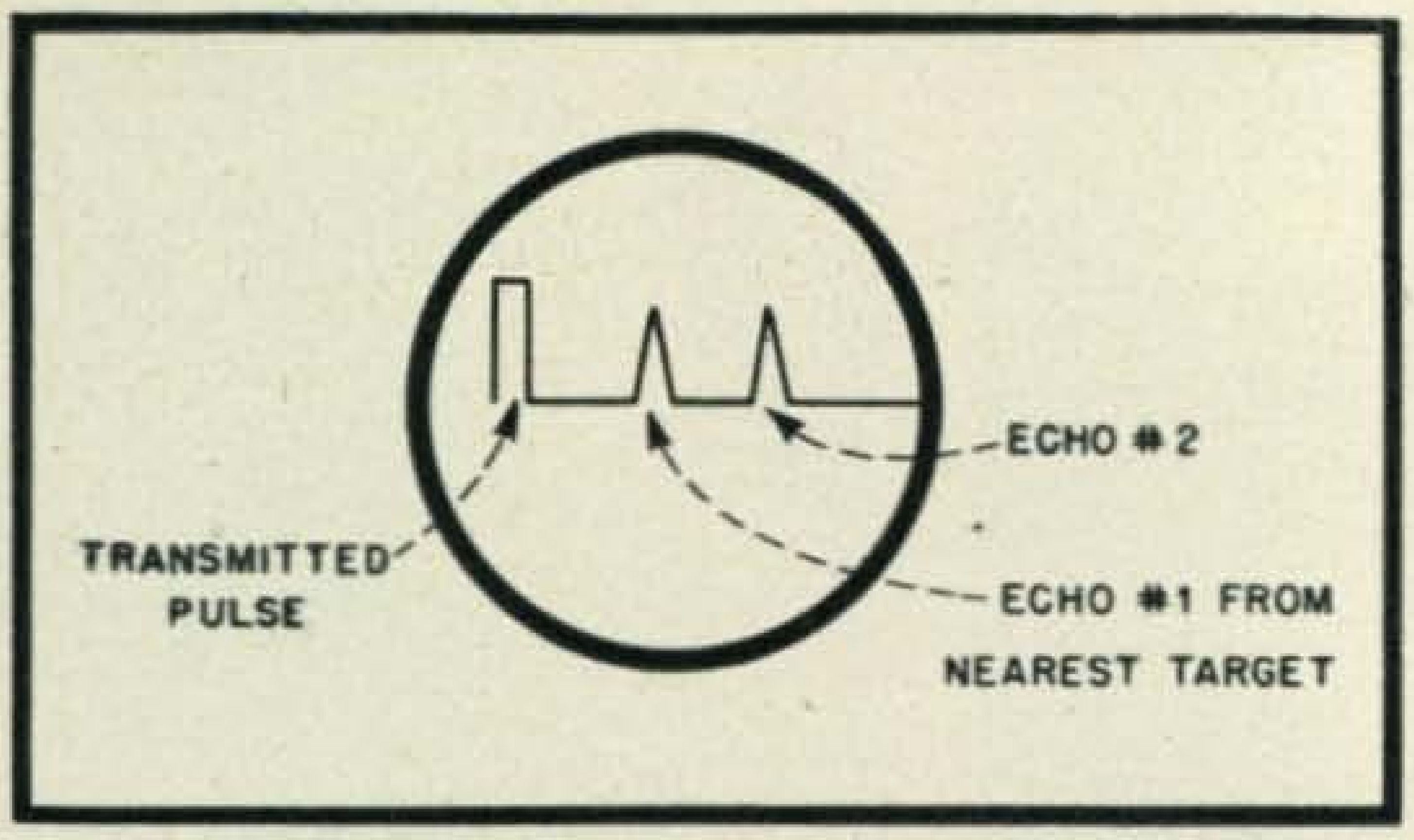


Fig. 3. Radar echos on the cathode-ray screen

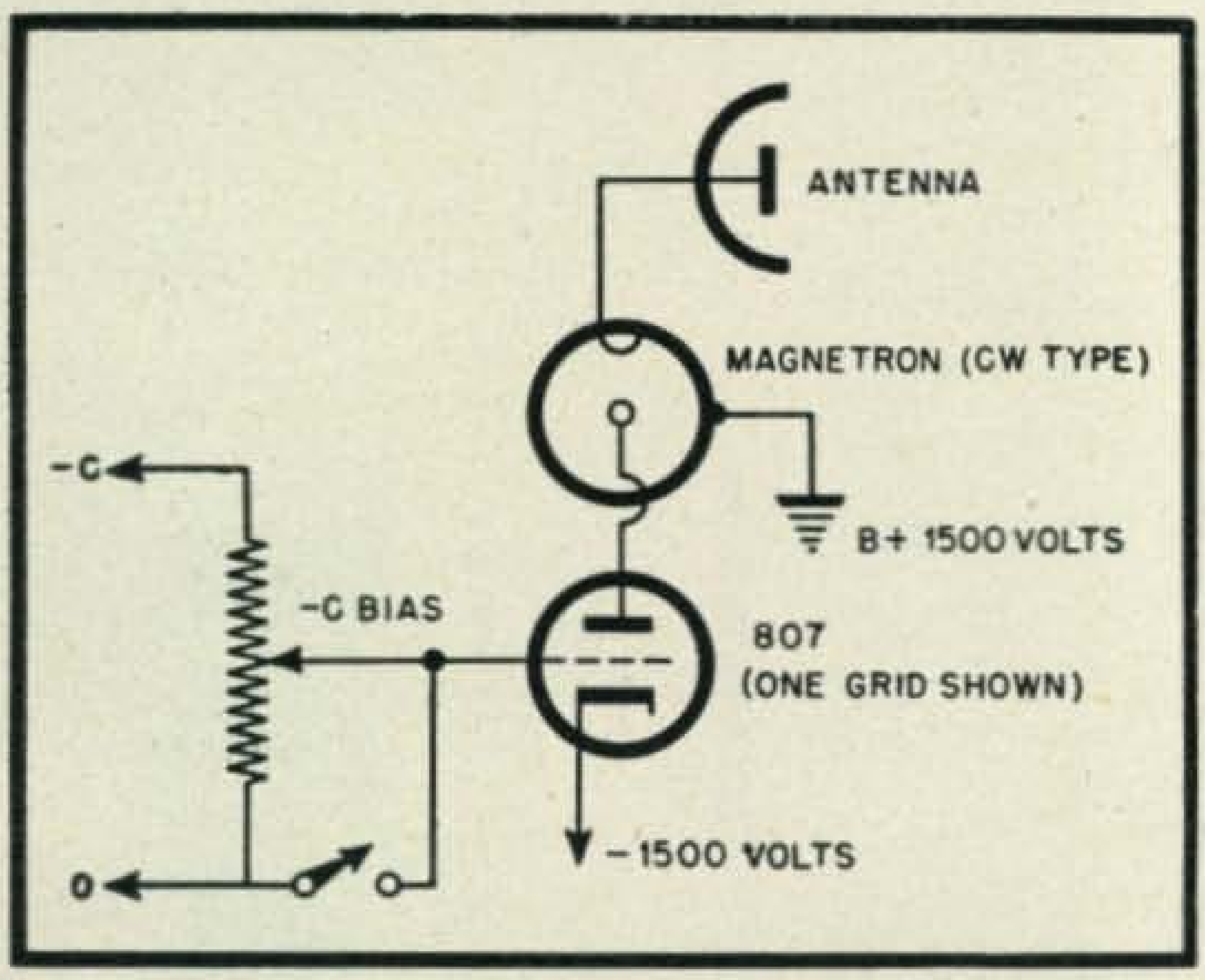


Fig. 4. Schematic representation of the c.w. magnetron in an amateur microwave transmitter

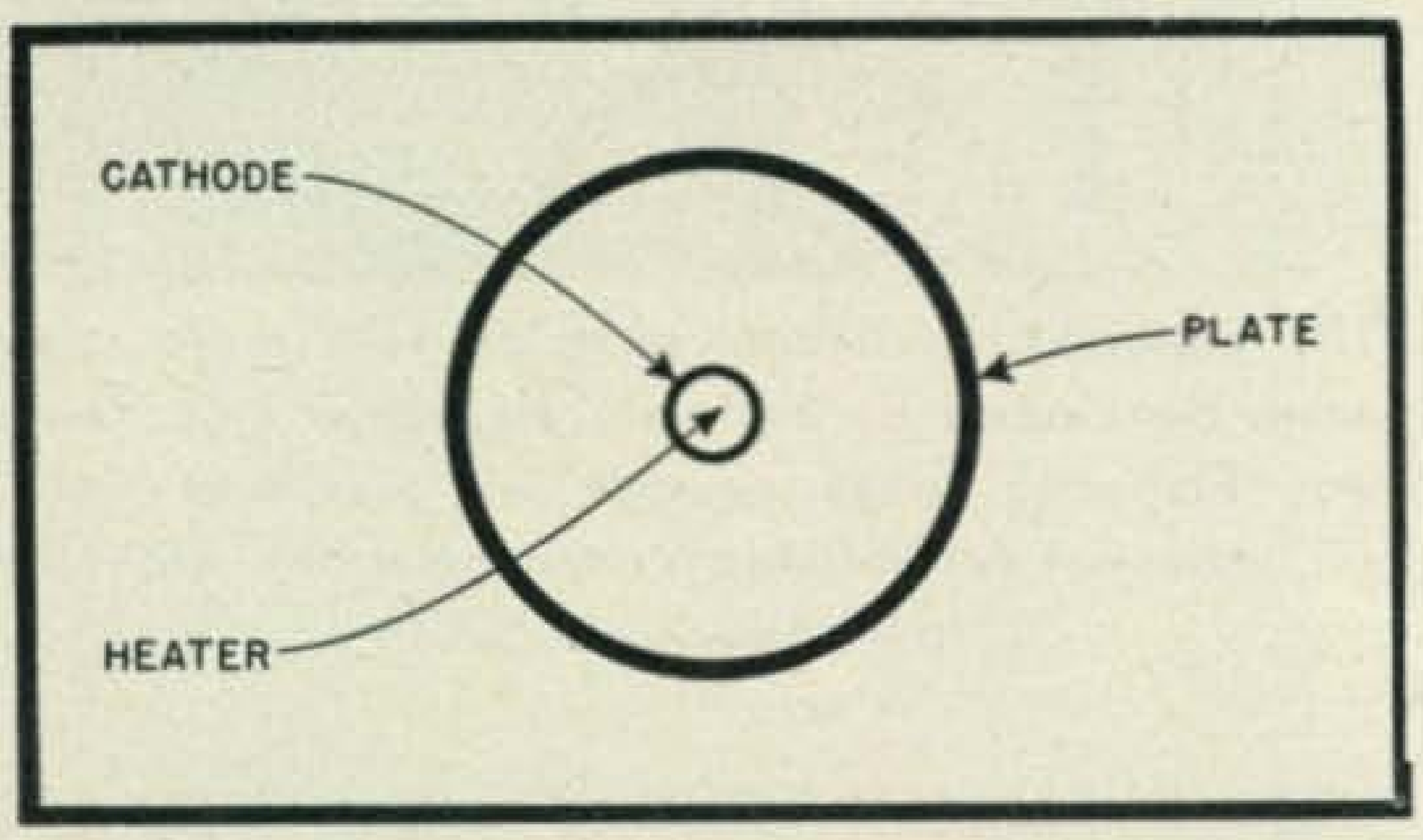


Fig. 5. End view of the magnetron, to be connected as shown in Fig. 6

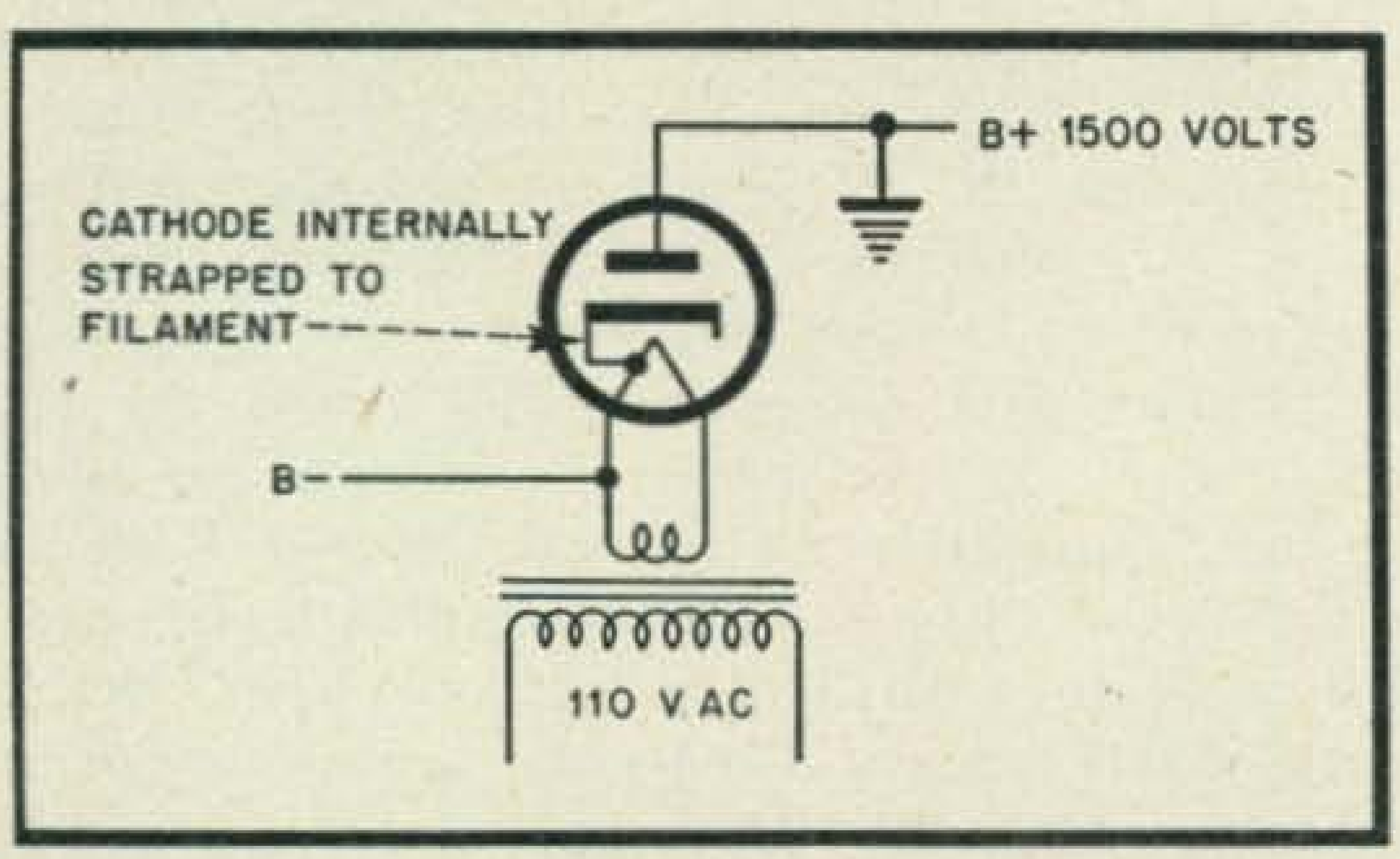


Fig. 6. Magnetron connections. The filament or heater transformer must be insulated for the B+ voltage

The returned echoes, some microseconds later, are detected and apply a positive voltage to plate V_1 of the cathode-ray tube. A trace without echoes appears on the face of the cathode-ray tube as a straight line. As echoes are received the trace momentarily is deflected upward. Two echoes at different distances from the antenna would draw the trace shown in *Fig. 3*.

Instantaneous Power

Thus, if the transmitter is turned on and off at a rate of 1,000 times per second, the transmitter is on for 1 microsecond and off for 999 microseconds. With such short pulses a tube can take a terrific beating if the cathode provides sufficient emission to handle peak currents. The relatively long interval between pulses provides an ample cooling period. From this it may be appreciated that the radar magnetron is not suitable for amateur operation.

