CQ

JULY, 1946

W2FX

The Radio Amateurs' Journal

25¢

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HERE'S the new RME 84 you'll be hearing a lot about during future QSO's. It's a precision instrument built to RME's tradition of expert engineering and quality components.

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Features

- Four tuning ranges .54 to 44 MC.
- One Preselection Stage
- Smooth Vernier Tuning Control
- Bandspread Scale, arbitrarily calibrated from 0 to 100
- Bandspread, positively geared to main tuning control for accurate logging—no backlash!
- Automatic Noise Limiter
- Beat Frequency Oscillator—continuously variable by panel control
- Self Contained Shock Mounted PM Speaker
- Headphone Jack
- Standby, Receive & B F O Switch
- Antenna Input Terminals, provision for doublet or single wire
- Cabinet of heavy prime furniture steel beautifully finished in two-tone grey
- Plug connection provided for low drain battery operation.
- Eight tube superheterodyne circuit

Specification Sheet on Request

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RADIO MFG. ENGINEERS, INC.
Peoria 6, Illinois U. S. A.

THE NEW

S-38's

4 Bands—540 kc. to 32 Mc.

$39.50

ADD 3% IN ZONE 2

The Model S-38 meets the demand for a truly competent communications receiver in the low price field. Styled in the post-war Hallicrafters pattern and incorporating many of the features found in more expensive models, the S-38 offers performance and appearance far above anything heretofore available in its class. Four tuning bands, CW pitch control adjustable from the front panel, automatic noise limiter, self-contained PM dynamic speaker and "Airodized" steel grille, all mark the S-38 as the new leader among inexpensive communications receivers.

FEATURES

1. Overall frequency range—540 kilocycles to 32 megacycles in 4 bands.
   Band 1—540 to 1650 kc.
   Band 2—1.65 to 5 Mc.
   Band 3—5 to 14.5 Mc.
   Band 4—13.5 to 32 Mc.
   Adequate overlap is provided at the ends of all bands.
2. Main tuning dial accurately calibrated.
3. Separate electrical band spread dial.
4. Beat frequency oscillator, pitch adjustable from front panel.
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6. Standby/receive switch.
7. Automatic noise limiter.
8. Maximum audio output—1.6 watts.
9. Internal PM dynamic speaker mounted in top.
10. Controls arranged for maximum ease of operation.
11. 105-125 volt AC/DC operation. Resistor line cord for 210-250 volt operation available.
12. Speaker/phones switch.

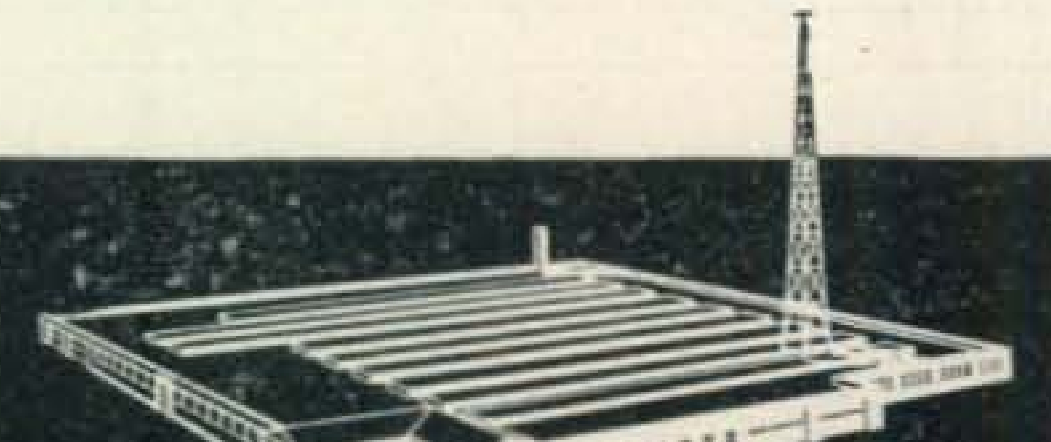
CONTROLS: SPEAKER/PHONES, AM/CW, NOISE LIMITER, TUNING, CW PITCH, BAND SELECTOR, VOLUME, BAND SPREAD, RECEIVE/STANDBY.

EXTERNAL CONNECTIONS: Antenna terminals for doublet or single wire antenna. Ground terminal. Tip jacks for headphones.

PHYSICAL CHARACTERISTICS: Housed in a sturdy steel cabinet. Speaker grille in top is of airodized steel. Chassis cadmium plated.

SIX TUBES: 1—12SA7 converter; 1—12SK7 IF amplifier; 1—12SQ7 second detector, AVC, first audio amplifier; 1—12SQ7 beat frequency oscillator, automatic noise limiter; 1—35L6GT second audio amplifier; 1—35Z5GT rectifier.

OPERATING DATA: The Model S-38 is designed to operate on 105-125 volts AC or DC. A special external resistance line cord can be supplied for operation on 210 to 250 volts AC or DC. Power consumption on 117 volts is 29 watts.



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THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

CQ
The Radio Amateurs' Journal

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

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Vol. 2 No. 7 JULY, 1946

COVER

Welcome to the WØ's! Still a novelty, this collection of WØ QSL cards represents the combined efforts of the WØ gang and QSL printers W3FSW, W8DED, W8JOT, W9-HUO, W9KXL and Fritz. Since preparing the cover, dozens of WØ cards have arrived, indicating a boom for one of the best features of ham radio, swapping cards.

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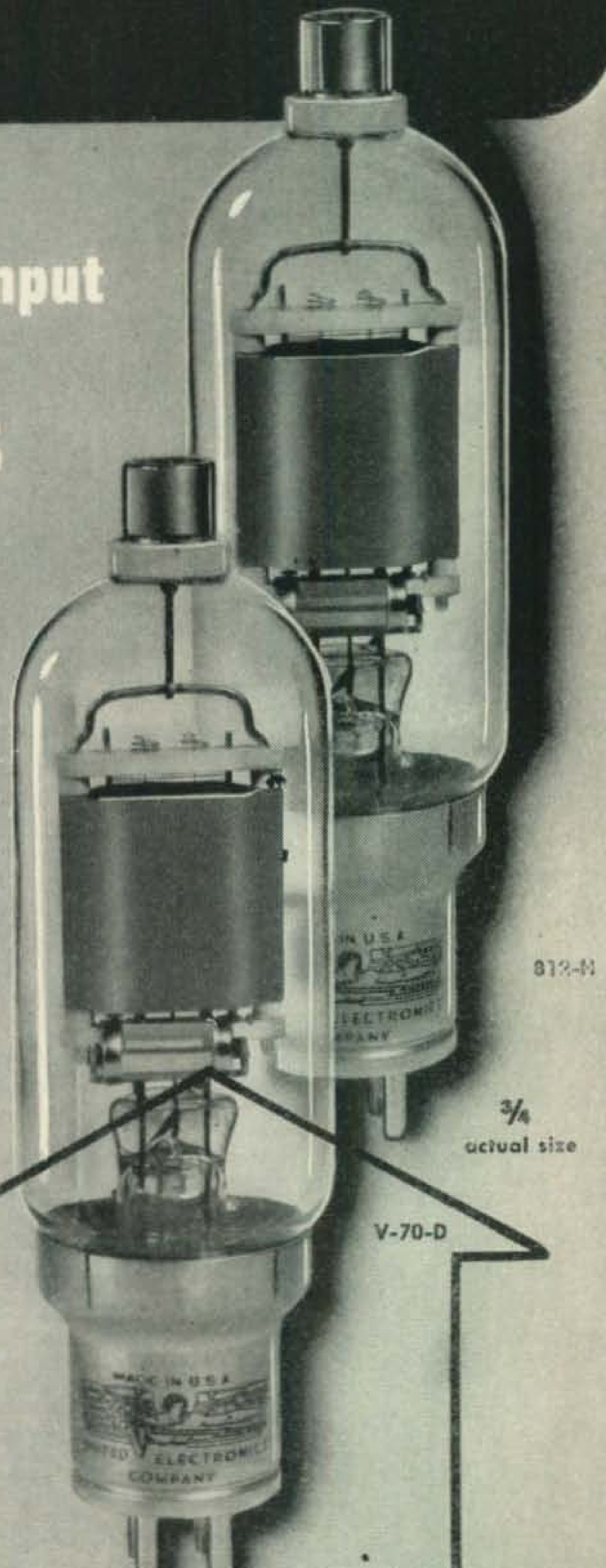
Only 8 Watts Drive for ½ K.W.* Phone Input with NEW UNITED GRAPHITE TRIODES



Highest Ratings On Record for Graphite Anode Tubes Made Possible by New Getter Trap

A great development in graphite anode tubes . . . the United *Isolated Getter Trap* . . . has resulted in new, clear glass tubes free from the familiar dark metallic deposit on the bulbs, and utilizing for the first time all the superior advantages of graphite.

The net result of this United achievement in the two types illustrated is a very low cost replacement for lower rated tubes of the 40 or 55 watt plate dissipation class as well as original tubes for new equipment with minimum driver construction cost.

Choice of two types, V-70-D and 812-H bridge many replacement needs with little or no circuit changes. *A pair of either type will take ½ K.W. phone input at 30Mc—up to 60Mc with reduced input. Available now at all leading Radio Parts Distributors.