Because of this, the c.w. magnetron is of particular interest to the ham. Its operation, being on a continuous wave basis, is in keeping with amateur requirements. For c.w. operation the transmitter, excluding power supply, would approximate *Fig. 4*. With the key open, the 807 is operating at cut-off, meaning that the magnetron is receiving zero voltage. When the key is closed, plate voltage is applied to the magnetron and the tube oscillates on its tuned frequency.

Theory of Magnetron Operation

To understand the theory of the magnetron, consider a diode with a cathode and heater in the center of the tube, surrounded with a circular plate (*Fig. 5*), connected as shown in *Fig. 6*. Electrons, attracted by the electrostatic force, will flow from the circular cathode in all directions to the plate (*Fig. 7*). The electron paths are straight lines. If a magnet is placed so that its north and south poles are at the ends of the cathode (*Fig. 8*), the magnetic lines traveling parallel to the cathode and plate will exert a force at right angles. The electron stream will then spiral as indicated in *Fig. 9*. If the magnetic field is too strong, the electron stream will start whirling around the cathode and never reach the plate. If too weak or if the plate voltage is too high, the tube will act as a diode. Therefore, the balance of magnetic field and operating voltage ratio cannot deviate over a great range.

In *Fig. 10* the plate is broken and quarter-wave lines are installed. The tube, in a magnetic field with plate voltage applied, will oscillate at a frequency depending on the setting of the shorting bars. In brief, the electron stream travels toward the plate in a curved path. On one-half of the radio-frequency cycle, as the plates (one between each set of stubs) collect electrons, plate current flows, lowering the plate voltage due to the drop in the tuned circuit. This change in voltage causes these tuned circuits to oscillate at the natural frequency, depending on the position of the shorting bars. As the plate voltage decreases, the magnetic field predominates and prevents the electrons from reaching the plate. With the plate current dropping off, the plate voltage rises, generating the second half of the r-f cycle. As the cycle progresses, the plate again goes more positive, causing electrons to reach the plate. This operation is repeated with each radio-frequency cycle.

Cavity Technique

For the 1,145-mc, 5,250-mc, and 10,000-mc amateur bands, the dimensions of the tuned lines would be too minute. The magnetron is therefore constructed with thick walls into which carefully matched cavities are cut as shown in the photograph on page 30.

The copper envelope of the tube being the plate accounts for B+ going to ground as previously shown. With the cathode at − 1500 volts and tied to one side of the filament, the primary-to-secondary insulation in a magnetron filament transformer must be excellent. In radars using 15,000 volts, the primary is wound on one leg of the transformer core with a ½ inch air-gap between the primary and the secondary.

The frequency of a magnetron is primarily a function of the cavity size but will vary slightly with field strength, plate voltage, and load. Note that the cavities are effectively connected in phase with each other by magnetic coupling, and also by a direct connection method known as strapping. As the cavities are paralleled within the tube, energy may be taken from any cavity by a low impedance coupling loop placed within it.

During the war, as might be expected, much of the magnetron development work was performed by amateurs. Mass production of magnetrons, considered all but impossible, was carried out during the entire war by Raytheon. Percy L. Spencer, W1GBE, long prominent in amateur circles, was the inventor of the lamination method of manufacturing these tubes in the quantities required during the war.

It is expected that Raytheon Manufacturing Co., and possibly other tube manufacturers will have a c.w. magnetron available at a popular price. Prior to such a date it is cautioned that few if any magnetrons suitable for amateur use will appear as surplus — primarily because they were never manufactured. As the basis for almost all successful super-high frequency gear the magnetron will be an interesting tool for exploring the frequencies beyond the reach of amateur equipment until now.

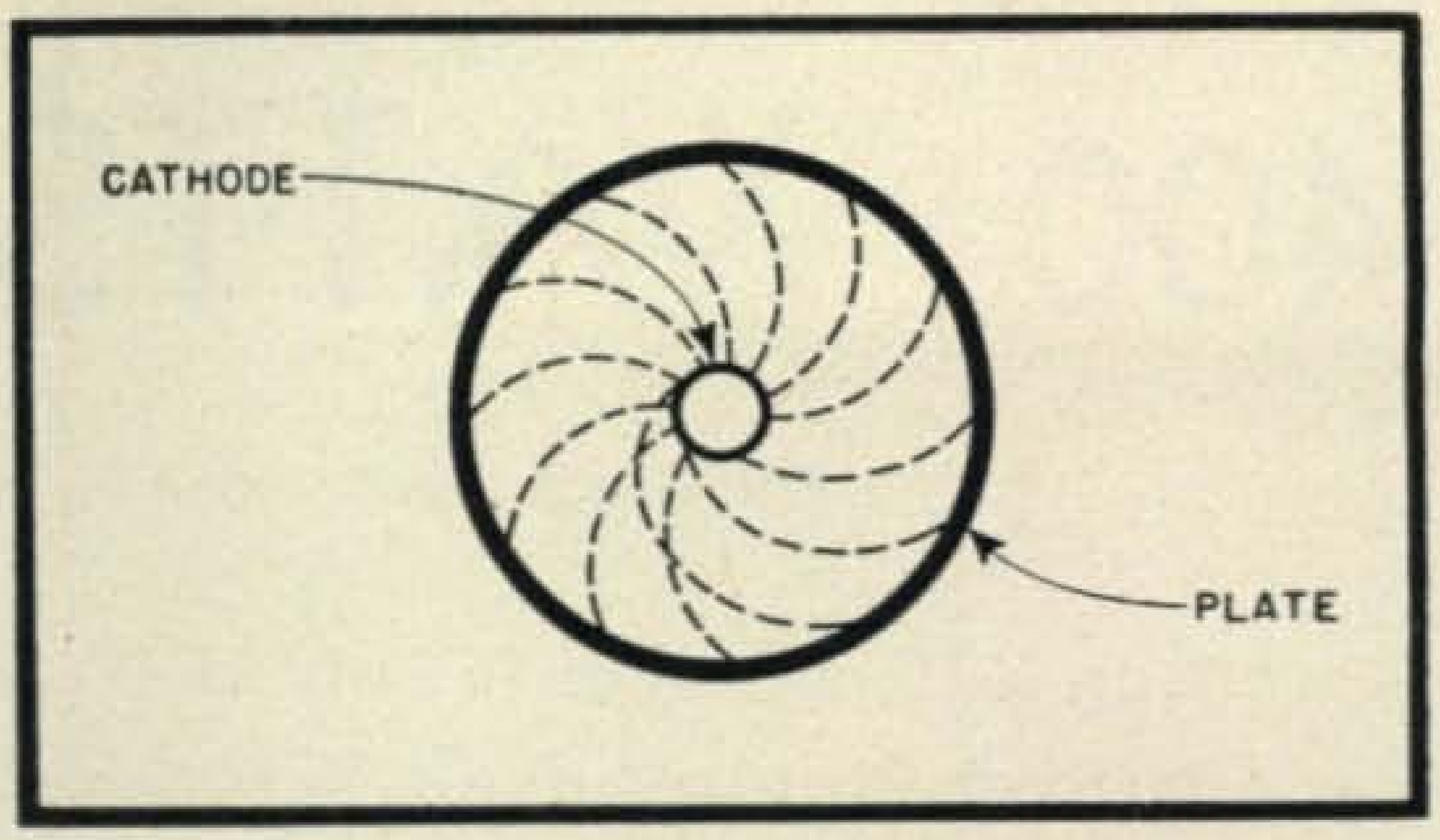


Fig. 7. Showing electron distribution in normal diode operation

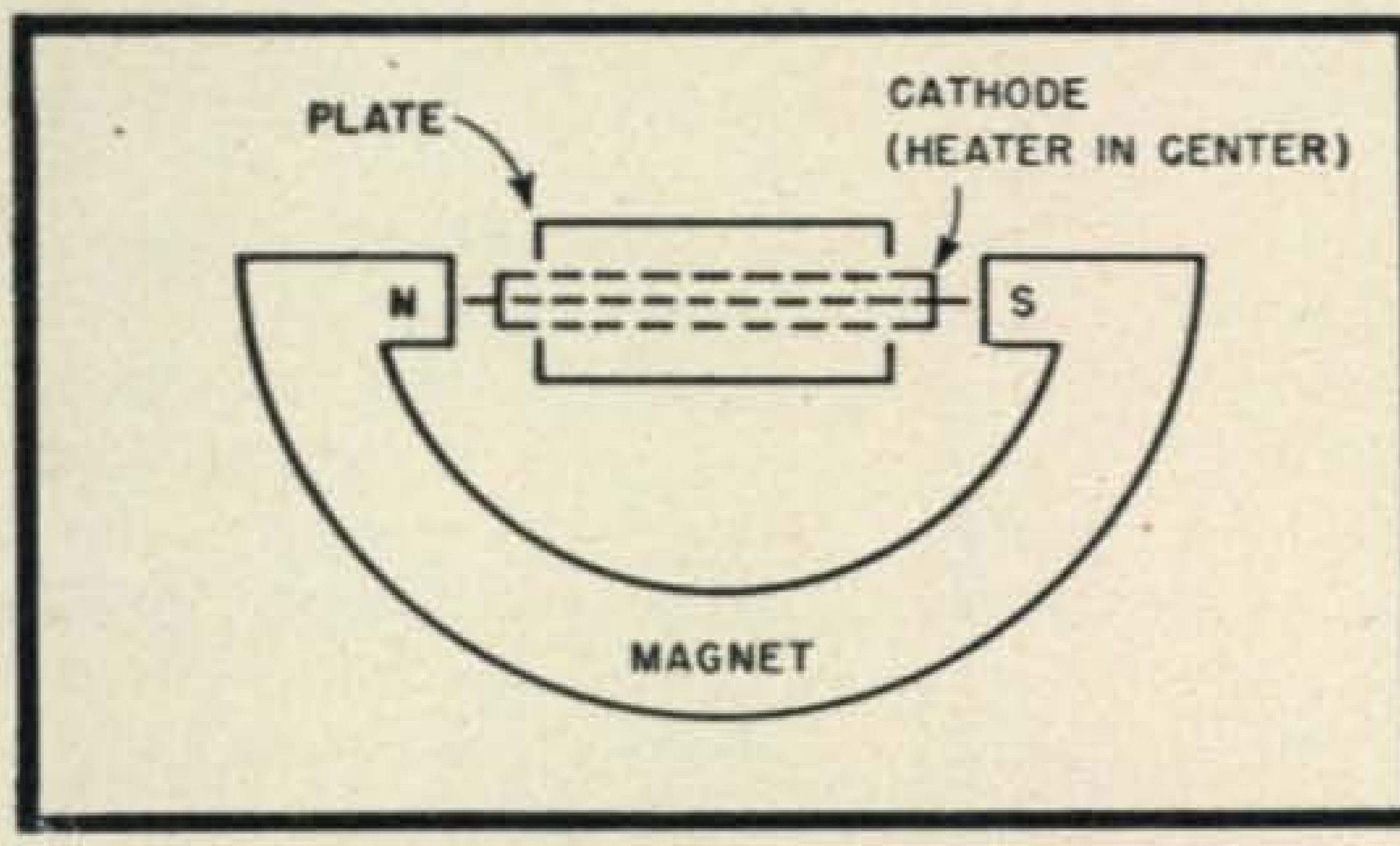


Fig. 8. The magnet alters the diode operation and contributes to the name of "magnetron"