Type	Filament		Max. Plate	Capacitances uuf			Max. input	Max. Plate	
	Volts	Amps	Dissipation	cgp	cgf	cpf	per tube	Volts	Mils
V-70-D	7.5	3.25	85 Watts	4.5	4.5	1.7	300 Watts	1750	200
812-H	6.3	4.0	85 Watts	5.3	5.3	0.8	300 Watts	1750	200

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... Zero Bias ...

The Class D License

In CQ for May we discussed an idea for the creation of a new Class D license. The reaction from readers was quite surprising, and by far the majority of them opposed the suggestion. In most instances their reason was the same—the desire to prevent our already crowded frequencies from still further congestion. Some of our readers misinterpeted the editorial, which never meant to suggest that new amateurs be permitted on existing frequencies without passing the minimum requirements of the Class B examination. But, when all is said and done, CQ readers, both licensed and unlicensed, do not agree that the Class D license is the solution. For this reason we will not press the issue.

The fact that licensed amateurs and would-be-hams are so acutely aware of the problem of utilizing our frequencies in the best possible manner is in itself an indication that we are headed in the right direction. There are altogether too many poorly operated stations on the air—and we do not refer to signal quality alone.

Phone men are no more guilty of poor operating technique than c-w operators. But the public, which is an influential group in determining the fate of any government regulated group, unfortunately forms its opinions about ham radio almost entirely from phone contacts heard on their all-band receivers. The impression that the phone man makes must stand for all amateurs. For this reason it is up to him to be particularly careful. Improper voice operations of any kind hurt the entire hobby far more than similar conduct on the part of the c-w man.

A Class D license may never be necessary if we insist upon good operating techniques, cooperation in avoiding interference, and most important, development of new techniques to utilize better existing frequencies. Because certain bands have been sparsely settled by amateurs it has even been suggested that a no-code examination be permitted for these frequencies. Such a drastic step is one that will only be settled after prolonged debate among all groups of amateurs. CQ could hardly speak without bias on the subject unless it individually polled its readers. The opinion of the editor does not necessarily represent the views of the majority. Personally speaking, we do not see where c.w. might prove to be any less valuable on the super-high frequencies than it is on, say, 80 meters. Once licensed, the amateur may choose any means of communications he desires. If we drop the code requirement, which is certainly no more difficult than any other portion of the exam, perhaps we should drop any reference to phone operation in the event that a new ham desires to confine his operation to c.w. We'd like to hear from you on this, OM.

QSL's

Activity has reached a point where it is time we spoke of QSL's. One of the grand parts of the hobby has always been swapping cards. There are some old-timers who have worked everything there is—who are so blasé that a card doesn't mean anything. But every amateur should be duty bound to reply to every QSL card received. Before the war the percentage of replies on cards sent was unfortunately very low. Starting anew, with the slate clean, we should avoid the bad habits and develop the good ones.

The easiest way to QSL 100% is to stay current on your mail. Don't let cards accumulate. Reply as promptly as possible. If you don't already have a QSL card use a penny postcard or a picture postcard from the local drug store. For a penny or two don't deny some amateur the pleasure of hearing from you.

DX cards are a horse of another color. Any DX man will tell you stories for hours on end of various attempts to pry a card from a reluctant catch. The situation here is somewhat different because DX stations may receive hundreds of cards. QSL'ing can become very expensive if they mail individual replies. QSL bureaus have been established by most amateur organizations for the purpose of handling cards in bulk. DX stations which permit cards to accumulate before mailing have a good reason for being slower on QSL's. Gradually as world-wide postal facilities return to normal and radio societies resume activity, the QSL channels will become more sharply defined. Until then, every amateur should make an effort to QSL promptly by the most expeditious method available. DX stations which will not or cannot QSL for one reason or another should make some sort of arrangements to confirm contacts for WAZ and DXCC credits. Ideas on the subject are most welcome.

Convert Your 5 Prong Crystal Sockets for Both *Old* and *New* Type Holders in *3 minutes*

It isn't necessary to build complicated adapters or install new octal sockets in your transmitter to use the new ½ inch pin spacing on modern crystal holders. You can convert standard 5-prong sockets to accommodate BOTH old and new types in three minutes. Just do this: Solder a jumper between the No. 2 pin receptacle and No. 3 as indicated in the drawing above. Then pinch the sleeves of 3 and 4 slightly so they will grip the new, smaller pins.

That's all there is to it. Plug the new-type holder pins across 4 and 3. Old-style holders are plugged in the ordinary manner. This is a practical tip from PR. And here's another: Get the new PR Precision CRYSTALS for accuracy . . . maximum power output . . activity . . . stability . . . low drift . . . even on the highest frequencies. At your jobber's . . . for ALL BANDS. PETERSEN RADIO COMPANY, 2800 WEST BROADWAY, COUNCIL BLUFFS, IOWA. (Telephone 2760)

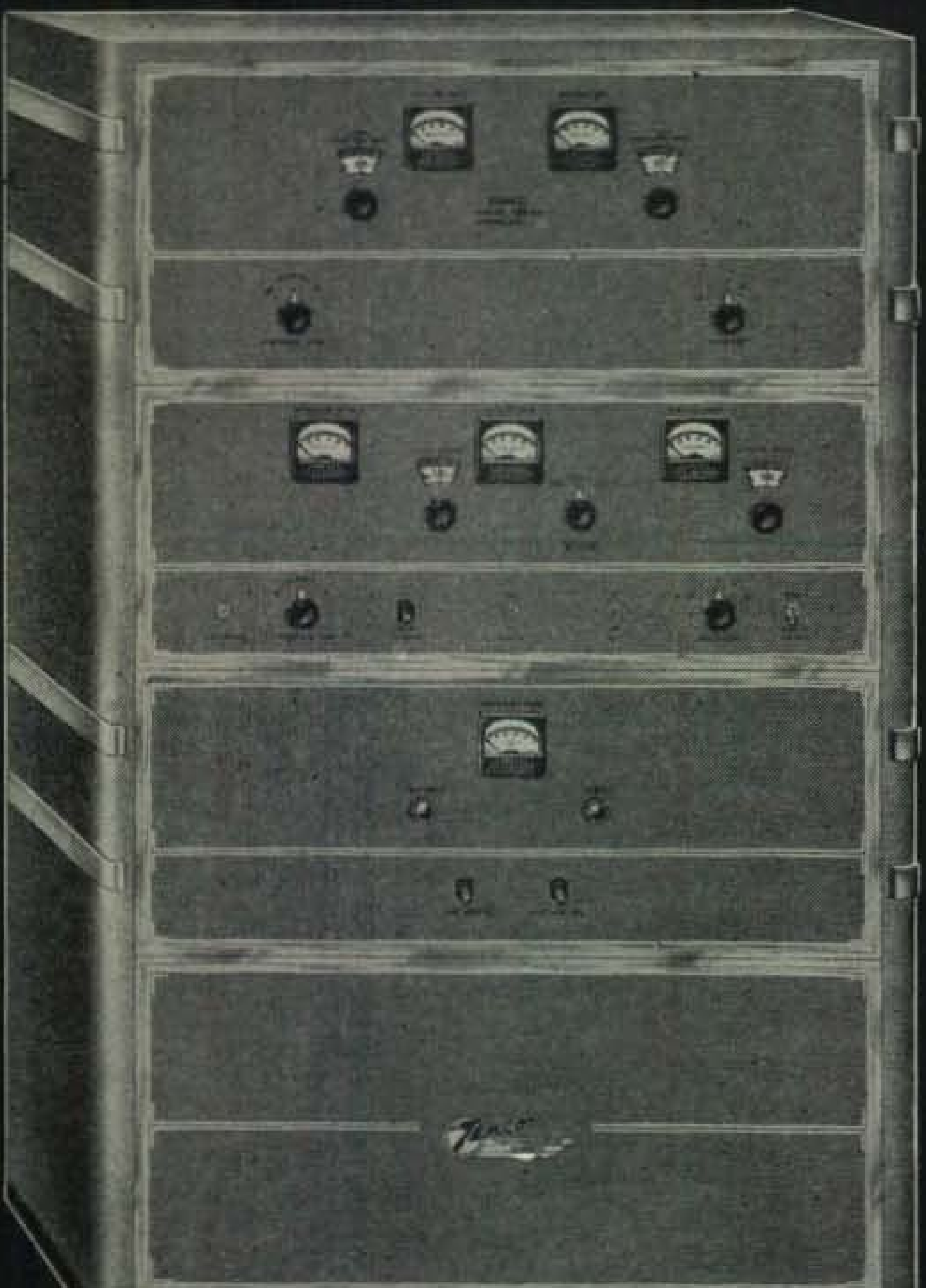
PR *Precision* CRYSTALS

10 METERS PR Type Z-5.	Temp. coefficient less than 2 cycles per MC per degree centigrade. High activity. Heavy drive without crystal damage. . $5.00
20 METERS PR Type Z-3.	Temp. coefficient less than 2 cycles per MC per degree centigrade. High power output. High activity $3.50
40 & 80 METERS PR Type Z-2.	Rugged. Low Drift (less than 2 cycles per MC per degree centigrade). High keying activity. High power output. Accurate calibration $2.65

DOLLARS S-T-R-E-T-C-H *far*

when you buy a TEMCO 75GA Transmitter

TEMCO 75GA 75 watt *output* on Phone and 100 watts *output* on CW.