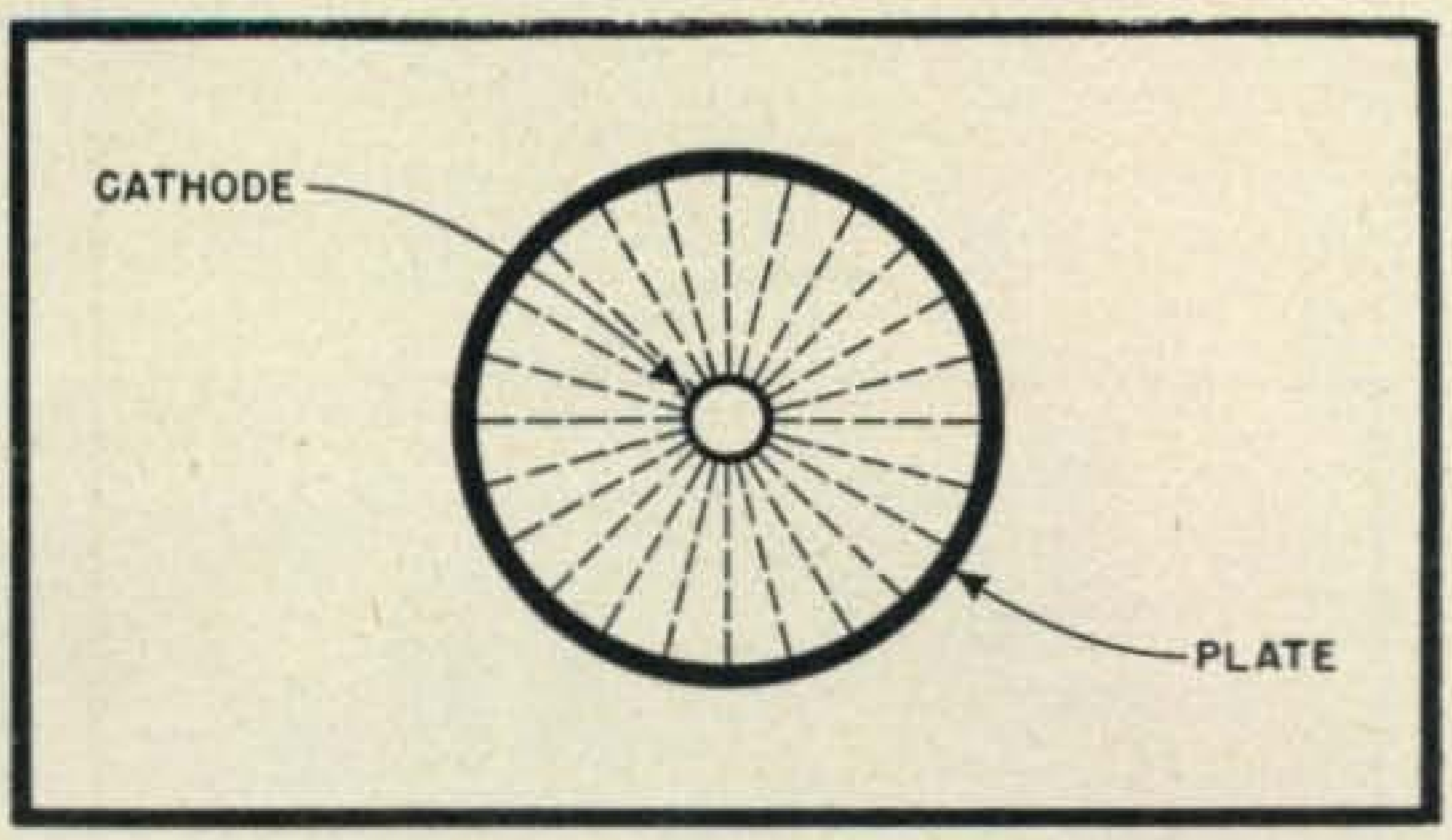


Fig. 9. Spiral electronic pattern in the magnetron

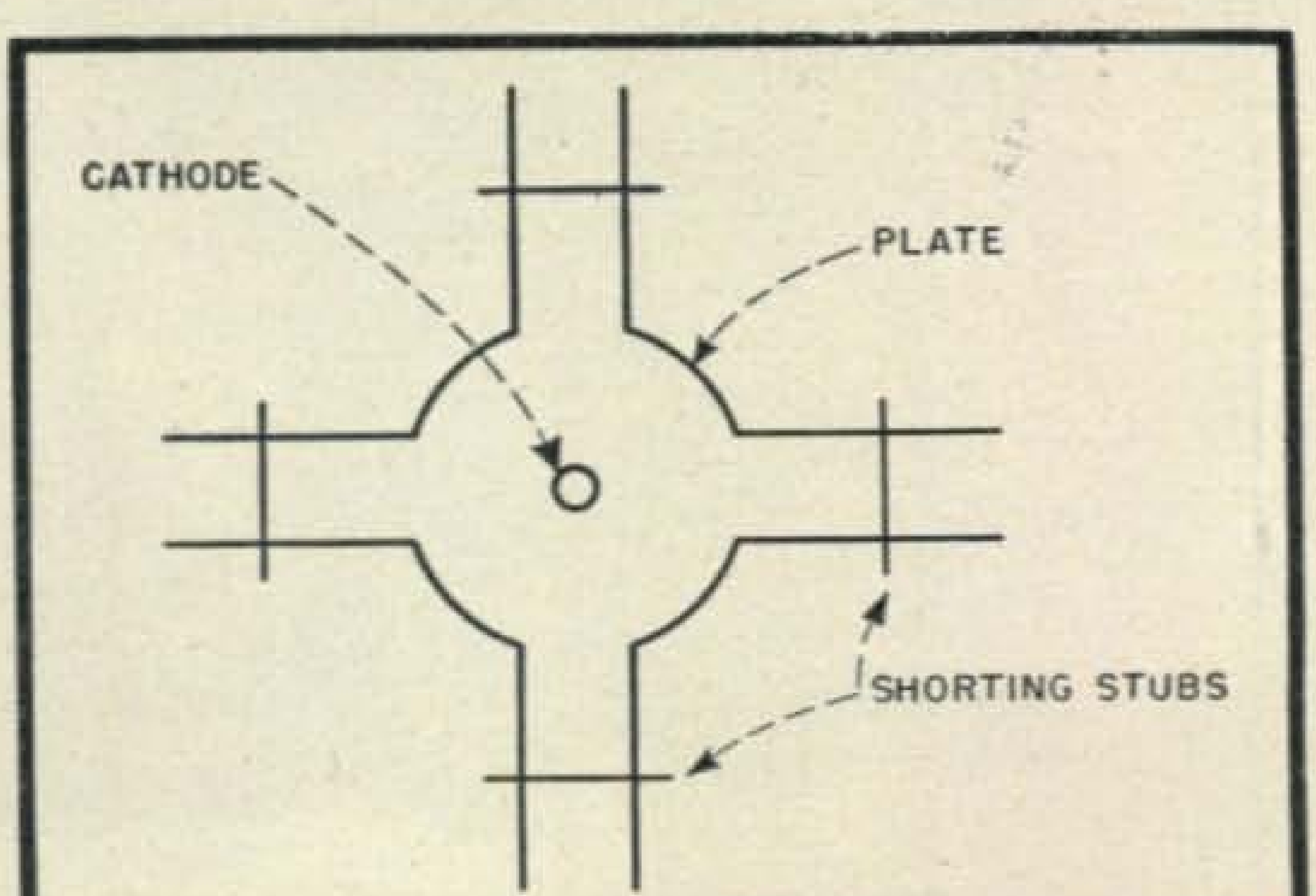


Fig. 10. Shorting stubs which can be used on fairly high frequencies, but not on microwaves

400 WATTS ON 144 MC

LAWRENCE LeKASHMAN, W2IOP, and JAMES J. HILL, W2JIH

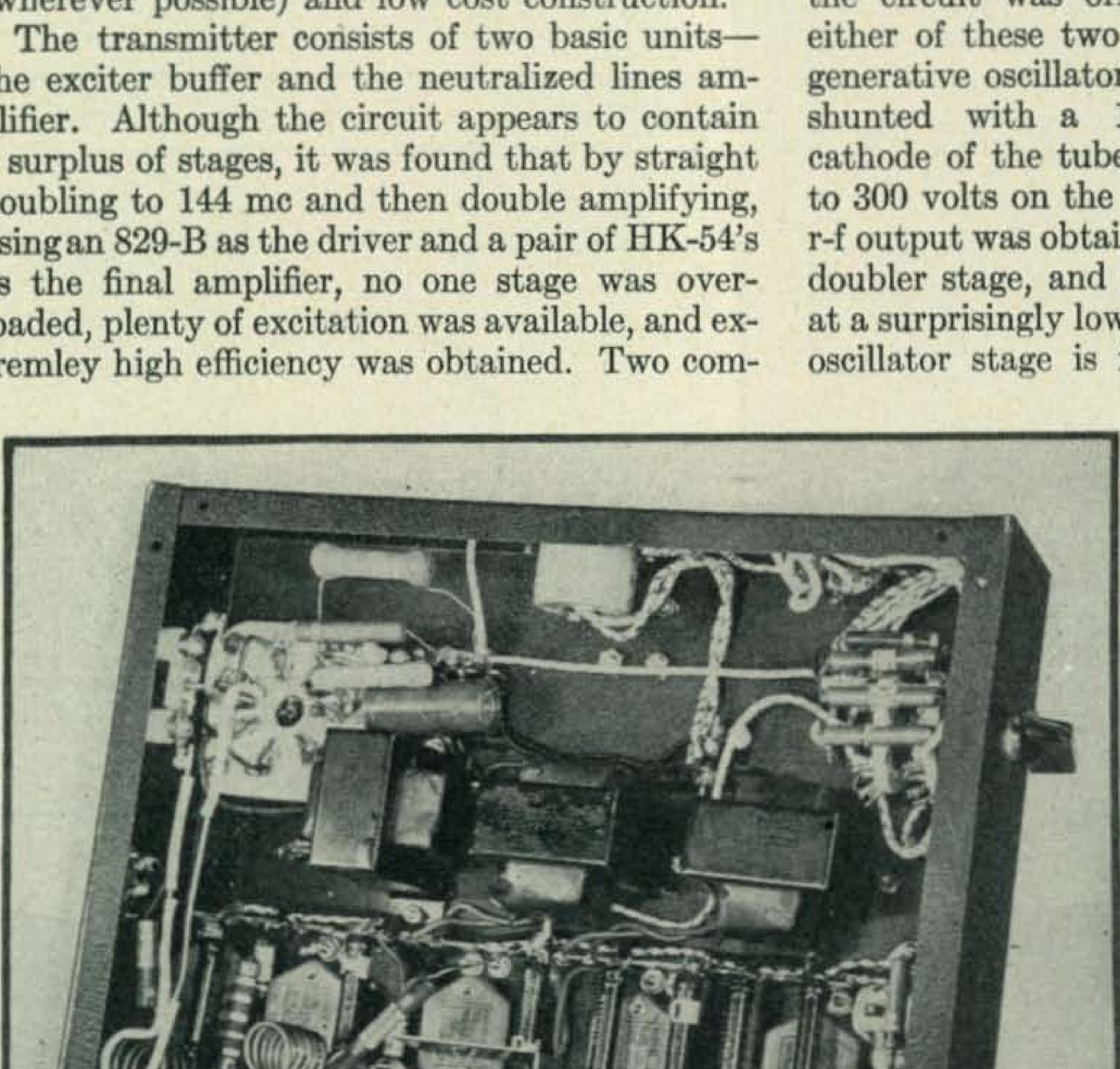
The 829-B driver in this 400 watt transmitter makes a compact transmitter by itself. Coupled to the HK54's in a neutralized lines amplifier it is a highly efficient low cost transmitter

AMATEURS USED TO shudder at the thought of using crystal control on frequencies even as low as 56 mc. During the war, many high efficiency, high frequency tubes were developed, making it a relatively simple matter to construct a small, compact, efficient, high power crystal-controlled transmitter for frequencies above 100 mc. The transmitter herein described has been developed and constructed keeping in mind minimum space requirements, standard circuits (wherever possible) and low cost construction.

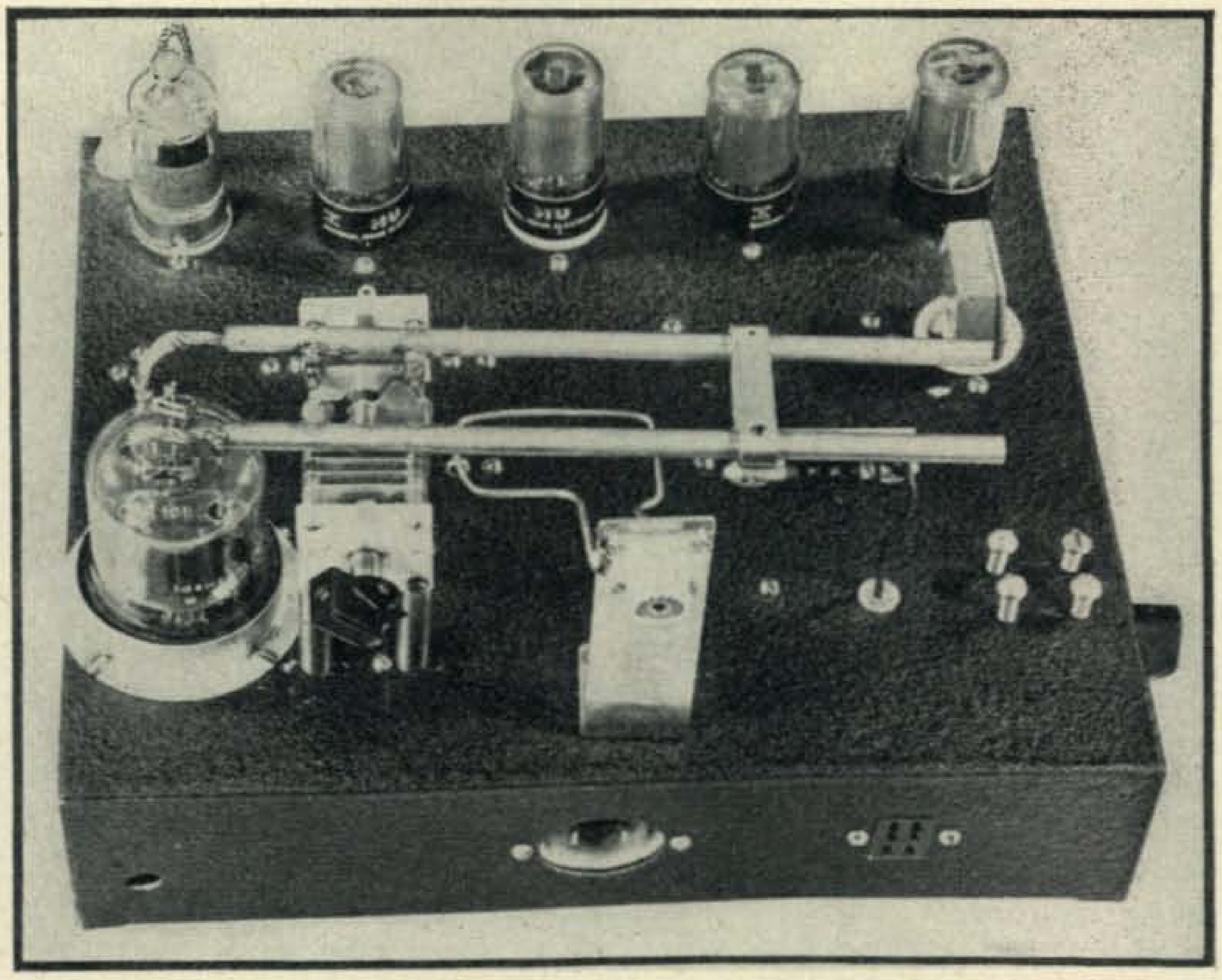
The transmitter consists of two basic units—the exciter buffer and the neutralized lines amplifier. Although the circuit appears to contain a surplus of stages, it was found that by straight doubling to 144 mc and then double amplifying, using an 829-B as the driver and a pair of HK-54's as the final amplifier, no one stage was overloaded, plenty of excitation was available, and extremley high efficiency was obtained. Two comparatively small chassis were used for the complete transmitter. A 12" x 10" x 3" chassis was used for the exciter unit, and a 14" x 7" x 3" chassis was used for the HK-54 lines amplifier.

Exciter Unit

Because of its relatively high r-f output and stability as an oscillator, a 6V6 tube was employed (A 6F6 may be substituted). A 4.55-mc crystal or a 9.1- mc crystal may be used. Because the circuit was originally designed to employ either of these two crystals, it was made a regenerative oscillator by inserting a 2½-mh choke shunted with a 100-$\mu\mu$f condenser-from the cathode of the tube to ground. With from 250 to 300 volts on the oscillator, more than enough r-f output was obtained to drive the next 6V6-GT doubler stage, and the crystal current remained at a surprisingly low minimum. The regenerative oscillator stage is followed by four frequency-



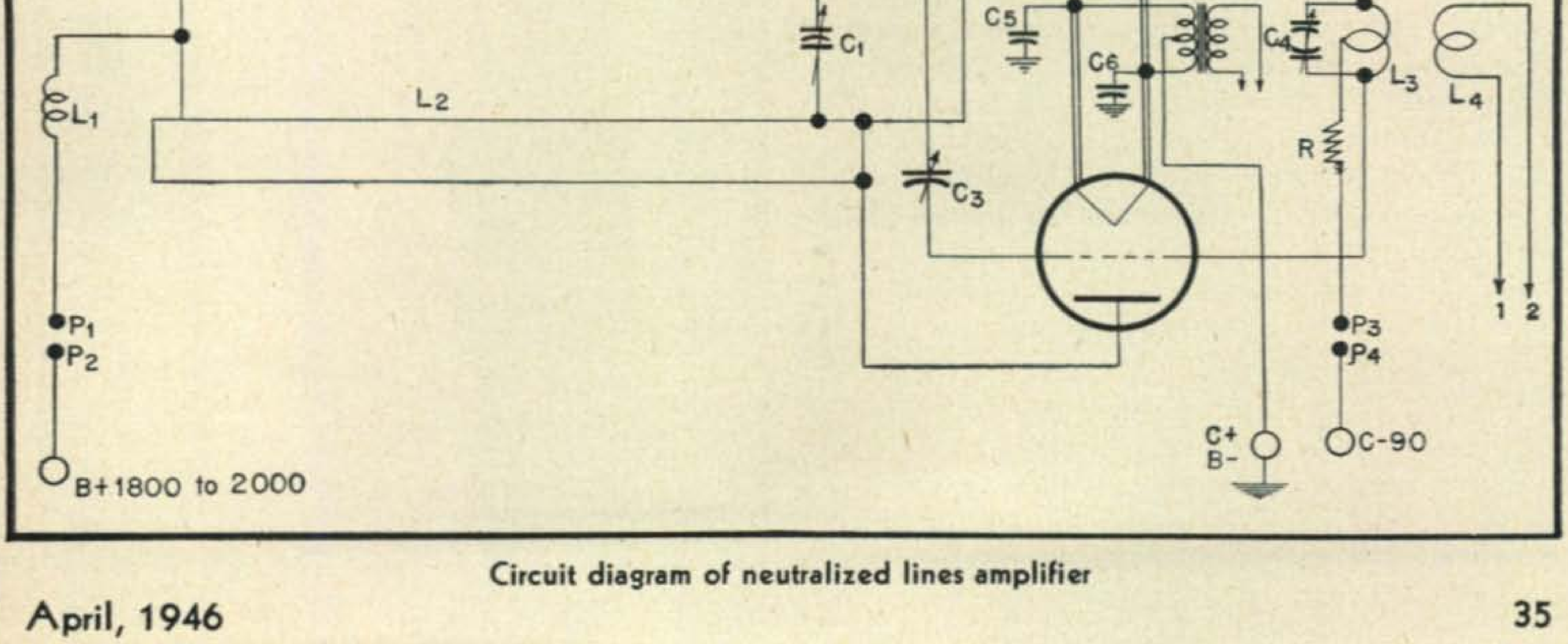
Neat work is the key to success on 144 mc. The placement of parts as shown should be carefully duplicated



The exciter unit ending up in an 829-B makes a complete transmitter by itself

doubler stages—the first three stages being 6V6-GT's and the last a 2E26. The first doubler is capacity coupled to the second doubler, and the second capacity to the third, with fixed 100-$\mu\mu$f mica condensers. When using a 100 $\mu\mu$f-coupling condenser from the third doubler stage to the grid of the 2E26, it was found that the third doubler, or the 72.5-mc doubler stage, was overloaded and drew excessively high plate current. As a result, the tank circuit was changed as shown in the schematic by tuning the plate coil to ground through a 50-$\mu\mu$f condenser and feeding B+ into the plate circuit through a 2½-mh choke tapped at the center of the tank coil. The coupling condenser from this doubler stage to the grid of the 2E26 was changed to a 35-$\mu\mu$f variable padding condenser. This provided sufficient drive on the fourth 2E26 doubler stage and, at the same time, retained normal plate current in the preceding stage.