TEMCO 500GA 500 watt *output* on *both* Phone and CW incorporating the 75GA as the exciter unit. The final amplifier comprises push pull 100-TH's with a normal input rating of 750 watts modulated by a pair of 100-TH's class B.

In addition to the many advanced technical features of the new Temco 75GA Transmitter its ability to perform as both a transmitter and exciter, indefinitely protects your investment against obsolescence when you decide to increase power.

You can start now with a Temco 75GA which is a complete 75 watt phone/100 watt CW transmitter featuring multi-frequency VFO and crystal control —— later when you decide to step up to 500 watts output you can do so *without sacrificing one cent of your original investment* for this higher powered unit utilizes the 75GA as the exciter. Thus when you buy a 75GA you are also acquiring a stake in a Temco 500GA.

The 75GA is designed to operate within the 3.5, 7, 14, 21 and 28 megacycle bands but is also available for operation on any five harmonically related bands for other forms of communication. Unexcelled in craftsmanship, these units feature maximum frequency flexibility and unusual operational simplicity. The only accessories needed to go on the air are a microphone, telegraph key and antenna installation. For further information see previous ads in this publication. Also contact your dealer or write directly to Temco for Bulletin T-5.

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TRANSMITTER EQUIPMENT MFG. CO., INC.

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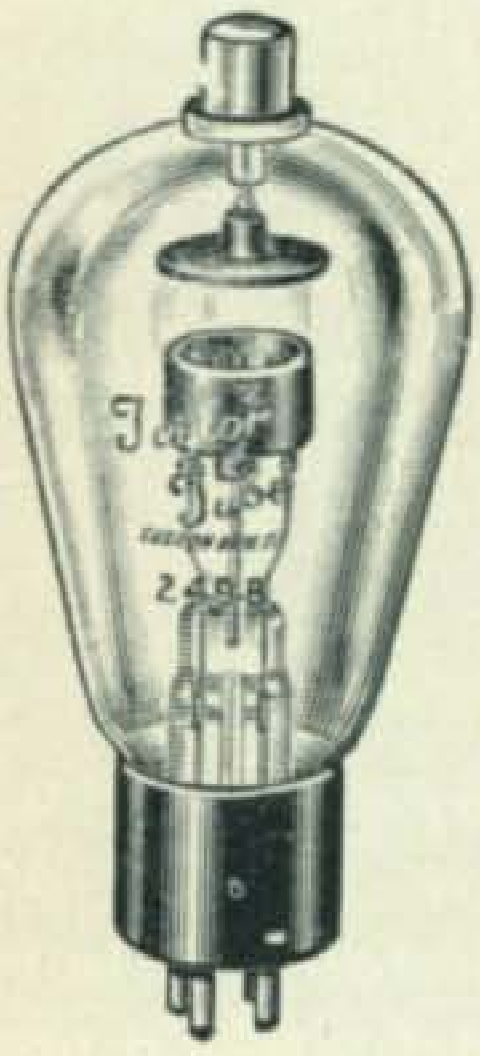
A TAYLOR *Rectifier* *for Every Purpose* . . . *and* LONGER LIFE!



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866 Jr.—for 1000 Volts —250 MA.	$1.00
866A—for 3000 Volts —500 MA.	$1.50
249B—for 3200 Volts —750 MA.	$5.00
872A—for 3200 Volts —2.5 Amps.	$7.50
TT-17—Grid Control for 2500 Volts —500 MA.	$6.00
873—Grid Control for 3000 Volts —2.5 Amps.	$17.25

Taylor Rectifiers, like all Taylor Tubes, are backed by the broadest guarantee in the entire tube industry.

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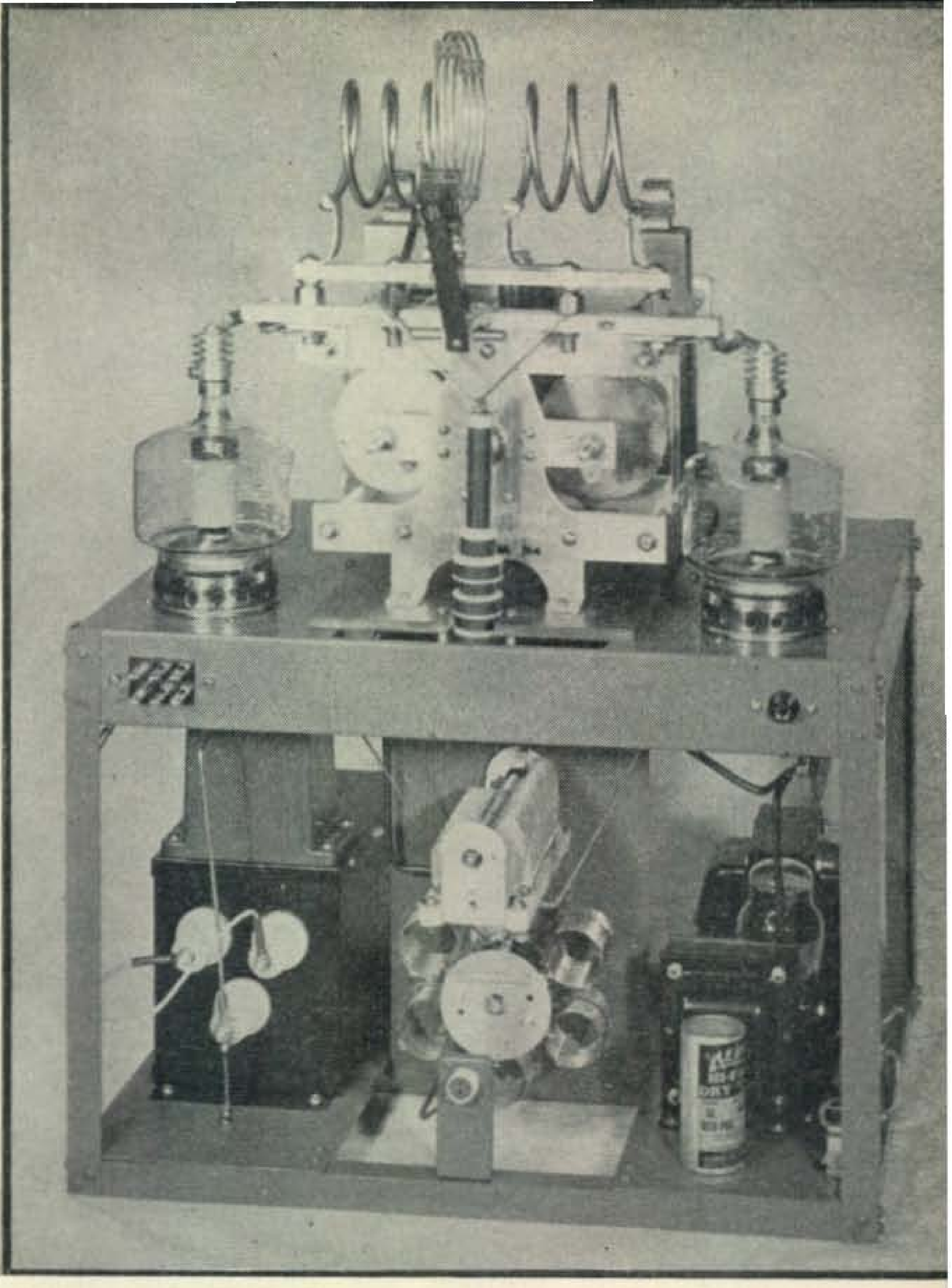
"MORE WATTS PER DOLLAR"

Taylor HEAVY CUSTOM BUILT DUTY Tubes

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



Rear view of PA. The band-switching turret is in the grid circuit. Bias supply on the right-hand side of chassis. Filament transformer and HV blocking condenser on left-hand side. The coax connector shown is for grid input

The Lazy KILOWATT

Clean-cut and bugless, the 4-250A's just start to work at the legal maximum input. Longer tube life and less wear and tear on circuit components is achieved by allowing a large safety factor for everything used and letting the Lazy Kilowatt loaf along

LAWRENCE LeKASHMAN, W2IOP

BUILDING a new transmitter from scratch is a job facing most hams returning to the air. It is unlikely that any two identical rigs will appear out of the multitude being constructed because every ham has his own pet ideas. Unusual rigs are worth examining, though—for the ideas they offer if nothing else.

The Lazy Kilowatt had to meet severe requirements, yet be relatively inexpensive and simple to build. It had to be capable of running the maximum legal input on phone or c.w.—and loaf while doing it. The high power was wanted with a minimum of tuned stages. Easy bandchange, good safety factor in components, and flexibility in all units to allow for expansion and incorporation in other apparatus to be built in the future were incorporated in this transmitter. With no shop facilities available it was a decidedly ambitious project, but one which the average ham can duplicate.

Eimac tetrodes, the new 4-250A, were chosen for the final amplifier. Low driving requirements meant elimination of the exciter problem, so an all-out effort was concentrated on the final amplifier.

Mechanical Considerations

Forced air cooling of the filament, grid and screen seals of the 4-250A by means of a small blower or fan is necessary because of the compact design of the tube. Forced cooling of the envelope is only necessary when the tube is operated at, or near, maximum ratings. This condition will not arise in amateur service.