The 144-mc doubler is link-coupled to the grid of the buffer amplifier 829-B stage. At this frequency, 144 to 148 mc, using standard twisted link coupling, the r-f output was relatively low



Circuit diagram of neutralized lines amplifier and there was insufficient drive on the grids of the 829-B amplifier. By inserting a 35-$\mu\mu$f padding condenser in series with one leg of a link, the grid of the 829-B tuned to resonance and at the same time gave a little over 15 ma of grid drive. It was also found that this eliminated the excessive dropping off of grid current in the 829-B stage during the loading of the plate circuit.

The oscillator coil and the first two doubler coils were wound on 1" x 5/8" diameter bakelite coil forms, and the last two doubler stages were air-wound 5/8" coils. Coil dimensions are given in the table of parts.

All filaments of the exciter amplifier unit may be lighted from one heavy duty filament transformer; however, our model shows three separate small filament transformers mounted beneath the chassis. This was done in order to isolate the cathode circuits of the 72-mc and 144-mc doublers from the preceding stages. About three mils more drive was obtained on the 829-B stage by doing this.

At 144 mc, lead wires which are 6" long or over tend to resonate and therefore should be made as short as possible. It was found unnecessary to by-pass any filaments except those of the 829-B stage. The cathodes should be grounded at the tube socket, and all filament leads should be tightly twisted. R-f by-pass condensers should be mounted directly to their respective tube prongs and tied together with a common ground.

The chassis length of 10" approached very closely to the 1/8th wave length and thus had a tendency to absorb r-f energy. This was eliminated when using the tank circuits mentioned above for the 2E26 stage and its preceding drivers.

The final stage of the exciter unit (the 829-B stage), when shielded with the standard 829-B shield, showed no signs of oscillation unless excited, and showed extremely high efficiency when loaded. Due to the internal resistance of the tube at 144 mc, it will be noted that its efficiency is lower unloaded than when loaded to normal plate current. For this reason, it is advisable to keep the plate voltage below 400 v when making tests with the coupling between the exciter unit and final amplifier stage removed. When the 829-B stage is coaxially coupled to the HK-54 stage, the voltage may be increased to 500 volts with no danger of harming the 829-B tube. However, enough excitation was obtained with slightly under 400 volts on the 829-B amplifier.

The 829-B plate circuit consists of two parallel ¼" copper tubes spaced 1½" apart, 8" long. The only critical part of this stage is the coupling link to the coaxial plug. This link must be made as shown in the schematic so that no reactance occurs which will tend to overload the lines capacitively and to resonate the coaxial coupling cable.

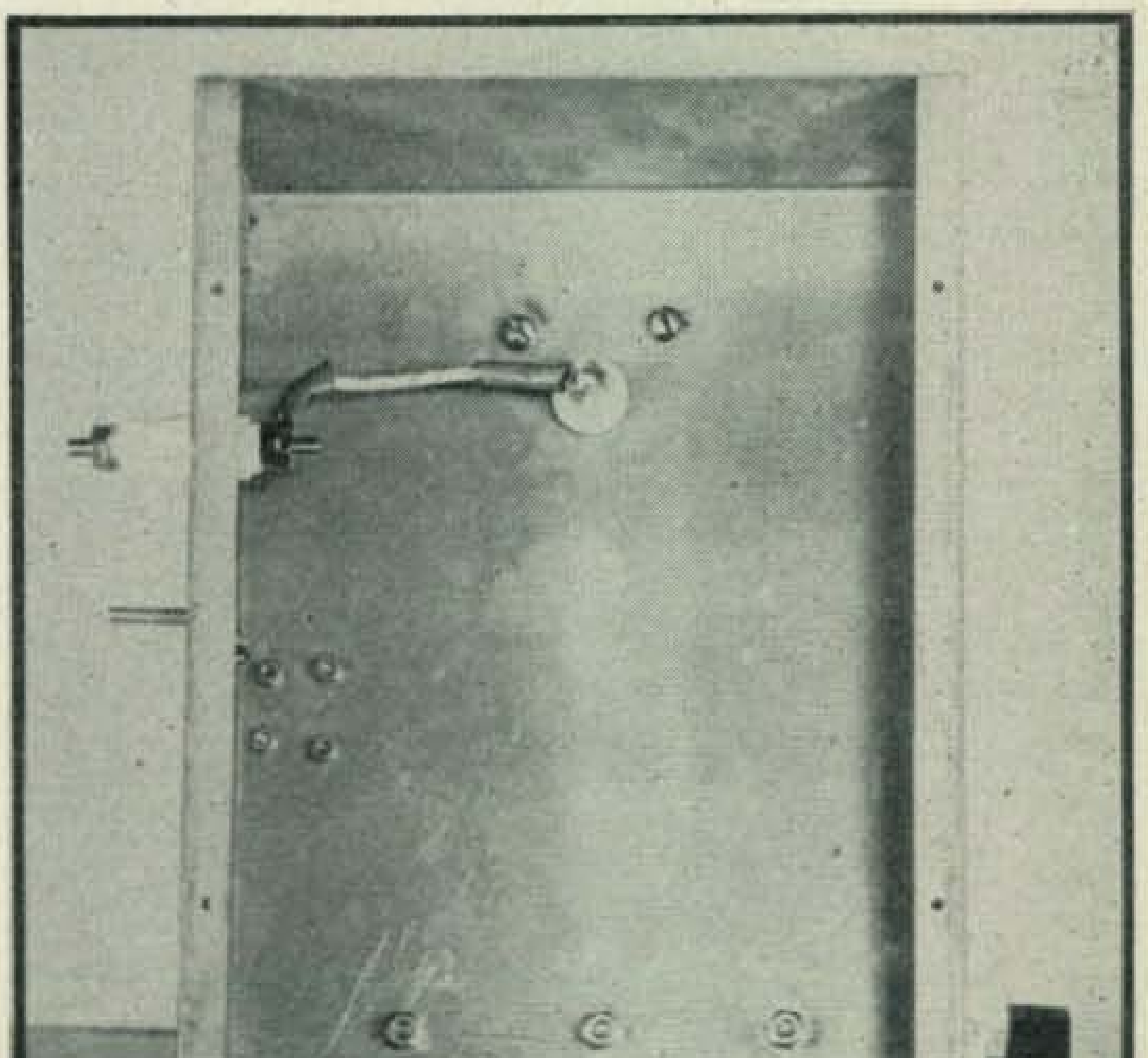
Final Amplifier

A pair of HK-54's were chosen for the final ampilfier because of their relatively low cost, high output and high efficiency at this particular frequency. If the circuit is duplicated exactly, one should be able to operate this amplifier with no trouble from parasitics, with 15 ma per plate static plate current and with 1,000 to 2,000 volts of B+.

The plate lines were made of 5/8" copper tube, 10" long, spaced 1" apart, and were gold and silver plated. This plating is unnecessary for average amateur use and was only employed to determine how efficient the circuit could be made. Without the gold and silver plating, the static plate current per tube will be approximately 25 ma.

The braid used to connect the neutralizing condensers and the grids of the tubes to the grid tuning circuit were silver and were obtained from

The HK-54 amplifier chassis is relatively bare of parts. Notice the unusual filament leads which are wound as a three-turn choke to eliminate r.f. on the cathodes of the tubes

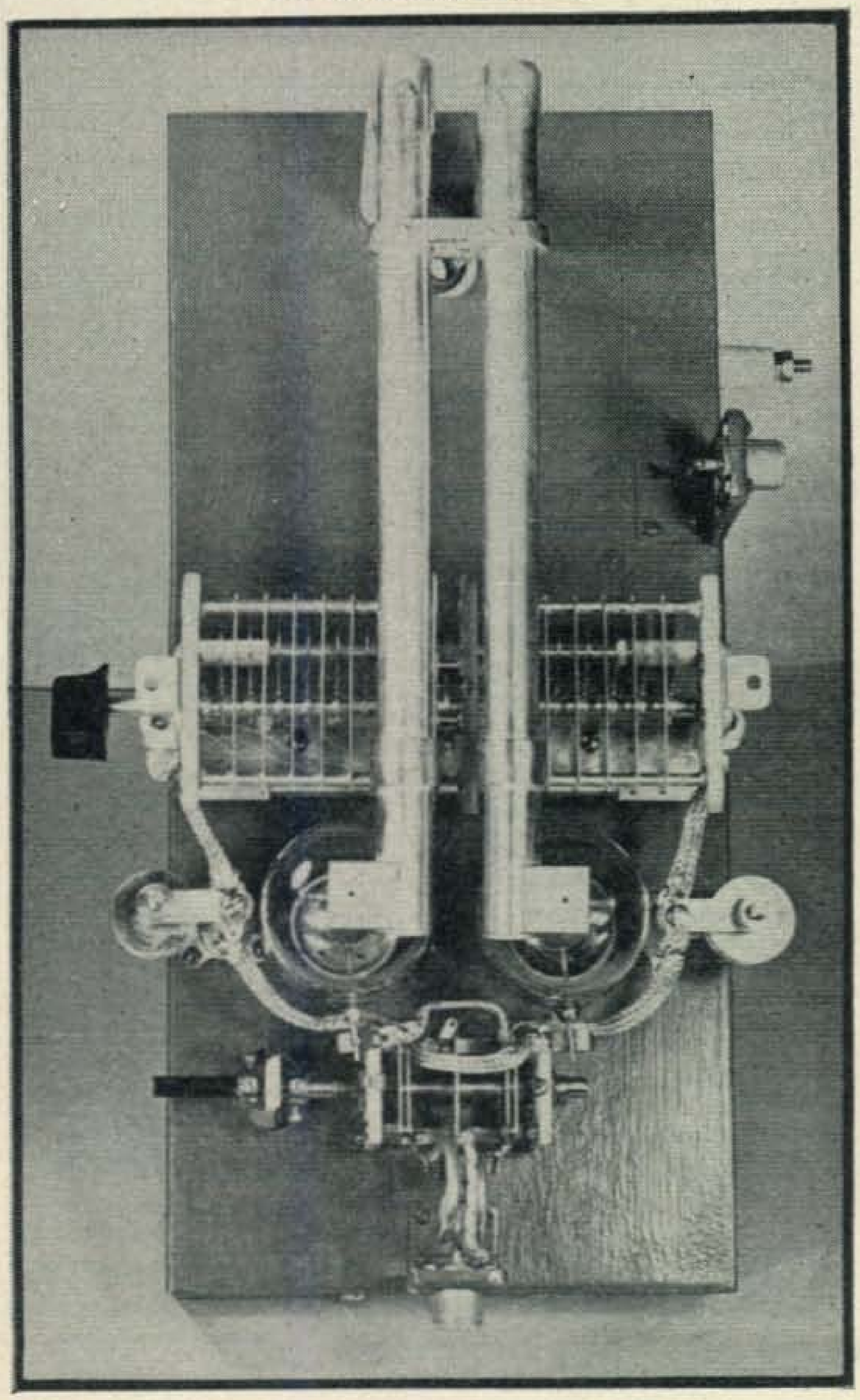


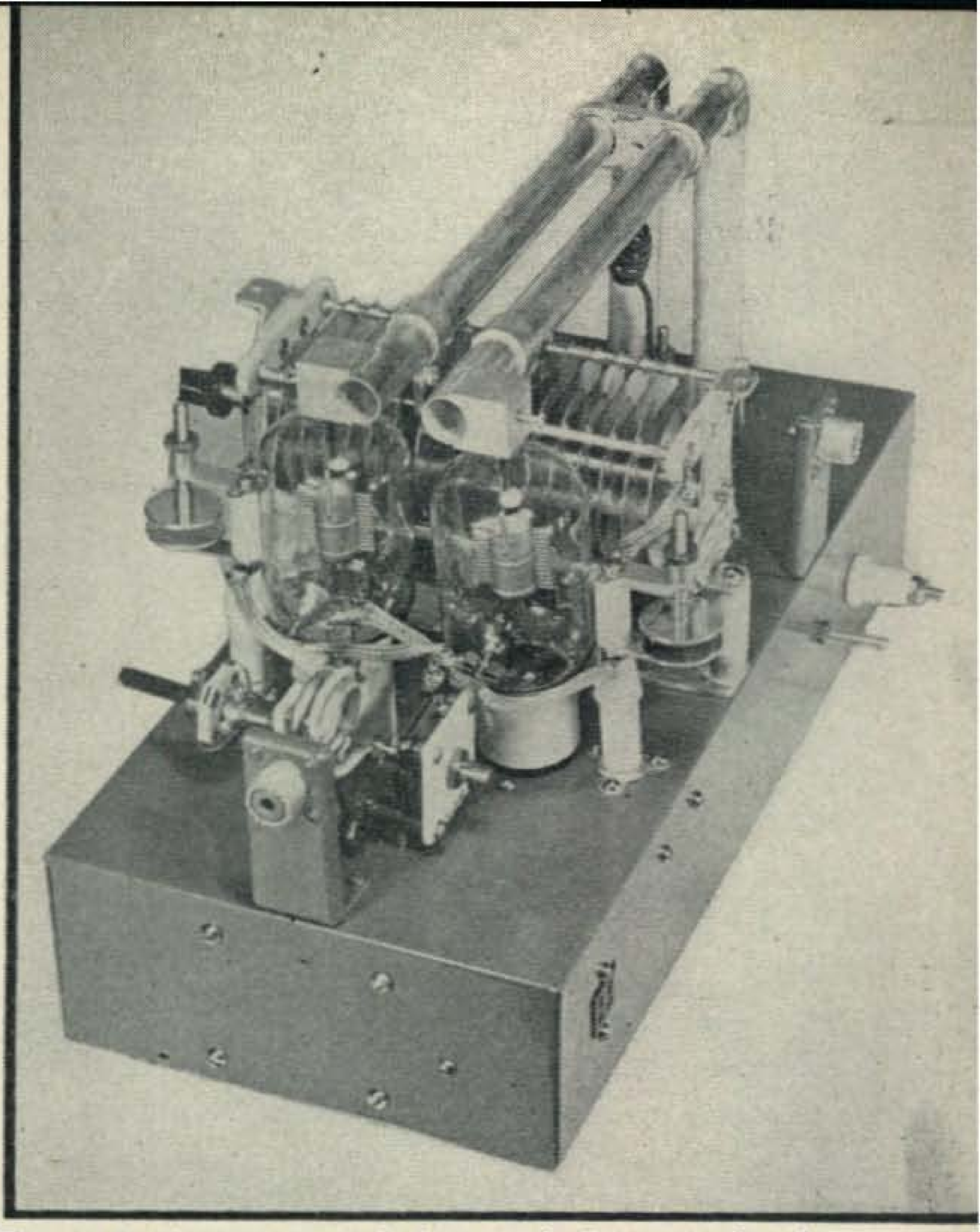
of the 829-B stage; a 0-100 milliammeter for the a piece of RG9U cable. This cable contains a double braid, one of copper and one of silver. By removing the outer vinylite covering and pulling out the polyethylene dielectric and inner conductor, it was fairly simple to separate the two braids for this job. Here again, a common copper braid may be used for the leads.

Dimensions of the lines and the grid coil are given in the accompanying parts list. The same type coupling link should be used in the output of the HK54's as was used in the output of the 829-B.

The only unconventional circuit employed in this final amplifier is that of the filament circuit. Here it was found that ordinary by-pass condensers and chokes would not eliminate the r-f. present on the cathodes of the tubes. It was finally eliminated by winding the filament leads of the transformer around a pencil forming a three-turn choke coil. The filaments of the two tubes were then connected together with 4 inches of ¼″ copper tubing spaced 1½″ apart. Using this method of filament connection, no trace of r.f. was found, with a sensitive r-f indicator.

Simplicity of design makes it relatively simple to duplicate this PA. This same construction can be duplicated with almost any triode with characteristics similar to the HK-54





The perfectly symmetrical design of the neutralized lines amplifier contributes to it high efficiency

Constructional Notes

The photograph of the exciter unit clearly shows the tube alignment as well as the parts placement. If possible, the general placement of parts should follow fairly closely that shown in the under-chassis view. One meter in a meter-switching circuit was used; however no circuit change will be necessary when individual meters, if available, are employed for each stage.

Referring to the schematic, it will be noted that meters are shown in series with the plate leads of the first three stages of the exciter unit while the last three show connection points, P_1, P_2, etc. This was done to indicate that a meter switch connects across points P_1, P_2, P_3, P_4, etc. A 75-ohm, ½-watt resistor should be connected across these points in series with the B+ lead of each stage so that current will flow in the circuit when the meter is removed or switched from one circuit to the next.

The coupling link from the plate of the 2E26, 144-mc doubler to the grid of the 829 B amplifier' driver should be tightly coupled to the "hot' end of the 2E26 stage and to the center of the 829-B grid coil. The coupling link tuning condenser should be tuned to give maximum meter reading in the grid of the 829-B stage with the plate voltage of that stage off. When plate voltage is applied, it will be necessary to retune this condenser to resonance.

A 0-100 milliammeter will be required for the plate circuit of all doublers and the grid of the 829-B stage, a 0-200 milliammeter for the plate grid of the HK-54 amplifier stage; and a 0-500 milliammeter for the plate circuit of this stage.

Operation

The following are average plate currents for the transmitter:

STAGE	PLATE CURRENT
Crystal	20 ma
1st doubler	35 ma
2nd doubler	37 ma
3rd doubler	40 ma
4th doubler	42 ma
5th doubler	45 ma
829-B grid	10-15 ma
829-B plate	125-150 ma
HK-54 grid	35-50 ma
HK-54 plate	150-250 ma

There are two methods of tuning the plate lines of the 829-B stage and the HK-54 stage:

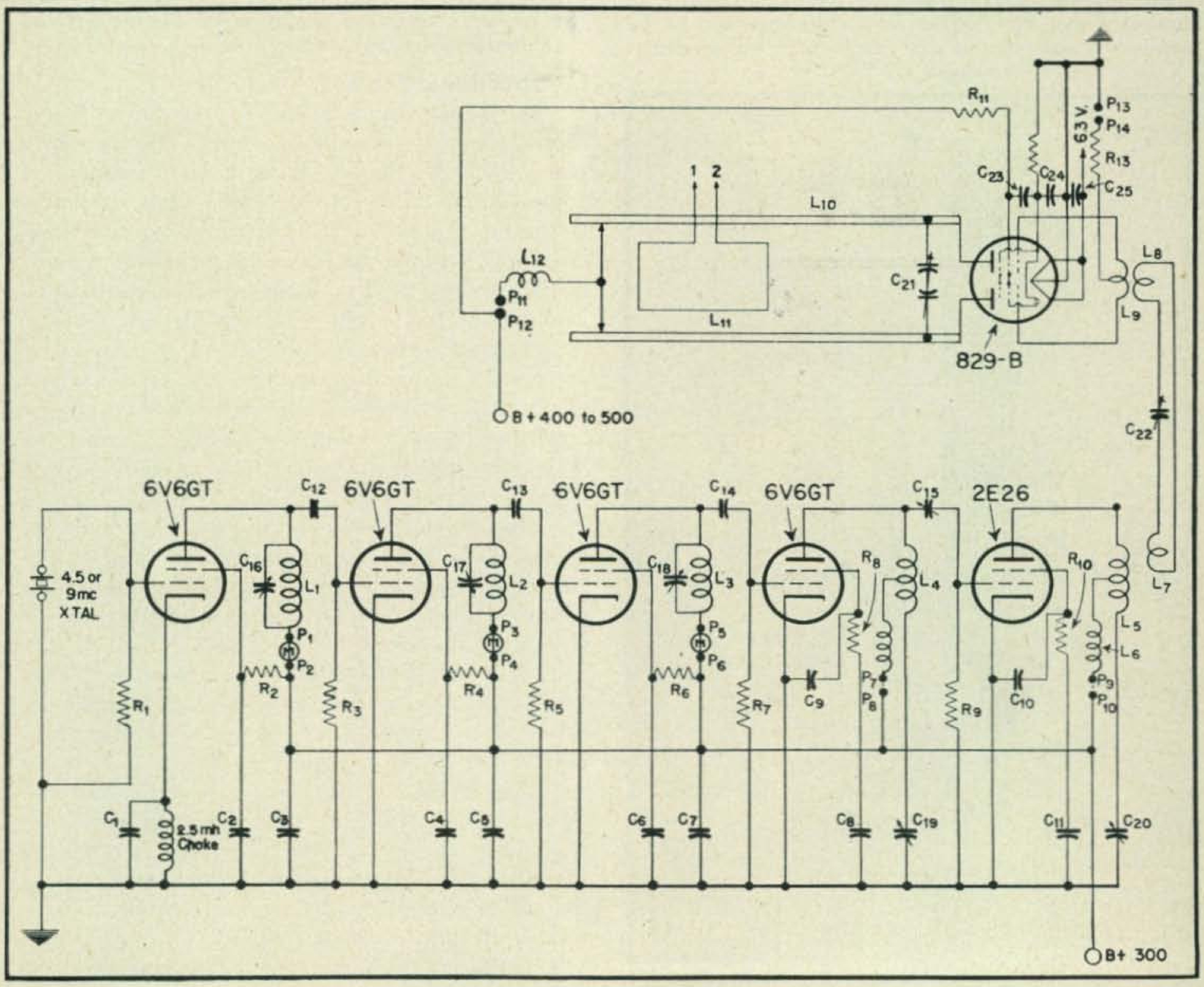
1. With the line shorting bar fairly close to the end of the line, the condenser will hit resonance with the rotor blades three-quarters out. (This gives the best unloaded r-f output.)
2. With the line shorting bar a few inches from the end of the line and the rotor blades of the tuning condenser three-quarters in. (This gives a lower unloaded r-f output, but when coupled to the coaxial coupling line it gives a better match to a 72-ohm coupling and thus transfers more r.f. to the grid of the final amplifier stage.

The Q of the final tank circuit is made quite variable by using a 40 $\mu\mu$f per section tuning condenser as a plate shunt across the lines. By lengthening the lines and using less capacity or by shortening the lines and using more capacity, any line impedance from 30 to 600 ohms may be matched. The final amplifier requires 200 watts of audio for plate modulation.

The final output of the HK-54 amplifier was fed into RG attenuation cable, giving an effective infinite length and was measured with an r-f output meter. The output ran between 300 and 400 watts, with no excessive color showing on the plates of the tubes at any time.

This transmitter is small but efficient and may be duplicated at relatively low cost. For

[Continued on page 62]



Circuit diagram of 829-B driver unit

W9CVU, Charles Boegel Jr. enjoying the first breath of spring at Cedar Rapids, Iowa. 2 meter rig is a TR-4

DEPARTMENTS

- *CQ DX*
- *Parts and Products*
- *YL'S Frequency*
- *Calls Heard*
- *Club News*
- *UHF*
- *Postscripts and Announcements*

CQ DX

By HERB BECKER, W6QD

[Send all contributions to Herb Becker, 1406 South Grand Ave., Los Angeles, 15, Calif.]

It has been a long time since we've had a chance to sit down and really go into this DX thing. As a matter of fact, the last column we dished out was in July 1941. Many of you may remember that due to the slim pickings. DX was somewhat of a misnomer, and we at that time called it X-DX. I know it's going to be a while before we can spread the word around that "DX" is in print again, but we'll make it because I'm counting on the same kind of cooperation I got before on the contributions. After all, it's your column; you send in the stuff and we do the filtering, then put it into what we think might be readable copy.

Well, let's see what we can put together for this time. For the lack of nationwide contributions this column is going to have a rather W6 complexion, but if you can put up with this I guarantee we'll equalize the situation as contributions from other sections of the world come in.

Strayed DX'ers

Maybe a lot of you would like to know, for example, what some of the old W6 DX men are doing. W6GRL will soon become an XU. Doc has been recording the Chungking broadcasts for the last 6 years, never having missed a day. The Chinese Government has thrown a real project into his lap. They want him to take charge of getting a 10 kilowatt transmitter installed in China, and at the moment the transmitter is being constructed. Naturally, Doc couldn't go to China without a ham rig of some kind and so he is whipping something together that he can put on the air, shall we say as "XU6GRL." W6CUH is now with Fairchild Aircraft in Long Island. Dave Evans, ex-W4DHZ (you wouldn't know him by his W6 call) is chief radio engineer at Hughes Aircraft out here, and Ray Dawley, W6DHG, one of the editors of prewar *Radio*, is working with Dave.

In the northern part of California, we find a great deal more interest in DX than seemed to be displayed before the war. Practically all of the hams at Eimac (30 of them) are active on the air and doing quite well for themselves. Some of those old-timers include, W6CEO, W6VX, W6SC, W6WN, and W6CHE. Incidentally, CHE is Jack McCullough. I got a bang out of Jack because for over a year he has had that W6USA transmitter sitting in his new shack and actually operating into a dummy antenna. When the whistle blew for the opening of the 10 meter band, I think CHE must have been one of the first to push the key or yodel into a mike.

W6ITH is doing his usual DX on phone and, at the moment, is building a new rig. W6TT is also working his share of DX.

Further north on the West Coast W7VY, W7FNK seem to be the most consistent on c.w. Again bouncing back to Southern California, 6AM is doing o.k., dividing his time between phone and c.w. Incidentally, Don is getting a big kick out of the anticipated moving to his new super DX location. He has taken over the old hilltop receiving location of Press Wireless on the Palos Verdes hills, which has rhombics headed for practically every point on the globe.

W6LEE, I understand, has worked about 40 countries already and W6ANN likewise is doing well. Other old-timers back on the air around here include 6NNR, 6MBD, 6FEX, 6ENV, here include 6NNR, 6MBD, 6FEX, 6ENV, 6EXQ, 6GRX, and 6SA, who incidentally is very busy at his El Monte location getting his antenna system "just right."

DX!

So far we haven't been able to mention a thing outside of the country but it seemed good to hear fellows like GI6TK, LU3DH, LU7AZ, K6CGK, K4KD, K4ESH, HB9J, OZ2M, and many G stations which I won't try to pin down.

With our hams in the service scattered all over the world, it makes a guy feel a little funny to make WAC by working nothing but W's, which, of course, are operating portable in foreign countries. Some of the other fellows heard include W2OAA/J9, W8RHU/KA2, who is on Leyte 27990, W2KQT/KB6 and then, of course, there was W9TQD/J, who by the way was in Long Beach the other night and has his cards printed for all contacts made while in Japan. All

[Continued on page 59]

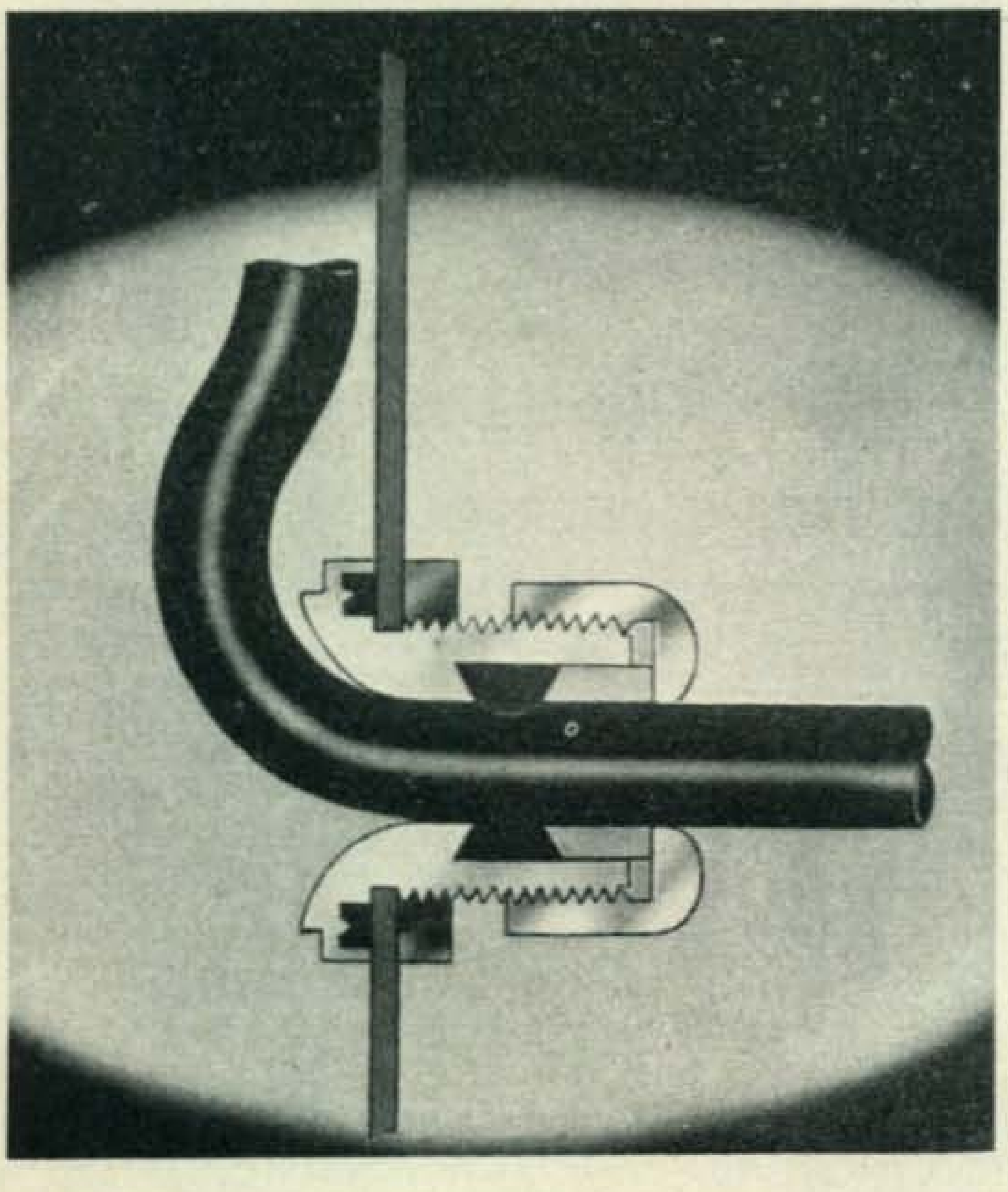
Parts and Products . . .

NEW WATER-TIGHT CABLE LEAD-THRU CLAMP

A new type of cable clamp is now available which offers not only a secure and distortionless anchor for various sizes of jacketed cables, but also acts as a barrier to any flow of moisture along the outside of the cable cover. As shown in the cross-section illustration, tightening the nut at the rear of the clamp places pressure on the internally mounted captivated rubber gasket through which the cable is passed The angular wells of the cavity containing the gasket are so designed that pressure results in the rubber flowing inward to take an evenly distributed grip upon the cable insulation.

All metal parts exposed to contact with the cable are smoothly finished, thus eliminating any possibility of cutting the cable insulation even under the most severe conditions of vibration.

Neither the effectiveness of the clamp nor its water-tight feature will be impaired, even though the cable be removed and reinstalled many times. Originally designed and used for both rigid and flexible coaxial lines, this same clamp is equally effective when used for radio leads and high or low tension line lead-ins, or for any other lead, through where it is desirable not to cut the cable or line. The clamp is designed and manufactured by H. H. Buggie & Company, Toledo 1, Ohio.



G.E. GL-592

A new transmitting tube, Type GL-592, has been announced by the Tube Division of the General Electric Company's Electronics Department.

This new tube has been designed for use in amateur radio and industrial applications which require power in higher frequency ranges.

Transmitting Tube GL-592

Maximum ratings of the GL-592 apply up to 110 megacycles. The new tube has a maximum d-c plate voltage rating of 3500 volts and a maximum plate dissipation rating of 200 watts under class C r-f amplifier and oscillator conditions. Under these conditions the maximum plate imput rating is 600 watts.