Small blowers, built by Barber-Colman, were mounted directly behind each tube. These blowers will handle in excess of 1 cubic foot of air per minute. It was found that considerable vibration resulted from the blowers when bolted directly to the chassis. To overcome this, small rubber grommets were placed between the unit and the angle brackets supporting them. While this did not completely eliminate vibration, it greatly reduced it. Later, four small Lord shock mounts were obtained and substituted for the grommets. These made very little difference in the performance of the fans and some vibration was still perceptible to the hand when placed on the tubes. The blowers operate continuously, starting when the tube filaments are turned on, since their principal function is to cool the stem of the tube.

For mounting convenience, the blowers are mounted on the chassis deck, aimed directly at the tube base where holes are provided to facilitate the circulation of air. If space permitted the fans would be somewhat more effective mounted below the tube and blowing upward through the socket, although they are adequate in either mounting position.

It is useless to take pains to build a tube with such extremely low feedback as the new tetrodes unless adequate isolation is provided between the grid and plate tank circuits. In triode amplifiers the neutralizing circuit usually takes care of such stray coupling, but there is no way of counteracting it in the unneutralized tetrode stage, and the oscillation which results is invariably blamed on the tube. The necessity of proper circuit isolation in any tetrode transmitter cannot be over-emphasized. By using the two-deck design excellent isolation of circuits resulted in bugless operation from initial tests on.

The amplifier was constructed in a small apartment-house kitchen, proving that no extensive shop facilities are necessary. The main chassis on which the tubes, tank circuit, and fans are mounted is a standard heavy duty 17″ x 13″ x 4″ size. The frame work is constructed of ¾″ aluminum angle, of any thickness available so long as it will support 25 pounds or so. Since this material is sold by the pound, it represents a very small investment and may be handled with simple tools. Dimensions are not critical and the units can be made smaller or larger within reasonable limits.

To keep the final tank condenser isolated from ground to provide additional protection for the high voltage supply in the event of a flash-over, and at the same time to avoid mounting it on large stand-off insulators, a sheet of Mykroy insulation—12″ x 7″ x ¼″—was obtained. Cutouts in the chassis (*Fig. 1*) allowed more than ample clearance for the hardware bolting the condenser to the insulating sheet, which was in turn bolted to the chassis. Since the breakdown point of Mykroy is far in excess of anything approaching peak voltages across the condenser, this arrangement is very practical. The Mykroy can be sawed, filed, and drilled with ordinary hand tools.

The large r-f choke of special design to provide high inductive reactance throughout all the amateur bands is mounted directly on the Mykroy making one integral unit out of the final tank condenser, coil and link mounting bar, and r-f choke. The husky final tank condenser with half-inch spacing, is designed to preserve perfect circuit symmetry. Incidentally, the B & W CX model condenser shown in the illustration happened to come equipped with integral neutralizing plates. They were never removed, but are not incorporated in the circuit. For a triode final, this same layout could be used and the additional leads wired in the circuit.

To avoid the usual annoyance of meters which have screw terminal connections in the transmitter, meter jacks were placed on small pieces of Mykroy fastened to both ends of the screen resistor mounting strip. These jacks provide entrance into circuits to obtain screen current, grid current, plate current, and plate voltage. Because it is impossible to insert meters into these jacks with the equipment operating (safety interlocks are on the rack door) there is no danger from flash-over in the small jacks. However, even if this should occur, because the jacks are mounted on insulating material the only result would be to short the meter out of the circuit.

Two safety connectors on the rear of the chassis[1] bring in the high voltage and screen voltage and are widely separated to prevent accidental reversing of connections. The common ground is brought out through the connector plug. The switch to throw the screen resistors out of the circuit and connect the screens directly to the low-voltage exciter supply is mounted where it is electrically convenient, since it cannot be thrown while voltage is on. While not visible in the photos, it is on the forward portion of the top deck.

The final is mounted on a standard rack shelf and is not connected to the front panel in any way. This allows simple servicing and simplifies the mechanical problems involved in fastening two separate panels (meter and front) to the one large chassis assembly.

---

[1]Only one high voltage plug is visible in the photos. The second connector was added to carry screen voltage from the low voltage power supply.

A small spring clip made of spring-brass is fastened to the chassis to make contact with the 4-250A bases. These spring fingers ground the metal base, in accordance with the manufacturers operation specifications.

Filament Circuit

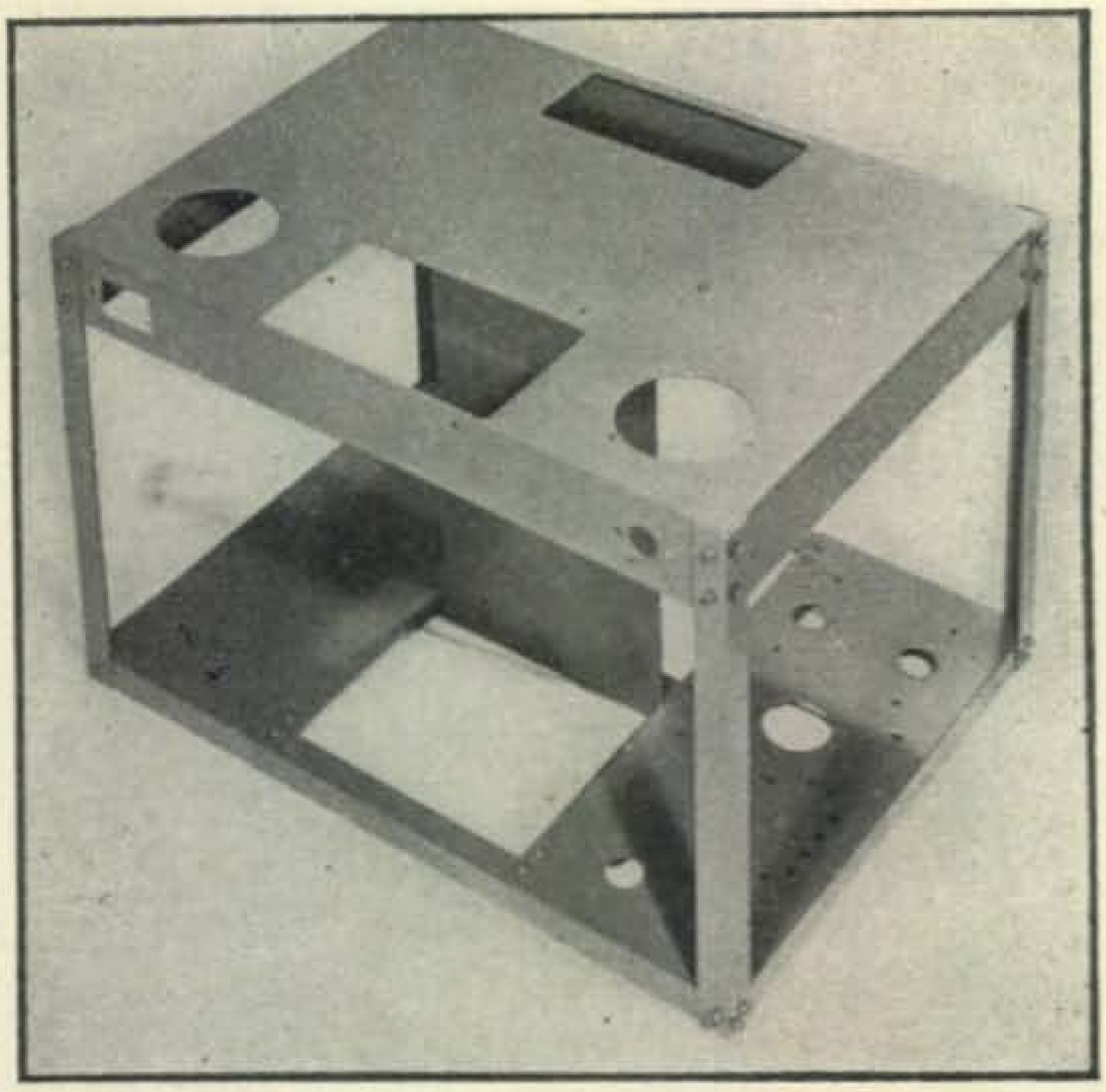
Obtaining a filament transformer capable of handling the 5 volt 30 amp requirements of the 4-250A's was quite a job. After inquiring in most of the New York stores it was learned that Stancor was manufacturing a special unit for this job (P6305).[2] This transformer has a tapped primary for either 105 or 115 volt input. When the filament circuit was first wired the line input was run to the 115 volt tap. Secondary leads were #12 stranded and ran a total length of approximately 16 inches. Output voltage measured 5.0 volts at the transformer, 4.9 at the socket of the first tube, and 4.79 at the socket of the second tube. Moving the tap to 105 volts input helped, but the voltage drop was still noticeable and in preliminary transmitter tests an unbalanced loading was noticed because of this condition. The filament circuit was rewired using 1/8" copper rod. The transformer leads were brought to approximately the center of the filament busses and the resulting readings showed equal filament voltage on each tube. Filaments were bypassed at each socket as indicated on the schematic.