Fernico-seal design of the tube makes possible elimination of bases, soldered terminals and permits a reduction of leads length: This design provides greatly increased structural strength.

[*Continued on page 58*]

E·L MODEL 2606

INPUT: 6VDC at 8 amps.
OUTPUT: 300VDC at 100 ma.
DIMENSIONS: 4¼" x 4⅞" x 5¼"
WEIGHT: 5 lbs. 2 ozs.

Amateurs!

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in your portable rig

No matter what the particular power requirements of your rig may be, there is an E·L Vibrator Power Supply built to fill your needs. E·L Vibrator Power Supplies deliver constant output voltage despite wide variations of input; have power outputs up to 1000 watts; and can furnish any wave form including a pure sine wave. Units are available with multiple input and multiple output. All are lightweight, sturdy, and are superior in performance and dependability.

The latest E·L post war model, No. 2606, pictured above, is ideal for supplying plate and grid voltages in receivers and transmitters. It delivers up to 300 V DC at 100 ma and power output up to 30 watts, from a 6 V DC supply. Its great usefulness is indicated not only in radio, but in P. A. systems and in test equipment, as well. Completely filtered, the output is hum-free. Model 2606 is ideal for stationary, mobile or portable communications applications such as used by amateurs, police, coast guard, and in marine and farm applications where battery power is all that is available. It will pay *you* to investigate the advantages of E·L Vibrator Power Supplies. Catalog sent on request, or see your dealer.

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The YL's Frequency . . .

by Amelia Black, W1NVP

Amelia Black, ex-W4HZP, W1NVP, is just about a typical YL. Back in 1939 she had only a general-science knowledge of radio. Then she met W2ESO/W4GNQ (all one fellow) at a dance. They were married the following summer and Gene through adroit maneuvering got his wife to study for her ticket. Prior to the war W1NVP was on 20, 40, and 80 c.w., worked in most contests, and as might be expected from a YL was a member of the Rag Chewers Club. Now on c.w. and phone, she and the OM are looking for a good radio location with plenty of room for two stations.

Amelia Black, W1NVP

As a typical YL ham, my first premise in writing this column, is getting more of a voice for the YL in ham affairs. Obviously this can be best accomplished by closer cooperation among the YLs and a better chance for expression of their thoughts. In fact, that is the primary purpose of this column—to let the YLs speak. All you YLs, ham or aspirant, are invited to write in your grievances, thoughts, and suggestions.

A regular portion of this column will be devoted to the most interesting and pertinent letters received each month. Here you can exchange ideas and get the reactions of others to your own thoughts.

Here, perhaps, those unlicensed wives of hams will become inspired to get their own tickets or at least will find a way of sharing the OM's hobby by understanding it better.

Someone has suggested a YL chain letter to be originated in this column and sent throughout the country. You might let me know what you think of the idea.

Another regular feature of the column will be the YL of the month. Usually this will be an active ham, but we will also include ham's wives who are as yet unlicensed but genuinely interested in the hobby. We'll try to select persons whose stories are not only interesting, but whose thoughts and philosophies should prove helpful. If you know of someone you think would fit into this category, please let me know.

In other words this is your column—to be handled as you wish. You can have chatter, letters, contests, even technical advice as far as I'm able—if you must! We want to make the Woman's View your very own.

YL of the month—Dorothy Evans, W1FTJ

Appropriately enough, our first YL of The Month is from the first district. She is Dorothy Evans, W1FTJ, one of the most active and best known YL operators in the country.

Dot's interest in ham radio dates back to 1931, when her brother, who is W1BII, helped her into the hobby, and she became the second licensed YL in New Hampshire.

From the beginning Dot was a very active ham, and from '31 until '38 spent most of her time rag-chewing, usually on 80 meters.

In 1938 this was changed by her marriage to W1BFT (then SCM for New Hampshire) who, she says, "is such a dyed-in-the-wool DX and contest enthusiast that I just HAD to let the DX bug bite me too." No doubt she did, for at the time of this writing she has a WAS certificate and needs only one more continent for WAC. She is a good c.w. operator, as is shown by a 35 wpm

[Continued on page 48]

Calls Heard

HEARD IN NORTH CHARLESTON, S. C.

Marvin J. Fein W2JUW/4

28 Megacycles 1/15/46—3/10/49

A1

DG4RS	F3AAL	F3XN	F8BBA
FA8DA	FM8AC	G2GL	G2JU
G2PL	G2PN	G3SN	G5L1
G5PP	G5SN	G6QB	G6SQ
G6WU	GI6TK	HK1AB	HK2AC
G6ZO/I	W7DRF/I	K6BHL	W4EPT/K6
W6TZB/K6	W7FJU/K6	W9DTE/K6	
W6MBA/KB6	KZ5AA	LU3DA	
LU7AZ	OZ2M	TG9AK	TG9WPB
VP2AT	XACA	XACD	XACK
ZS1AJ	ZS1AX	ZS2AL	ZS2BZ
ZS2CD	ZS2X	ZS2Y	ZS4AA
ZS4AY	ZS5CK	ZS6AM	ZS6DF
ZS6EQ	ZS6FN		

A3

W3FWI/CT	CX2CA	CX2CO	D4ABK
D4ACD	D4ACZ	EK1IND	FA8NF
G2PU	G4OC	G8IG	K6CGK
K6MVV	W2LYE/K6	W4EPT/K6	
W6NHS/K6	W9KLE/K6	LU7AZ	
SU1MW	VK2GU	VK2AHP	VP2AT
VP6JR	VP6YB	ZS1T	ZS4AA
ZS4H	ZS5S	ZS6DW	

HEARD IN YONKERS, N. Y.

J. Alan Biggs, W8LO/2

28 Megacycles Nov.-Dec. 1945

FA8NF	EA1D	K4HQU	HK3AB
W9LOG/VP4	VO2KJ	VP2AT	
W8BOR/PY			

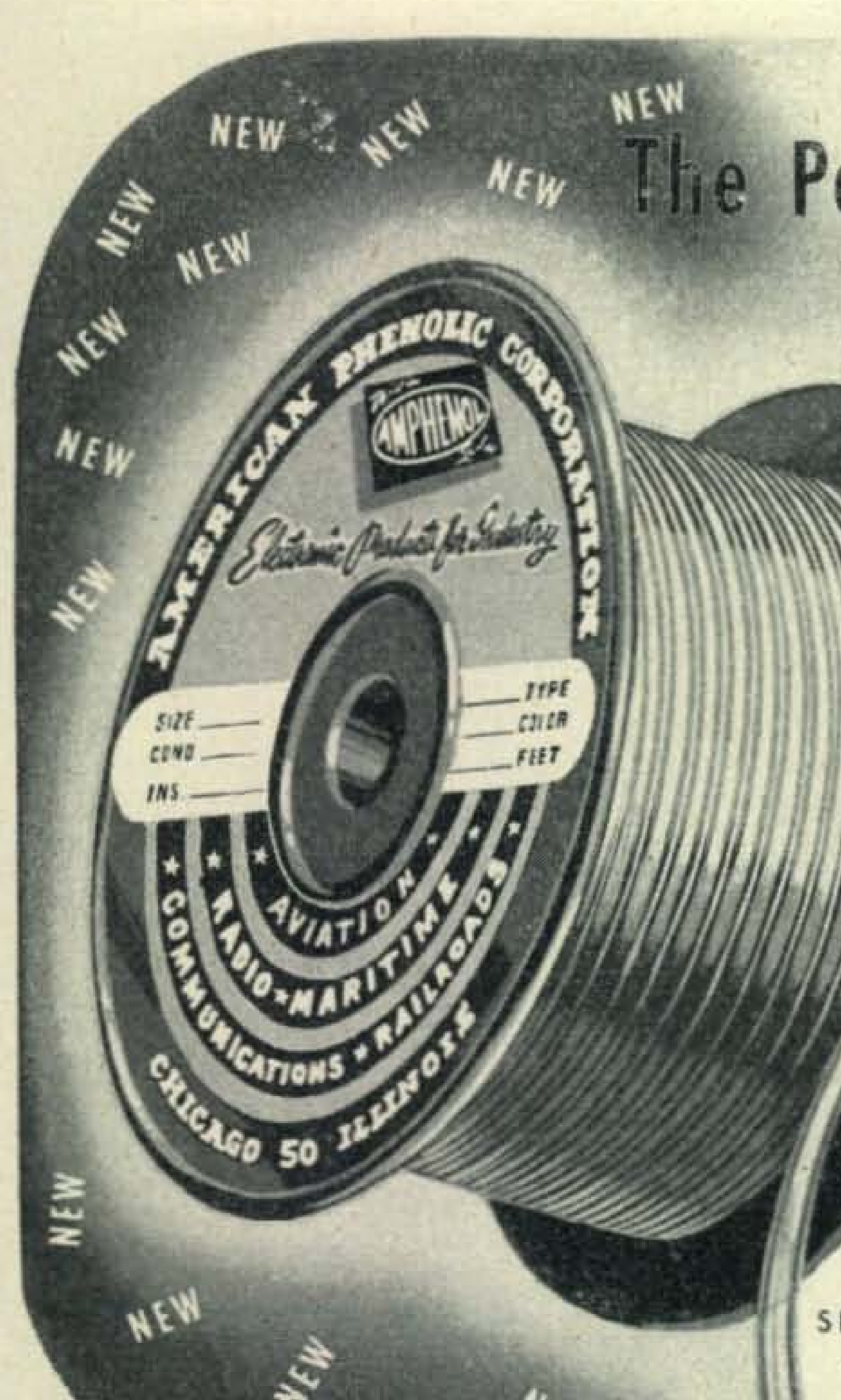
28 Megacycles Jan. 1946

ZS6DW	K4FSP	K4IFO	K4JA
TG9JBM	XE1A	W9LOG/VP4	
W9MDQ/K4	W4HVT/PY7		

28 Megacycles Feb. 1946

CE2CI	CE2CE	CE2CO	CO8RL
CO2CO	CX2CO	CX5AY	CX4CX
D4AEC	D4ADW	D4ACC	D4AEI
D4ABK	D4ABU	D4AAG	F1DK
F3XN	EK1IND	FA8JD	FA8NF
G6VX	G6KL	G2TA	G6GO
G8RN	G3MI	G5ZJ	G3QD
G3BM	G6CU/ZC2)	GI6TK	GM3YS
GW2UH	HC1FG	HK1AB	HK3AB
K4ENT	K4DUZ	K4FSP	K4HLP
LA4P	OA4B	ON4F	OZ1
TG9JW	TG9JBM	TG9WPB	LX1DP

AMPHENOL



The Perfect Parallel Line Lead-in Wire

Amphenol Twin-Lead is a new type of radio frequency transmission line which combines the low cost of an open line with the excellent dielectric qualities of Polyethylene as a continuous spacer and insulator for the line. It is light and flexible—it can be tacked to a wall and is easy to lead in under a window sash. Its resistance to moisture, cold and heat is far superior to the usual rubber insulated, woven-braid-covered twisted pair used for antennas prior to the war.

Twin-Lead is made in three impedances that serve numerous applications. Selection of type is a simple matter. The *300 ohm* line is the most universal in use, particularly for FM and Television reception. Amateurs are using this line for both antenna and lead-in. The *150 ohm* type is excellent for antennas used mostly for short-wave broadcast reception, and is useful as a link between stages of a transmitter. The *75 ohm* line, originally designed for amateurs who operate in narrow bands of frequency, is also many times better for broadcast reception than the conventional rubber covered or cotton covered wire generally used.

It is to be emphasized that Amphenol Twin-Lead should not be thought of as exclusively for use at ultra-high frequencies. It is THE antenna lead-in for all frequencies.

AMERICAN PHENOLIC CORPORATION
CHICAGO 50, ILLINOIS
In Canada • Amphenol Limited • Toronto

SPOOL SIZE
10½" x 6"

ELECTRICAL DATA

300 ohm — Amphenol "Twin-Lead" Transmission Line is available in 300-ohm impedance value. RMA standardized on 300-ohm lead-in line for Television as the most efficient over broadband operation.

75 ohm — Amphenol also supplies 150-ohm twin-lead to those interested in particular applications and experimental work.

150 ohm — Designed especially for amateurs who operate in very narrow bands of frequency or one particular frequency. Ideal for dipoles with a nominal impedance of 72 ohms at the frequency for which they are cut. This line is also excellent for broadcast reception.

Dielectric constant of Polyethylene—2.29

Capacities (mmf per ft.): "300"—5.8; "150"—10; "75"—19.

Velocity of propagation (approximately): "300"—82%; "150"—77%; "75"—69%.

Power factor of Polyethylene—up to 1000 Mc—.0003 to .00045.

ATTENUATION—FM AND TELEVISION BAND

Megacycles	300-ohm DB per 100 Ft.	150-ohm DB per 100 Ft.	75-ohm DB per 100 Ft.
25	0.77	0.9	1.7
30	0.88	1.03	2.0
40	1.1	1.3	2.5
60	1.45	1.8	3.4
80	1.8	2.25	4.3
100	2.1	2.7	5.0
200	3.6	4.7	8.3

Depend upon AMPHENOL *Quality*

COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS, FITTINGS AND CONDUIT • ANTENNAS RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

LU3DH	LU3AC	LU4AC	LU3AQ
LU7AZ	K7HAR	K7IUN	VP2AT
XE1AC	XE1CX	XE3BK	W9LOG/VP4
W4HVT/PY7	W9QMD/KE6	W9MDQ/K4	
W6RNJ/PY7	KB4ACX/K6		

28 Megacycles Mar. 1-12, 1946

CE1AA	CE1AO	CO2RG	CO5FL
CX2CO	CP5EA	D4ACX	D4AFJ
D4ACD	D4ACT	D4AII	D4AEI
D4ACA	F3XN	F3ZN	F8BAR
F8XYZ	F3ACB	FA8NF	FA8JD
G5IU	G6KQ	G4NT	GW6JW
GW5XN	HB9BR	HB9ND	HH5E
HK3AB	HK1AB	K4GIG	K4FSP
K4DUZ	K4ENT	K4EJD	K7HAR
W6QYE/K7	LA8C		LU3DH
LU7AZ	LA8M	LX1DP	OA4AK
OZ5BW	OZ2M	OQ5B	OQ5AE
PY2FB	PY2AJ	PJ3X	PAOUN
SU1MW	SU1USA	TG9JF	TG9FG
TG9RFC	ON4F		W6QKB/KB6
W9WUG/KB6	W4HVT/PY7		W9QCI/CT2
W8SHI/NY4	W6PQE/K4		W9YM/KB6
W6PUZ/KB6	W5HHF/J		W1NDA/J5
W9JYF/J	W5JFE/KB6		W9DCH/J5
W5DBT/MM	VP2AT		VP6YB
XE1D	XE2FC	XAAA	XACM
YV5AN	ZS1T	ZS2CI	ZS1AX
ZS6FN	ZS6DW	DXEH7	G6CU/ZC2

The YL'S

[*from page 44*]

code proficiency certificate and membership in the A-1 Operators Club.

A friend of ours from New Hampshire, who knows both Dot and Carl, says that they each have a separate receiver and transmitter, and during Sweepstakes, ORS parties, and the like, they operate simultaneously, each trying to come out ahead of the other. In the '39 Sweepstakes Carl placed first for New Hampshire, and Dot was runner-up, but the next year Dot won; with Carl in second place. She admits, "We probably lived on canned goods over quite a few week-ends, but it did us no harm, and brought us a heap of fun." Dot also won the first annual QSO party, given by the Young Ladies Radio League in 1940, and a code proficiency contest at a Boston hamfest in 1941.

W1FTJ is a past president of the Young Ladies Radio League, and is one of the few YLs to hold the position of Section Communications Manager —a post she has held in New Hampshire since 1940. She was awarded a Public Service Certificate for operating at the time of the New England flood-hurricane.

[*Continued on page 50*]

Dot says her real love is operating, and that her technical knowledge is slight. She feels fortunate that there's always been a brother or a husband to build the equipment and to keep it perking.

The Evans' have two little boys, one born in '42 after Carl had been sent to sea, and the second born on V-J Day in Memphis, Tennessee, where Carl was then stationed.

They've been back home since last October, and are now in the process of re-opening their radio supply store in Concord. Here, too, they cooperate, for from the time of their marriage until they closed their business in 1941, Dot helped out by handling the office work in the store.

Dot says, "We have found that a ham-and-ham marriage is a mighty fine combine. We know what the other fellow is talking about—have a keen mutual interest in our hobby, and have oodles of mutual friends, many of whom we've never seen."

Dot Evans, W1FTJ

CLUB NEWS

Monmouth (N.J.) County Amateur Radio Association

All districts and several distant countries were represented at the recent Hamfest sponsored by the MCARA. Close to three hundred amateurs, YLs and XYLs, enjoyed an evening crowded with games, contests, music and refreshments. Those participating in the various humorous contests and those holding lucky tickets were amply rewarded with prizes of valuable equipment. The hard-working prize committee was fortunate in obtaining scores of desirable prizes ranging from headsets to complete transmitters and communication receivers.

This gala affair was the second of its kind given in recent months by this rapidly expanding organization. Representatives were present from *CQ* magazine, the American Radio Relay League, the Union County Amateur Radio Association and from various radio firms. All districts were represented and DX included VK2AJZ.

Preliminary plans are already under consideration for a still larger and better Hamfest. Plans are also being made for field days in the coming months. In the meantime all non-members are welcome at the bi-monthly meetings of the Association. Meetings feature qualified speakers on timely subjects and are frequently supplemented by sound movies. The organization is fortunate in having among its membership many prominent engineers who perfected much of the U. S. radar equipment in the nearby Signal Corps Laboratories. Correspondence may be addressed to Sidney Berg, Pres., W2IID, 74 Barker Avenue, Eatontown, N. J.

Westchester Amateur Radio Association

The Westchester Amateur Radio Association, founded in 1932 and now numbering 123 active members, invites visitors to their openmeetings. A speaker on some subject of general interest addresses the club at regular meetings. A feature of one meeting a month is a "swap" period where members bring in equipment they wish to trade.

A novel idea of the WARA is the position of Complaint Manager on their officer list. It is his job to aid hams who have had broadcast listener complaints. Dues are twenty-five cents a year for active members, one dollar a year for associate members. Meetings are held at the County Center, White Plains, N. Y. on the 1st and 3rd Thursday of every month.

Syracuse (N.Y.) Emergency Radio Communications Association

Amateurs in the Syracuse area who do not already know the ERC will do well to contact Ken Thomas at 316 South Warren St., Syracuse 2, N. Y. Not the least of the ERC's activities is the publication of an outstanding club newspaper, "The ERC Bulletin." Club activities include the continued operation of emergency communications and a full program of ham projects.

Cuyahoga Radio Association, Inc.

Cleveland Amateurs are invited to join the activities of the CRA. Details may be obtained by contacting W8QV, Ellis A. Smith, 2307 Allison Rd., Cleveland 18. Telephone Fairmount 8226. Directors of the CRA are W8LEX, W8NV, W8JNF, W8BUM. W8FP. W8SSW, and W8LB.

HAMFESTS

Greater New York

The North Shore Radio Club of Long Island will sponsor the second annual hamfest to be held in New York since the end of the war. It will be held Friday evening, April 26, 1946, at the Commercial Hotel, 96-43 Springfield Boulevard, Queens Village, Long Island, New York. As a result of the success of last year's Hamfest, larger facilities have been provided for the additional hundreds expected to attend.

The planned program, while essentially informal, will have as a theme "The Radio Amateur Looks to the Future." There will be prominent speakers from both the amateur and professional communications fields, over 100 door-prizes, and miscellaneous entertainment.

All radio amateurs are welcome at the Second Annual Hamfest. Tickets will be available at most New York radio stores dealing in amateur radio equipment, from North Shore Radio Club members and at the door. Price of admission is one dollar.

New England

The New England Division of the American Radio Relay League is holding its annual convention at Framingham, Mass., on May 6, 1946, sponsored by the Framingham Amateur Radio Club. This is the first convention of its kind since the termination of hostilities, and an unusually large attendance made up of people from all parts of New England and New York State is expected.

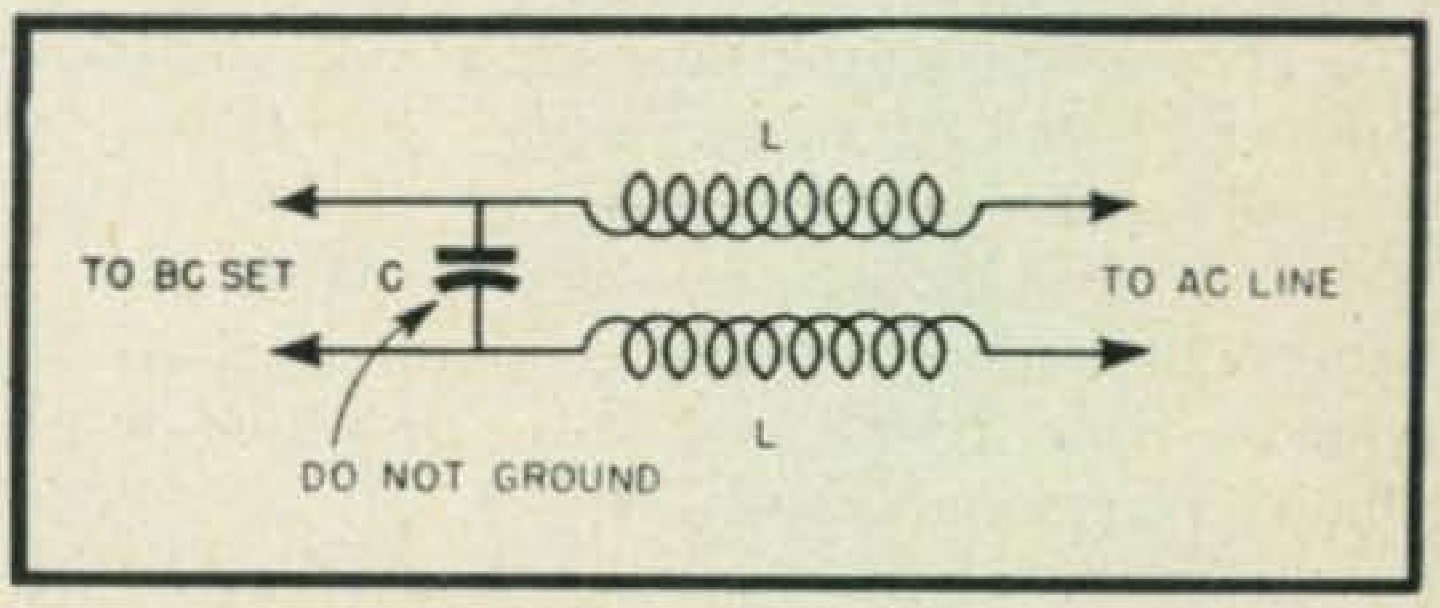
There will be displays by the leading manufacturers, as well as talks by competent authorities in the radio industry. The convention will be held in Nevins Memorial Hall in Framingham. Registration will be at 1 P.M. Starting at 3 P.M., there will be a hidden transmitter hunt on two meters. There will also be speakers and demonstrations throughout the afternoon. The banquet will be held at 7 P.M., followed by entertainment and prize drawings. At least three receivers will be offered as prizes.

CURING BCI TROUBLE ON 10 METERS

There is hardly a ham living in a congested area who does not experience difficulty with broadcast interference. This is especially true when operating on phone. While a-c/d-c midgets and portable sets are usually the most troublesome, shielded and better constructed floor console models also come in for their share of interference.

It has been the experience of W2MPS that r-f chokes in the a-c lines at the transmitter are ineffective and wave traps inserted in the antenna circuit of the bc receiver are useless. This is probably due to the fact that radiated r-f is picked up by the a-c house wiring and fed through to the first audio stage of the bc set.

After considerable experimenting with various unsatisfactory methods, a short piece of broomstick handle was obtained and a pair of r-f chokes



Line filter for eliminating BCI at 28 mc

made with #16 insulated bell wire close wound 5 inches long were tried. Friction tape was completely wound over each coil which were then slid off the broomstick handle. A nice air-wound coil resulted. Speaker or thinned-out Duco household cement generously applied would do an equally satisfactory job.

A 1 μf, 400 v, paper condenser is shunted across one end of the r-f chokes and left ungrounded. The entire unit is mounted in a small metal box approximately 5½" x 3½" x 2". At one end of this box a single a-c outlet is fastened by cutting a hole to fit the receptacle and fastened with a bracket fashioned from 1/16 inch thick scrap iron. An a-c male plug and a short piece of parallel rubber house wire are run through the other end of this box to the r-f choke, completing the unit. The bc set is connected to the a-c outlet on the r-f filter box and the other end connected to the a-c line.

It was found that in every case (12) interference was completely eliminated. In one other case, a floor console model, slight additional interference remained between stations. Bypassing the grid of the first audio stage with a .0001 mica condenser completely eliminated the remainder of the QRM. Living in a heavily populated location, W2MPS has found it to be the answer to his 28- mc BCI problem. Try it yourself.

UHF

by Josephine Conklin, W9SLG*

THERE has been some talk—just rumor, without question—about *CQ* carrying an ultra-high frequency column. If true, it will take some contributions of information of all kinds—technical, contacts, who is on what band, and all of that sort of thing—in order to make it work. So what do you say, gang? Do you want the old column brought back? It is up to you. My ("our" wouldn't sound right in this monogamous country) husband, Commander "Bill" Conklin, is still in the Navy so his contributions will have to be indirect for a while.

What should the column be called? It used to be "UHF" but, technically speaking, below 300 mc is VHF and above it is UHF. Suggestions are welcomed. All contributions may be addressed to Mrs. Josephine Conklin, care of Conklin Radio Company, 6800 Clarendon Road, Bethesda 14, Maryland.

The Old Gang on "Five"

Many of the fellows are getting back on the air. Frank South, W3AIR, has been reported on the VHF bands from Silver Spring, Maryland, along with W3CUD, but his signal on ten meters last night sounded too weak for Silver Spring and too good for Princeton, New Jersey.

W9ZHB is heard from indirectly now and then. His signals were picked up by Bill Conklin, W3JUX, while crossing the Atlantic on the *USS Lake Champlain*. W9ALU also mentioned him, and he has been heard called on the ten meter band here.

Vince Dawson, W9ZJB, the first to work all districts on five meters, is now out of the army, about to become a papa, and rushing his five and ten meter transmitters to completion before his family matters catch up with him. He is back in Gashland, Missouri, just out of Kansas City, and is working on ham equipment at Wilcox Electric.

Don McClenon, W3EIS, is back on a lonely five meter band—or call it six meters if you will—and still works at the Naval Research Laboratory. One of his few companions at the Lab and on Five (both at once) is Mel Wilson, W1DEI/3.

Mel's brother, Web Wilson, W1QB, is still in the Navy and is slightly on ten meters. Bill gave him a replacement crystal for 7006 the other day—from a stock supplied by Bill Copeland, W9YKX, who with his wife have been grinding crystals for the Army all during the war. Web has worked three ten-meter c.w. stations out of

Conklin Radio Co., Bethesda, Maryland

the country, but had little luck inside the country and out of town.

Bud Haskins, W4DRZ, has left the Navy and is back in the insurance business in Fort Lauderdale, Florida. He was also heard on ten meters on the *USS Lake Champlain* in December. His former five meter companion in Coral Gables, "Robbie" Robinson, W4EDD, is in Washington, D. C., and can be heard as W4EDD/3 on ten meters, using about 700 watts phone with a rotary beam on an office building.

May, W5AJG, had an article in *CQ* last fall but no word has come directly from him for several years.

When Bill was in England in December he missed seeing Nelly Corry, G2YL, and was unable to locate G6DH, G5BY, G2HG and other five meter addicts of the pre-war period.

Spring-Summer Skip

It won't be long until the May-June-July short skip will make 50 megacycles of interest to the old gang, but the reduced population of the band at this time may make DX contacts a little hard to come by. Please send in all reports, though, even if you *don't* find the band open. It always helps to pass around the information, because it often happens that two fellows a hundred or so miles apart can soup up their sets and start working each other, after which they occasionally find the band open to another pair who were on the air a thousand miles away. The ten meter DX is likely to be replaced by the summer short skip too, of course.

DX Reports

A number of months ago, K6ORN/W3IPQ was in Bill's office and stated that he had a card or letter from an amateur in South Wales whom he worked on five meters in December 1936 or January 1937 from K6. That certainly would be a tough one to work—just about over the north pole. We never were able to get the British people to become satisfied with reports of transatlantic reception or contacts, and had not heard of their investigating this one. It looks well worth checking into, to see that it is a real contact, not one of these misused-call deals that so often were perpetrated on innocent hams before the war.

One of the odd ones was explained to us a number of years ago by a British ham. A lot of reports had been coming out of a certain station over there confirming reception, and possibly two-way contacts. Upon looking over his place, the investigators concluded that he couldn't have even had a whole receiver on the band! That's from memory, of course, but it does illustrate the difficulties involved in making a thorough check of every reception report over such a difficult circuit as across the north Atlantic.

On the other hand, conditions in Hawaii are known to be more favorable to 50 megacycle work than they are in the north-eastern U. S., and there are very good prospects that the Hawaii-California hop will be spanned by 50 megacycles one of these days.

112 Megacycle DX

Don McClenon, W3EIS, telephoned a while back about some reports from the Miami area, confirmed both ways, about reception in Miami of signals transmitted by one or two radio engineers at the Naval Research Laboratory, using their 112 or 144-megacycle rigs at home. Ed Tilton, W1HDQ, feels very optimistic about the investigation of the reports. During the war, radar signals on about 112 megacycles frequently were picked up by similar equipment between islands in the Pacific spaced some 700 to 1000 miles apart. This looked very much like the old sporadic-E layer DX on five meters.

XU1YV

Lots of you know Commander "Brad" Martin, W3QV, until recently a director of the A.R.R.L. He left Washington for Tientsin, China, several months ago. There, he was sent to Tangku, nearby, to be communication officer of a Marine organization. The Marines got the Chinese Government to issue the call XU1YV to him. While this station is now heard on 28005 kilocycles, coming in from 6 to 8 o'clock in the evening in Washington, D. C., late in February, we'll horn in on W6QD's column to give you more dope on Brad.

Communications were set up using a three-kilowatt Navy Model TDN (Federal FT-300) mounted in a large van. Then other transmitters were set up in a nearby building. Judging from the photograph, most of the antennas are more or less vertical, running up to a strong-back between two large telephone poles.

Brad said that he dug up a BC-610 transmitter, known also as the HT-4, and put it on ten meters. He worked Burma, Alaska, Hongkong, Tinian, Okinawa, Guam, Saipan, Australia, Manila, Japan, Honolulu, and Iwo Jima in two hours each on the first two mornings he was on the band. The total was 40 stations, all worked on phone on 28,100 kc. The input was 400 watts, and the antenna an old Jap one that is about 110 feet in the air. It is a center-fed flat top about 150 feet long. He just tapped on to the feeders at ground level and ran them to the van, which he found to be about the best available living quarters. He expected to improve the antenna when time would permit. Sitting in that van with a three kilowatt rig should be quite a temptation for Brad, we should think. Airmail reaches him for 6c when addressed to Comdr. W. B. Martin, % Gropac, Navy No. 3934, Fleet Post Office, San Francisco, California.

On 28 February, we looked around for W6MBA/KB6 in Tinian and found him on about 28008. Shortly thereafter, while tuning around, there was Brad signing XU1YV. Mostly he worked stations in the middle west and on the west coast

Up to that time W3JUX had not worked any station out of town, phone or c.w., so you can see what an optimist Bill is. Anyhow, he did get on the next evening while looking for Brad, and worked a W6. Then with this band-warming contest on, he hooked LU7AZ, K4ESH, a W6 and some W5's the first thing in the morning. All on the same rig that wouldn't raise a soul before. All was on c.w. this time. Bert Williams, W3-JLN, a Commander in the Navy, had the same trouble and on c.w. finally raised a bunch of W6's in the band-warming contest, along with some DX. A W5 let him shift to phone and gave him a fair report—for the first phone contact out of town in months. All goes to show that it isn't that low power won't get out on ten meters, it's just that the listeners want to skim off the loud ones who have more power or better antennas—or both.