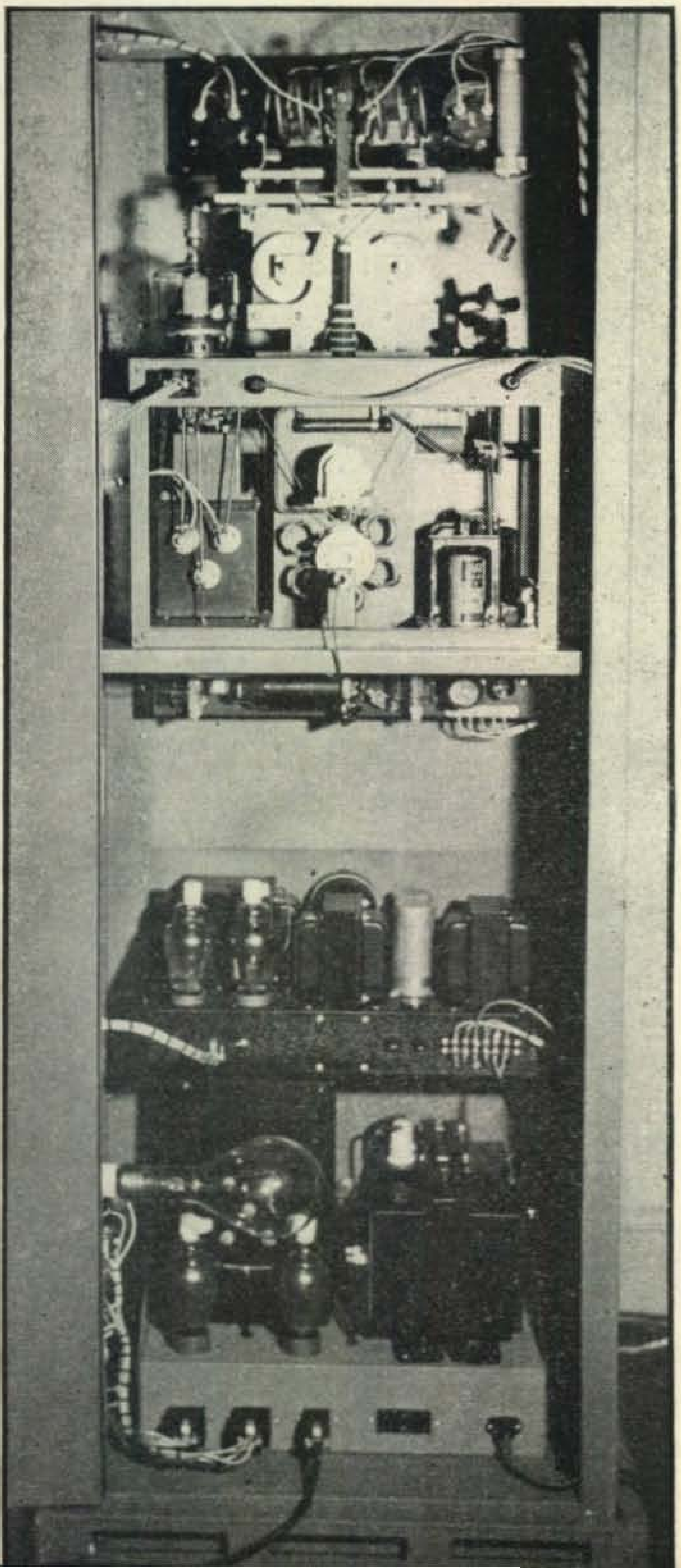
Bias Supply

Biasing the final amplifier was considered from every angle of convenience and reliability. The rig was designed primarily for c.w., but phone would also be employed. Break-in c.w. operation was contemplated, probably keying the oscillator. The final solution used was the tried and true combination of grid leak and fixed bias.

An interesting variation suggested by Eimac, eliminates the necessity for fixed bias and screen voltage on the final amplifier by utilizing a triode connected 6Y6. Originally used with 4-125A's, the circuit would require parallel 6Y6's to handle

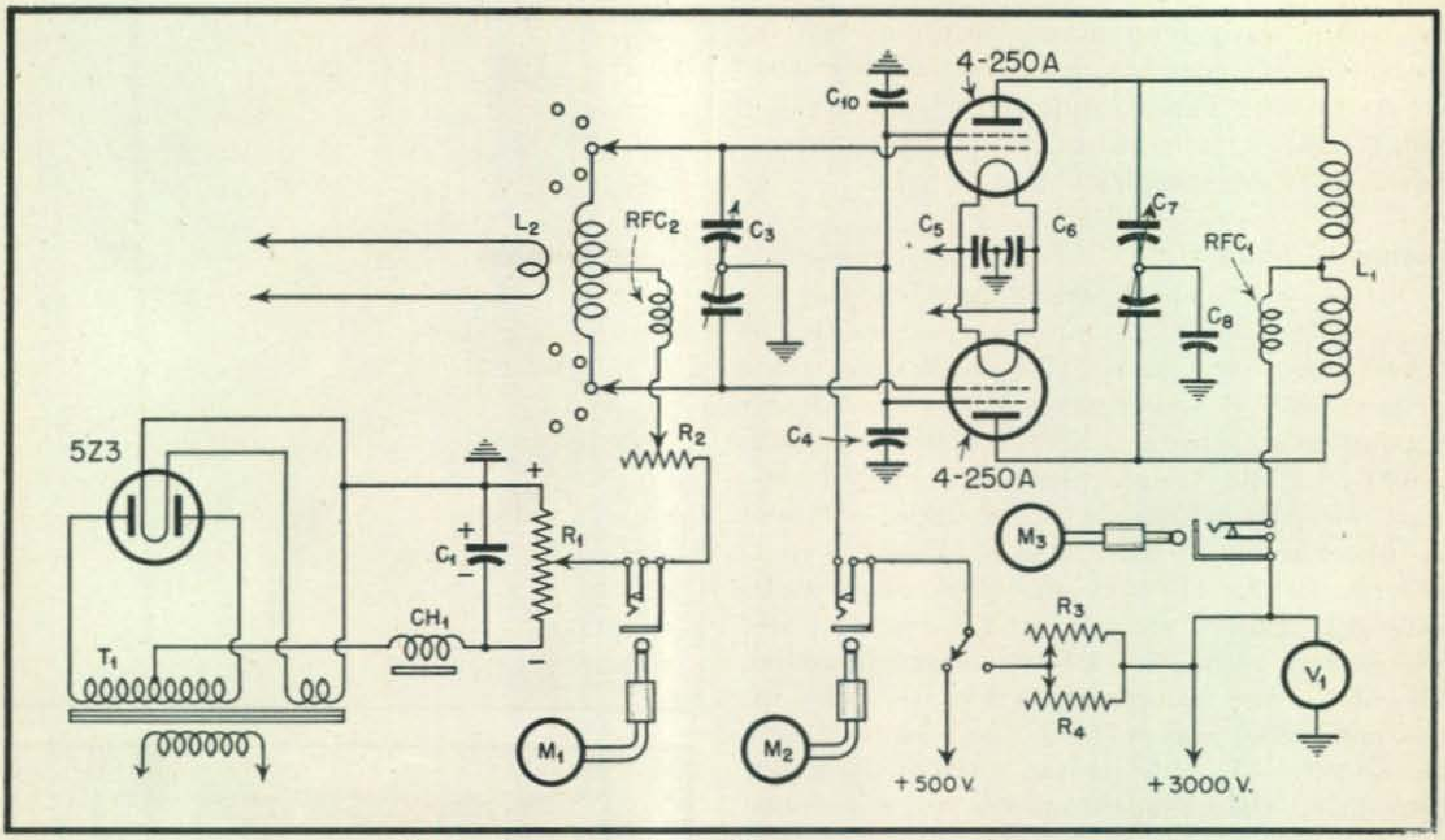
[2]Some surplus radar equipment includes a heavy duty 5 volt 60 amp transformer, which when obtainable makes a good filament transformer.





(Above, right) Fig. 1. Chassis for PA consists of standard 13" x 17" x 3" chassis with framework built up of aluminum angle and sheet stock. Overall height is 12". Large square cutouts provide clearance for condenser mounting screws. This is described in detail in the text. Layout dimensions are not critical since ample clearance has been allowed for all components

(Below, right) The Lazy Kilowatt rack mounted. One tube has been removed to show the blower fan. Directly below the PA is the Millen 807 exciter used in operating tests. The medium and high voltage power supplies occupy the bottom of the rack



Circuit diagram for Lazy Kilowatt power amplifier

Parts List

C1—8 μf 450-volt electrolytic
C2, C9—.002 μf mica bypass
C3—200 μμf split-stator variable (Cardwell MO-180-BD)
C4, C10—.05 μf 1000-volt working mica bypass
C5, C6—.05 μf 1000-volt working mica bypass
C7—Type CX B & W CX49A .5" airgap with vacuum condenser mounting brackets. (Note: B & W HDV base assembly mounts directly on this condenser)
C8—.002 μμf 8000-volt working blocking condenser (Solar XH-8-22)
L1—B & W HDVL series coils
L2—Grid turret bandswitch 25 or 50 watt size CT Center link (B & W BTCL)
R1—10,000 ohms, 100-watt
R2—6,000 ohms, 50-watt
R3, R4—100,000 ohms, 200-watt screen dropping resistors (Ward Leonard 200F, IRC HOA)
T1—250-volts, 150 ma bias transformer (Stancor P-6318)
T2—5.0-volts, 30-amps filament transformer (Stancor P-3064)
CH1—20 h 150 ma (Stancor C1410)
RFC1—800 ma National R-175
RFC2—2½ mh 125 ma (National R100U)
Vacuum condenser 25 μμf (Eimac VC25-32)
2 4-250A socket (National HX100)
2 high voltage safety terminal (Millen 37001)
4 phone jacks—normally closed
SPDT non-shorting rotary ceramic insulated switch (Centralab 2501)
5Z3 and socket
Mykroy sheet stock 7" x 12" x ¼" (1)
4" x 12" x ¼" (2)
Socket and plug combination (Jones S-406-CCT, P-406-AB)
Coax connector (Amphenol)
Meters: 0-10 volts a.c., 0-3000 volts d.c., 0-50 ma d.c., 0-500 ma d.c. (Simpson type 27 & 57 3" rectangular case)
2 blowers (Barber-Colman motor dYab 569-1, fan YAB 355-2, 2½")