This isn't much of a *UHF* column, you will admit, but it may be a starter until the gang sends in the dope. What say?

PARTS AND PRODUCTS

[*from page 42*]

CARDIOID CRYSTAL MICROPHONE

A new cardioid unidirectional crystal microphone, with high output, dual frequency re-

Cardioid Crystal Microphone

sponse selection, and other features is announced by Electro-Voice, Inc., South Bend, Indiana.

By means of a new, exclusive Mechanophase principle of unidirectivity developed by Electro-Voice engineers, this new model gives true cardioid performance—has wide angle front pick-up, but is dead at rear. Stops feedback. Substantially reduces pick-up of background noise and reverberation. Nearly doubles front pick-up range.

The new CARDAX has a dual frequency response selector on back of microphone which enables wide range flat response for high fidelity sound pick-up or wide range with rising characteristic for extra crispness of speech or high frequency emphasis. Built-in "On-Off" switch adds to convenience of operation. Rugged die-cast case finished in satin chrome. Built-in cable connector. Standard 5/8"-27 thread for stand mounting. 20 ft. shielded cable

TUBE BOOK

Sylvania Electric Products Inc. have released a new reference book giving typical operating conditions, characteristics and tube base diagrams for more than 450 types of tubes. Tube base diagrams are also available separately, printed on card stock and punched for wall mounting. Copies of the booklet and chart are available on request to Sylvania Electric Products Inc.

Crystal Chirps

February CQ, Fundamentals Electrical Measurements, *Fig. 1* should read "Elements to be measured are connected between Y and Z."

CQ DX
[from page 40]

of the above are CW stations. Two others that were being called by a few of the West Coasters are D4AFX 28070 and F3AAL about 28000.

In the recent BW contest quite a lot of good stuff was heard and worked. I only wish I had a fair representation of what most of the boys actually contacted, but here are a few good ones worked by W3EHW/1; ZS2AC, W6ITY, portable marine off Ecuador, D2DI, D4ABB, W9-QMD/KE6, HB9BX, F8AZC, G6ZO/I. G6ZO, operating portable in Italy, is pouring a consistent signal into the West Coast almost every day. W2KT/KQB6 gives his mail address as APO 182.

During one of the real hot days on 10 meters last week, W6ENV reports the gang really had a field day. Some of the stuff which Andy has worked or heard include F8CP 28040, FA8B

28040, FM8AC, EI6G, ON3A, and our old friend VK6SA, OQ5AQ, and OQ5AE. Then there is W9EWY/VS6, Hongkong. On phone FA8NF seems to be giving the fellows a run for their money. He puts in a good signal and that's a good country for a W6 to work.

By the way, W6IZB tells me that J2AN on phone is located with the AAF 35 miles outside of Tokyo and is running 225 watts into a rhombic antenna. Other stations 6IZB has heard or worked include J5QL, FO8FN, OA4M.

Remember Bill Conklin, ex-9FM, ex-9BNX, and now W3JUX. Well, he is Commander Conklin and gives me the following dope on XU1YV. "XU1YV on 28005 kc is Commander W. Brad Martin, W3QV, former director of the ARRL. His call was issued by the Chinese government, for use at Tangku (near Tiensin) China. The mail address is c/o Gropac, Navy # 3934, Fleet Post Office, San Francisco, California. A 6c airmail stamp will reach him. He will probably stay there until at least June. On the air, he voluntarily promises everyone he works a card."

On the East Coast XU1YV is being heard between 6 and 8 P.M. Bill also relates that he has had a hard job working any 28-mc stations out of town, which incidentally is Bethesda, Md., but he is hopefully calling XU1YV.

W2JIH apparently has been doing some very good phone work. Some of the stations are XU3IK, PK4LO, PK4TS, PK4AN, YS1JD. ZK1AB, and W6PCE, who was operating portable marine off of the Galapogas Islands.

Another station some of the boys are going after on c.w. is W4YA in Burma, Frequency 27990. Also PJ3X in Curacao at about 27980. Then there is FM8AC approximately 28030.

It was good to hear stations back on the air, W9PK, W9FS, W8LEC, W9IU. As far as W6QD is concerned, the first station worked after getting back on the air was—yes, you guessed it—a W9. QD moved into a new location on December 4, 1941, with the shack (XYL calls it a "den") designed for a ham station. Obviously it wasn't put in use due to what happened on December 7. Early in 1942 we moved bag and baggage to Northern California and the past 4 years have been spent with Eimac. The latter part of 1945 saw the Beckers heading back to the Los Angeles place we built in December 1941. However, gone are the days of long wire antennas for 6QD. The location is quite good, being on top of one of the highest hills in Los Angeles, but space is limited. Transmitter at present is a bit haywire, the power being 700 watts into a 4-250A.

This little DX session I'll admit is a little "local" but with support from you fellows we'll get it going again. How about it? That's all for now.

SURPLUS

[*from page 28*]

Corporation office cannot issue them to amateurs or other veterans who merely wish to buy the material for their personal or hobby use.

The surplus military radio equipment situation is not very promising for the amateur at the present time. Most of the equipment now being sold is manufacturer's surplus from uncompleted or cancelled war contracts. The radar parts on sale (mainly from the SCR-268 set) are of a prewar design. The same holds true for the communication receivers and transmitters released to date. A lot of the apparatus looks like a million dollars, is bulky and impressive—but so is a "white elephant."

Don't Be Stuck

The average radio amateur should ascertain that he really can use the surplus military equipment now being sold, otherwise he will have the said well-known elephant on his hands at a high price. Most of the ground radio communication equipment is designed to operate from a 6, 12 or 24-volt d-c source as found on jeeps, trucks, armored cars and tanks. Conversion to 115 volts a.c. is often a little difficult if the filament circuits are not the usual 6.3-volt type. The price of a suitable power supply for this purpose often will exceed the original cost of the radio set. However, the situation is not all snafu. The latest rumors have it that the War Department may release over $400,000,000 worth of surplus supplies from depot stock very soon. Radio equipment may be included in this sale. However, we still believe that old Roman saying, *caveat emptor*, ("let the buyer beware") is applicable in all cases.

Panoramic Adaptors

One place we visited had panoramic adaptors which were of interest. Fortunately we knew that there were many types of adaptors built for a number of special uses to operate with specific receivers. Most of these adaptors cannot be used, without considerable modification, with the ordinary type of amateur equipment.

Of all the military adaptors that have been built, the only ones which can be used by the ham without any change or modification (except tuning) are the Army BC-1031 and the Navy RCX.

The AN/APA10 which has recently appeared in surplus combines in a single unit an adaptor and oscilloscope, as well as several other desirable features. It does require modification, and like most equipment that has multiple uses is not

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5G SELSYN MOTORS: 110 v. AC 60 cycles—perfect for antenna or wind direction indicator—$12 per pair.

BC 406 RECEIVERS: Going fast, selected 15 tube, 205 MC receivers. Easily converted for 2 to 10 meter amateur, FM or Television operation. Write for instructions. Complete (with tubes) $30.

COAXIAL CABLE: RG-59/U: 72 Ohm, quarter inch, weatherproofed polyethylene insulation—8c/ft.

RG-8/U: 50 ohm, 3/8 inch—9c/ft. Minimum order 100 feet.

METERS: Brand new—write for complete surplus list.

"New Frequency Meters, 48-62 cycles, for use on 110 v. line." $2.95

COMBINATION SPECIAL – 3 inch 0-80 ma, 0-800 ma, 0-150 AC voltmeter, 0-8 AC voltmeter, 2 inch 0-1.5 RF thermocouple. Brand new - ALL FIVE for.....$23.00 Westchester Electronic Products, 29 Milburn Street, P.O. Box No. 231, Bronxville, New York.

QSL's??? SWL's??? World's Finest. Samples??? (stamp) "Radio" Handbook 700 pages (1946) $2.00. "Lefty" Sakkers, W8DED, Holland, Mich.

CRYSTALS: Precision low drift x-ray oriented units manufactured by latest and most scientific methods. Optional holder mounting type 400A for five prong socket or type 100A two of which plug in a single octal socket. Your specified frequency.

3500 KC to 4000 KC	$2.60
6250 KC to 7425 KC	$2.60
12500 KC to 14850 KC	$3.30

Rex Bassett, Incorporated, Fort Lauderdale, Florida.

QSL CARDS, in colors. Samples free. Glenn Print, (W3FSW), 1042 Pine Heights Ave., Baltimore, 29, Md.

Rotobeams. Bandspread RME-45's. Conklin Radio, Bethesda, Maryland.

Radio Tubes, Parts, Condensers. Free bargain lists. Potter, 1314 McGee, Kansas City 6, Mo.

QSLs, SWLs. Samples. Meade, W9KXL, 1507 Central Ave., Kansas City, Kansas.

SEND 20c for telephone plug brass, short type. Worth 49c! Electric tester, with neon light. Check circuits, electrical devices, 110-550 volts. Prepaid 39c. Big Ham-Experimenter list FREE. John Barron, 662-85 Street, Brooklyn, New York 9.

PERSONALIZED Q. S. L. Cards. Your Photo on your card. Price 500 cards $7.50; 1,000 cards $10.00. Samples on request. Albraun Studio, Dept. C, 1742 N. Palmer Street, Milwaukee 12, Wisc.

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ideal for any one of them. On the other hand, it is the better kind of war surplus equipment, for those able to do their own modification work.

The AN/APA10's were built for aircraft operation from 400 cycle a.c. Changing the transformer and filter system will permit their use on 110 volt 60 cycle a.c. Because of their wide i-f bandpass, sufficient to permit the scanning of a 1-mc band for the 5.25-mc i-f receivers, these adaptors will give a visual selectivity of about 12 kc. When used on a 455 kc i-f receiver, the resolution will be on the order of 10-12 kc, which is not ideal for optimum performance in amateur service. The changes to rectify this are beyond the scope of the average amateur. This unit, because of its other features it was definitely one of the more interesting items seen.

400 WATTS

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those who have a signal shifter of one type or another, this exciter unit may be made to cover the entire 144 to 148-mc band with little or no retuning of any stage.

EXCITER AMPLIFIER

C_1, C_{12}, C_{13}, C_{14}—.0001 μf
C_2, C_3, C_4, C_5, C_6, C_7—.01 μf, 1000 volts
C_8, C_9, C_{10}, C_{11}
C_{15}, C_{22}—35 $\mu\mu f$ variable padding
C_{16}, C_{17}, C_{18}, C_{19}—100 $\mu\mu f$ variable
C_{20}—50 $\mu\mu f$ variable
C_{21}—35-35 μf per section, split stator variable
C_{23}, C_{25}—.0005 μf
C_{24}—25 μf, 200 volts paper
L_1—26 turns #30, close-wound
L_2—18 turns #22, close-wound
L_3—5 turns #14, spaced dia. of wire
L_4—6 turns #12, 1½" long, center-tapped
L_5—3 turns #12, 1" long, center-tapped
L_6—2 mh 1 amp r.f.c. Ohmite Z-O
L_7—1 turn #12, 5/8" dia.
L_8—1 turn #12, 5/8" dia.
L_9—2 turns 1" dia., 3/16" tubing
L_{10}—2 parallel lines, 1¼" tubing, 8" long, spaced 1 1/8" apart
L_{11}—#12 wire, bent as shown into coupling loop 2" long x 1" wide
L_{12}—2.5 mh plate choke
P_1, P_2, P_3, P_4, etc.—Location of d-c milliammeters or switch contacts shunted by 75-ohm resistors
R_1, R_3, R_5, R_7, R_9—100,000 ohms, 1 watt
R_2, R_4, R_6, R_8—20,000 ohms, 10 watt
R_{10} R_{11}—15,000 ohms, 10 watt
R_{12}—300 ohms, 2 watt
R_{13}—1,500 ohms, 5 watt

FINAL AMPLIFIER

C_1—40 $\mu\mu f$ split stator variable, .071 (or larger) air gap
C_2, C_3—2 plate variable, neutralizing type
C_4—25 $\mu\mu f$ per section split stator variable
C_5, C_6—.0005 μf mica
L_1—10 turns hook-up wire on ¼" dia.
L_2—Plate line, 5/8" copper tubing, 10" long, spaced 1" apart

L_3—2 turns, 3/16" copper tubing, 1" dia. spaced dia. of tubing
L_4—1 turn hook-up wire, wound inside of grid coil L_3
P_1, P_2, P_3, P_4—Points of meter connection or switch contacts and resistor connections
R—5,000 ohm, 10 watt, grid resistor
T—Filament transformer for HK-54's

POWER SUPPLIES

[from page 25]

4. All parts were mounted on the chassis and wired. As installation of the front and side panels made some connections inaccessible, these parts were installed after all wiring had been completed.
5. It is generally a good plan to wire the high voltage circuits first, then the low voltage and control wiring may be installed and routed as necessary to provide proper isolation and spacing.

Before actually testing the unit with power all wiring was checked against the schematic diagram to make certain no errors had been made. Failure to observe this precaution may result in blown fuses, damaged rectifier tubes, chokes or condensers, not to mention frayed nerves. In addition to this thorough examination of the wiring, a 150 watt bulb may be placed in series with the high voltage primary winding for preliminary tests of circuit operation before full voltage is applied.

STATIC

[from page 18]

the antenna at nearby objects (a common fluorescent lamp radiates considerably in the microwave spectrum) will bring the hiss level up. As an antenna sweep across the sun the hiss rises and falls by about 10 db. It is a fascinating field of research that needs the assistance of the ham who has already contributed so much to our knowledge of sunspots and cosmic and solar-static.

References—Sunspots, Cosmic and Solar Static

(1) E. V. Appleton, *Nature;* vol. 156 #3970, Nov. 24, 1945
(2) J. S. Hey, *Nature,* vol. 157, #3976, Jan 12, 1946
(3) J. L. Pawsey, *Nature,* vol. 157, #3980, Feb. 9, 1946
(4) G. C. Southworth, *J. of F.I.,* vol. 239, #4, April, 1945
(5) K. G. Jansky, *Proc. I.R.E.,* vol. 20, #12, Dec., 1932
(6) K. G. Jansky, *Proc. I.R.E.,* vol. 23, #10, Oct. 1935
(7) G. Reber, *Proc. I.R.E.,* vol. 30, #2, Feb., 1940
(8) G. Reber, *Proc. I.R.E.,* vol. 32, #8, Aug., 1942
(9) G. Reber, *Astrophys. J.,* vol. 100, #11, Nov., 1944
(10) H. W. Newton, *Mon. Not. Roy. Ast. Soc.,* vol. 103, #5, 1943

CQ Ad Index

ACTUAL SIZE

New RAYTHEON BEAM AMPLIFIER

100 watts at 600 volts

Six Important Facts About RK-4D32 and RK-4D22

1. Over 100 watt output at 600 plate volts.
2. Low driving power requirements less than 1.25 watts required for full output.
3. High efficiency due to beam tetrode construction.
4. Full efficiency and no neutralization up to 60 megacycles.
5. Ruggedized construction for mobile and aircraft service.
6. 125 watts of undistorted audio output can readily be obtained from a pair.

Of special interest is Raytheon's newest cathode type beam amplifier. Capable of delivering 100 watts output with only 600 volts on the plate, this product of Raytheon research is of ruggedized construction designed particularly for ham use. It offers particular advantages for making a low powered, low cost, 100 watt band switch transmitter.

This new beam tetrode typifies Raytheon advanced engineering and precision manufacture. For any other tube application you may have, there is a Raytheon tube engineered to do that job, give you continuing satisfaction.

RATINGS

FILAMENT RATINGS

RK-4D32	6.3 volts at 3.75 amps.
RK-4D22	25.2 volts at .8 amps. or 12.6 volts at 1.6 amps.

MAXIMUM RATINGS CLASS C TELEGRAPHY

D.C. Plate Voltage	750 volts
D.C. Grid Voltage	−200 volts
D.C. Screen Voltage	350 volts
Plate Dissipation	50 watts
Screen Dissipation	12 watts

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