4-205A's. The triode connected 6Y6's have their grid tied to the minus side of the final amplifier grid leak, and their plate to the tube side of the screen dropping resistors. When excitation is supplied to the final amplifier, the voltage developed across the grid leak biases the 6Y6's to cutoff, effectively removing them from the circuit. When the key is up, and excitation removed, the bias on the 6Y6 and final drops to zero and the 6Y6's instantly start to draw plate current through the screen dropping resistors. The IR voltage drop through 50,000 ohms reduces the PA screen voltage to almost zero. With this low screen voltage, the plate current which the final can draw is limited to a low value, thus keeping the input well below the maximum rated plate dissipation of the tubes. The advantages of the various systems depend upon variable factors not too easily evaluated. When space is not at a premium the more conventional method has the advantage of completely cutting off the final and not putting any load on power supplies or tubes during idling periods.

Screen Voltage

As pointed out in the preceding paragraph, by using 6Y6's triode connected, a screen dropping resistor can be used to supply screen voltage with safety. However, the more conventional methods were used in the Lazy Kilowatt. On c.w., screen voltage is obtained from the exciter power supply and for phone operation through series dropping resistors.

The series dropping resistors are ideal to prevent the screens from drawing excessive current due to the IR drop developed across them which automatically lowers screen voltage. Should the plates draw zero current however, (due to failure of some circuit component such as plate r-f choke), full plate voltage will be applied to the screen (maximum screen voltage 600) with permanent damage to the tubes. In normal operation, of course, the screen and plate current react in opposite directions. When the plate current is cut off with blocking bias, the screen current is also zero. But this condition is almost impossible to obtain with series screen resistors, because the screen voltage rises just as fast as the screen (and plate) current goes down. For this reason it is important to incorporate safety devices in the PA to protect the screens when operating with screen resistors. Primary keying of the final will enable c.w. operation using screen resistors. A method of protecting the screens in the event of an open circuit in the final would be the installation of a small resistor in the B plus. When current flows through this resistor (assuring some plate current and hence some screen current through the screen resistors) it will develop a voltage which can actuate a relay to close the screen circuit. An underload relay could also be used, but it would have to be removable to allow for tuning up under conditions of low plate voltage and current.

Under actual operating conditions it was found that tuning the plate circuit to resonance did not result in an excessive increase in screen current. In any event this is not a problem, since the limiting action of the series dropping screen resistors will protect the tubes when operated on phone, and the fuse in the screen voltage line will protect the tubes when operated off a separate screen supply.

It is important to remember the fuse in the separate screen supply. If a tap is taken off a bleeder, fuse protection will be critical in-so-far as determining the value of current which can be drawn through the tapped-down portion of the bleeder. For example if it is a 750-volt supply and you are tapping down approximately 10,000 ohms on a bleeder to obtain 500 volts, the maximum current you can safely draw is 125 ma, and the screen fuse should be around 100 ma.

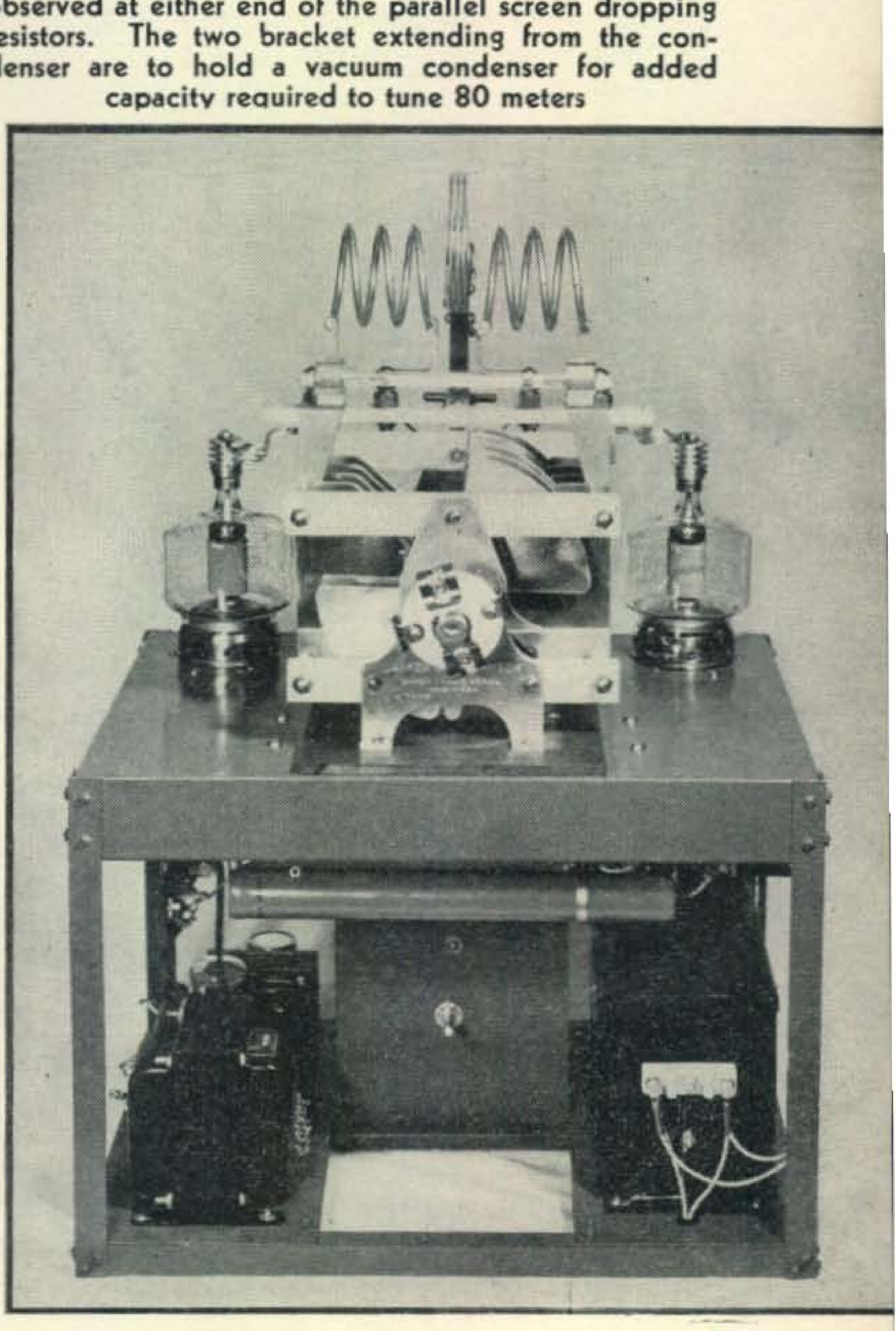
In order to have adequate safety factor in the screen dropping resistor, two 100,000 ohm, 200-watt units were paralleled to give an effective variable resistance of 50,000 ohms at 400 watts. This runs cool under all conditions! To make a neat job out of mounting the resistors they were fastened to a strip of Mykroy, wired to the respective jacks, and the entire sub-unit bolted to the chassis on four ceramic standoffs. The screen by-passes are .05 oil filled 1500 d-c w.v. condensers. They are mounted rigidly on the chassis, as close to the sockets as possible without upsetting the mechanical layout.

Operation

After completing the mechanical work and checking all wiring out with an ohmmeter, filament voltage was applied and grid bias measured and set at −200 volts from the supply. Low voltage, approximately 1000 volts, was applied. The 10 meter grid coil did not tune to resonance, undoubtedly due to the fairly long grid leads (5 inches). Removing one turn from each end of the coil readily corrected this. Running low plate voltage, and driving the final from a Millen exciter (807 doubling to 10 with 600 volts on the plate), 35 ma of excitation was obtained and a no-load resonance current of 18 ma per tube observed. Increasing the plate voltage to 2800 volts dropped the excitation to 30 ma, no-load plate current to approximately 21 ma per tube. Under an antenna load of 325 ma, 2800 volts on the plates, excitation remained almost 29 ma. With this input of 910 watts, the tubes showed a

[*Continued on page 54*]

Front view of PA. Not shown are the cooling fans and screen resistor switch which were not on hand until after the photos were shot. Extension shafts are used to bring controls through the front panel. Note the large insulated coupling used on the tank condenser. The insulated end pieces carrying the meter jacks may be observed at either end of the parallel screen dropping resistors. The two bracket extending from the condenser are to hold a vacuum condenser for added capacity required to tune 80 meters



Facts About Klystrons

OLIVER PERRY FERRELL

Klystrons, when properly handled, are ideal for some of the new super-high frequencies allocated for ham use. Definitely not for the novice, the klystron is just beginning to find its way into amateur radio. Here are some facts on its use and operation

MANY POTENTIAL MICROWAVE experimenters are carefully eyeing the war-surplus market for reflex klystrons. Some have bought surplus WL-417A's under the impression that they can be made to operate in either the 1145-1245 or the 5250-5650 megacycle bands. This is definitely not the case.

For all practical purposes the reflex klystron is designed for a particular frequency range, and no amount of amateur ingenuity can alter the manufacturer's design or specifications. Another note of caution is that all types of reflex klystrons on the market today look very much alike and the type number is a misleading indication of the spectrum coverage. For instance, although type 2K42 covers 3300-4200 mc and type 2K43 covers 4200-5700 mc, type 2K39, instead of operating below 2600 mc, tunes from 7500-10,300 mc. The frequency coverage of reflex klystrons made during the war by Sperry Gyroscope Co., Inc., for sale at the factory or on the surplus market, is given in *Fig. 1*.

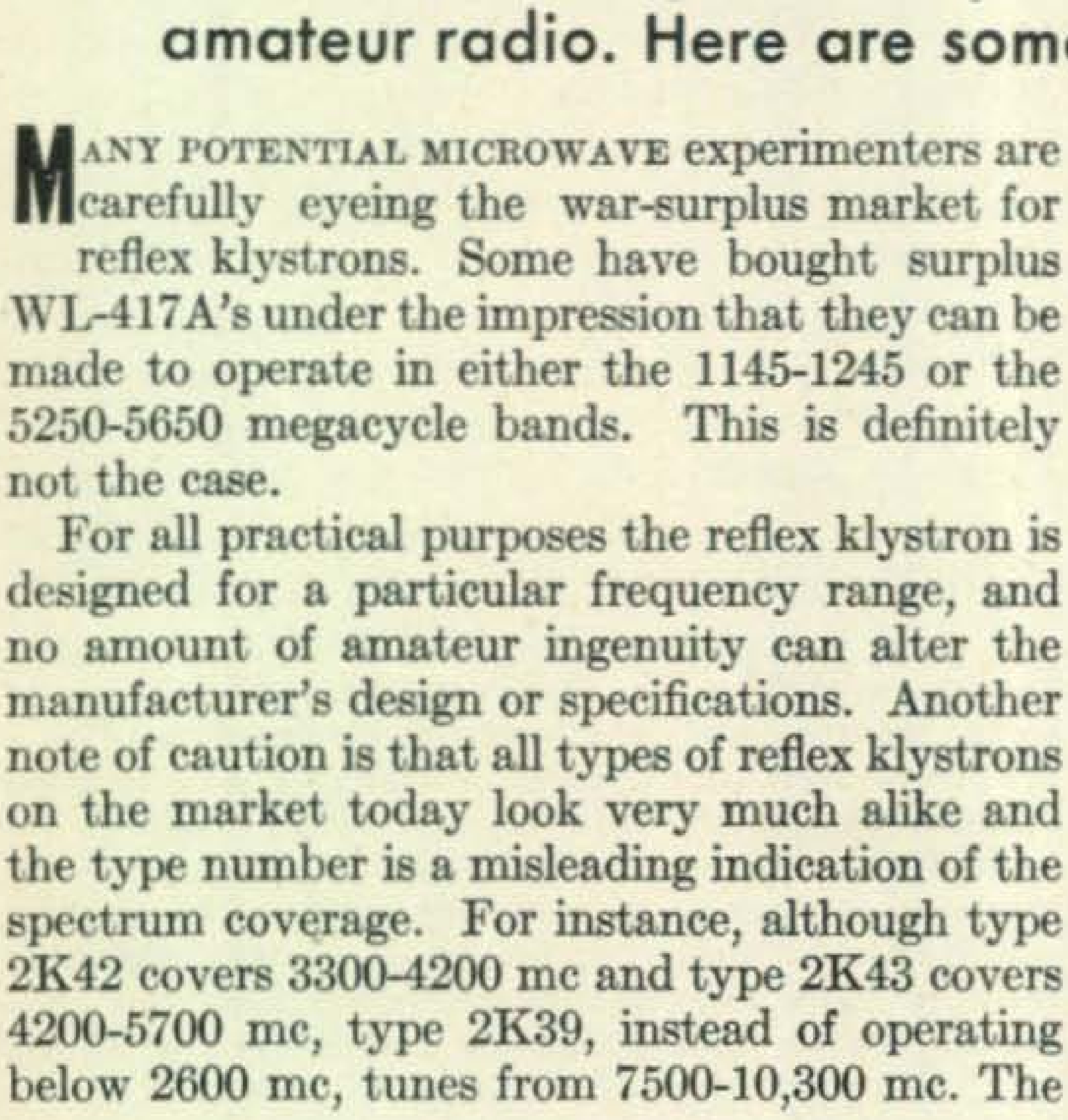


Fig. 1 Centimeter coverage with war-surplus reflex klystrons. "X" denotes that the model is not available or has not received a type number. The WL-417A, which is very prevalent in the market today is an old style 2K41

Theory of Operation.

The klystron is classified as a velocity-modulated tube in that its operation depends upon the modulation or changes in speed of electrons passing through grids, and may be broken down into these steps:

(a). The basic gun structure produces a constant speed stream of electrons. Emitted from the heated cathode (*Fig. 2*) they are attracted by the accelerator grid. Most of the electrons miss the grid wires and travel on at a uniform rate of speed.

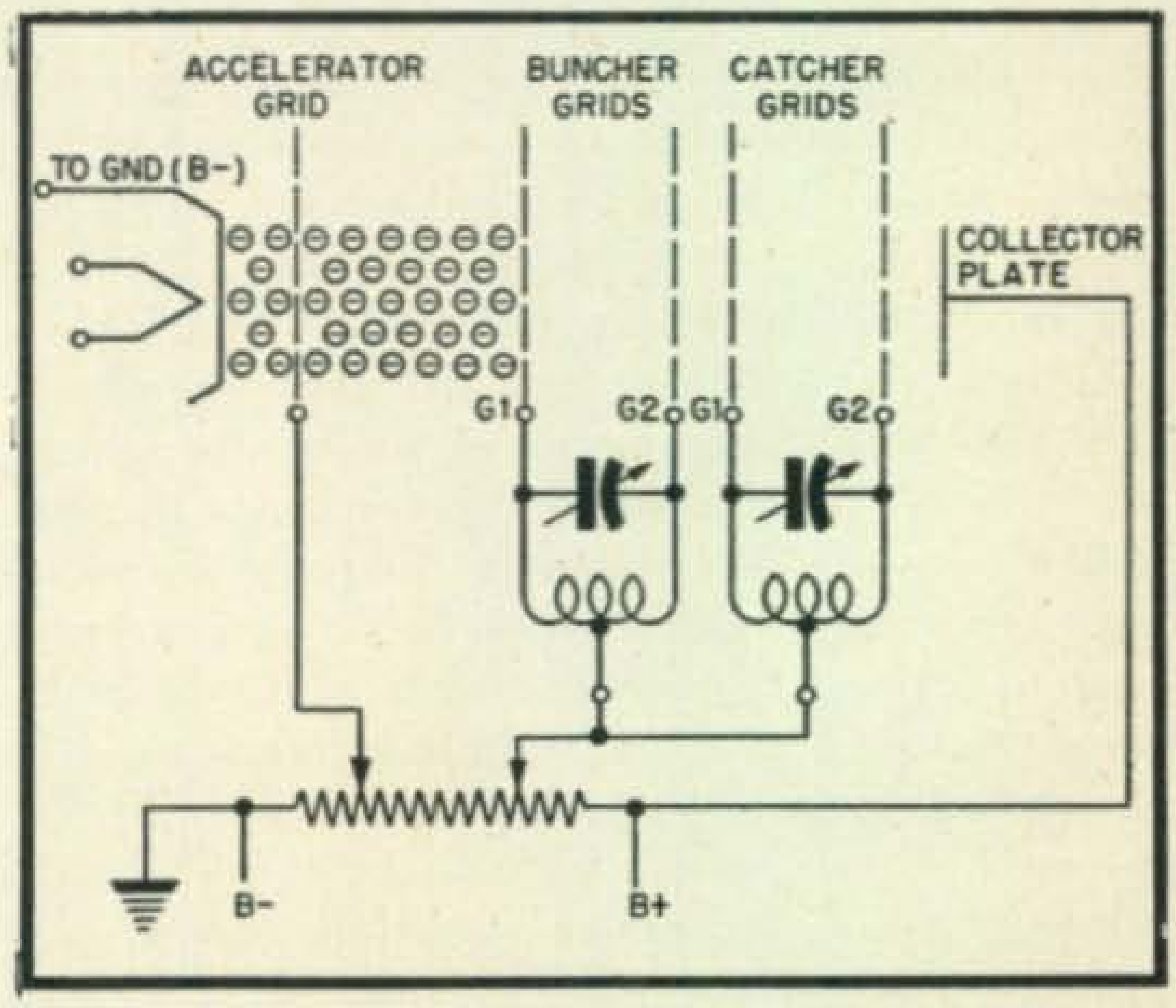
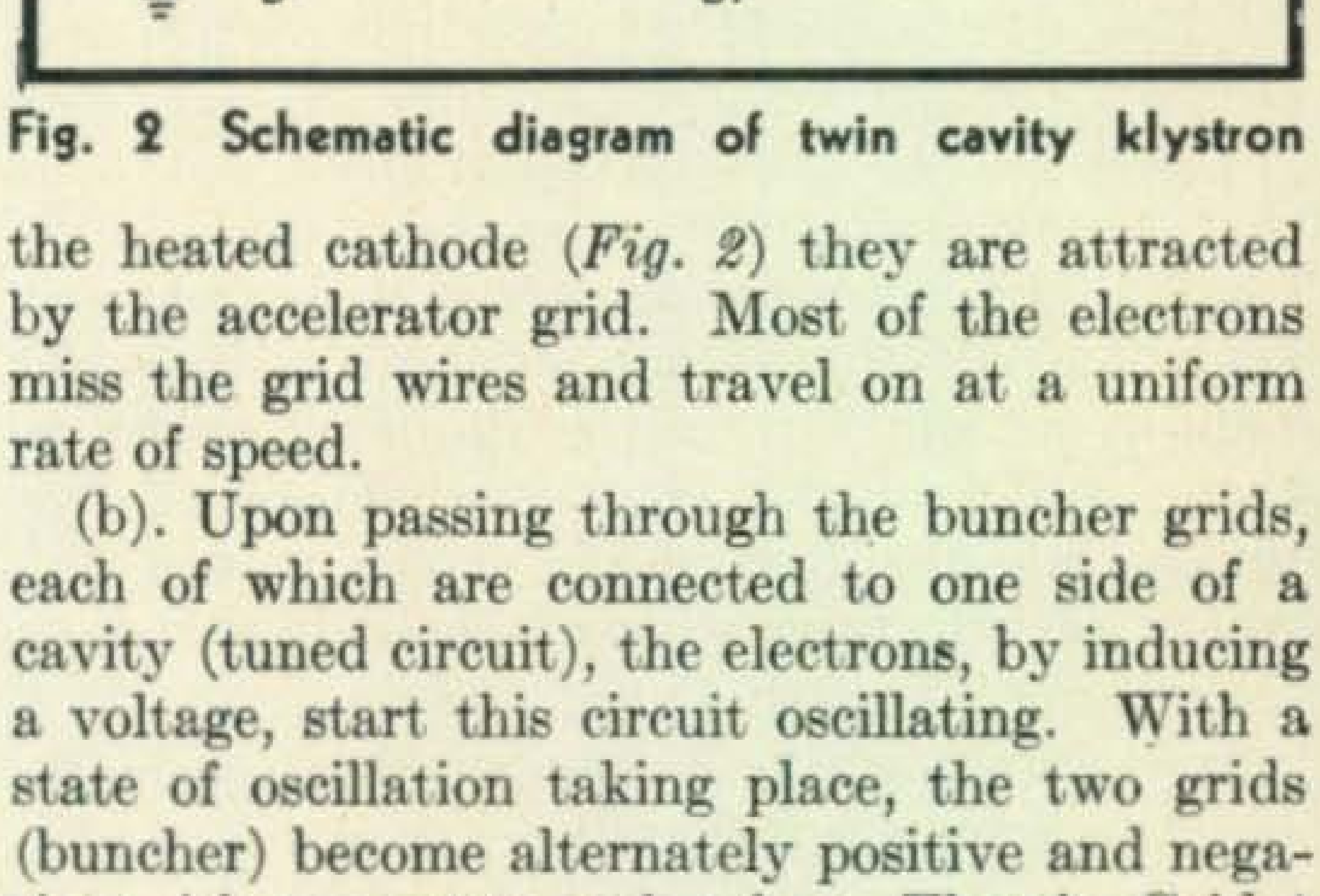


Fig. 2 Schematic diagram of twin cavity klystron

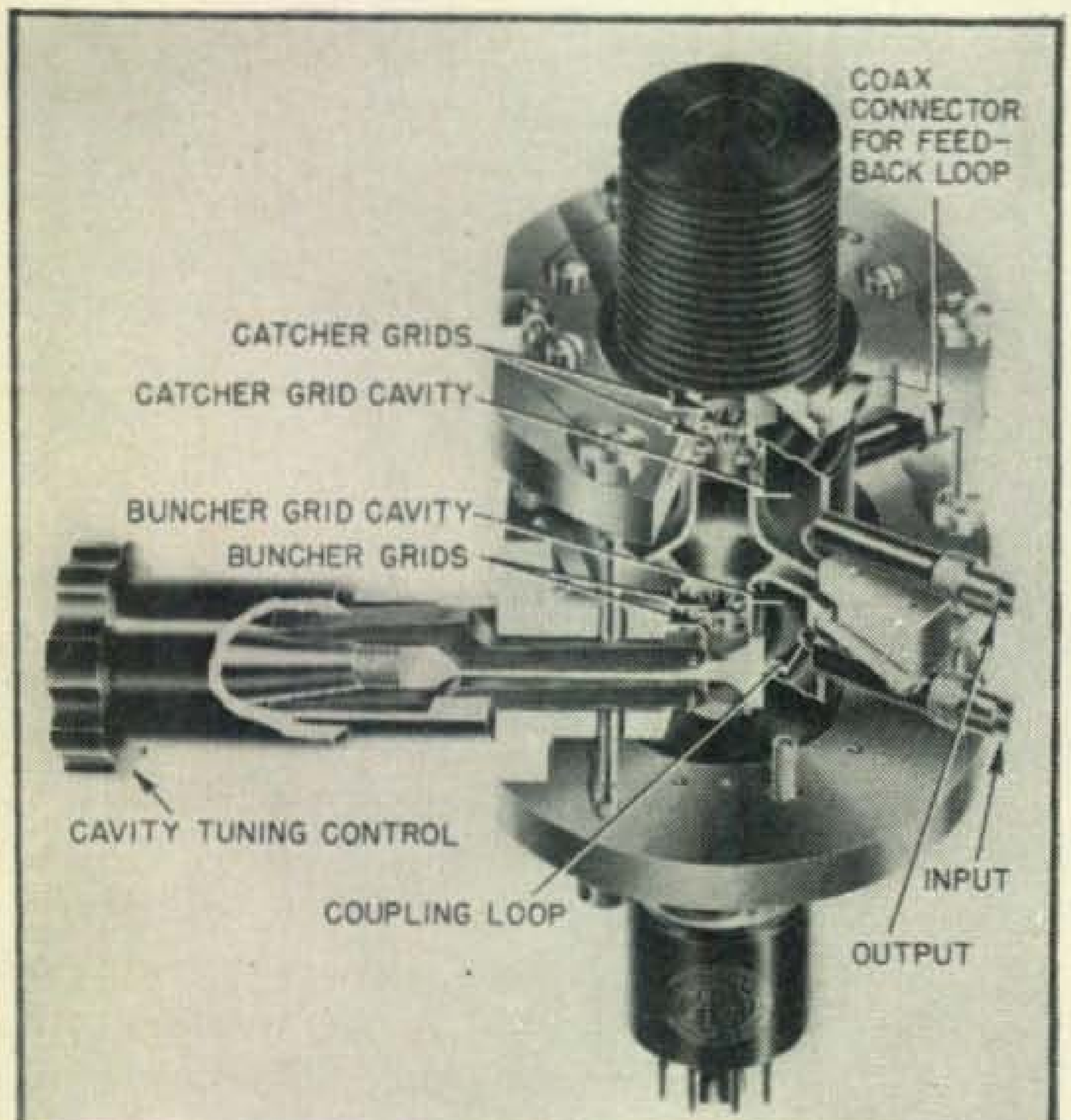
(b). Upon passing through the buncher grids, each of which are connected to one side of a cavity (tuned circuit), the electrons, by inducing a voltage, start this circuit oscillating. With a state of oscillation taking place, the two grids (buncher) become alternately positive and negative with respect to each other. That is, Grid 1 is positive when Grid 2 is negative on one-half cycle and Grid 1 is negative when Grid 2 is positive on the other half cycle. Thus, electrons passing through the grids during the first half cycle are slowed down in that they are traveling from positive to negative and on the second half



Operational limits of various high-frequency generators

cycle are speeded up, moving from negative to positive. This slowing down and speeding up of the electrons brings about a bunching and debunching of the electrons and the distance between alternate maxima or minima is a measure of ½ wavelength of the frequency of the buncher cavity tuning.

(c). With the electrons leaving the #2 grid first decelerated then accelerated, a point or series of points may be found beyond #2 buncher grid where the faster electrons will catch up with the slower moving ones. It is here where this bunching takes place. At this point of bunching, a second set of grids is located, the catcher grids. This point varies with frequency. These grids like the first set, go alternately positive and negative in this oscillatory circuit. The electron bunches striking first grid 1 drive it positive, thus releasing energy to the tuned circuit. By



Cut-away of Sperry klystron type 410-R with Model 11-C tuner

the time the electrons reach the second grid it is driven positive and more energy is released. In delivering this energy the speed of the electrons is greatly reduced, and the spent electrons are removed from the circuit by the positive charge on the collector plate.

The klystron action described is of the twin cavity type. The importance of the cavity tuning which is brought about by varying the spacing between G1 and G2 is readily apparent. Of further importance is the distance of separation between the catcher grids and the buncher grids. A simplification of this was brought about with the advent of the reflex type klystron (*Fig. 3*).

In this tube, a common cavity and a common set of grids are used jointly as the buncher and

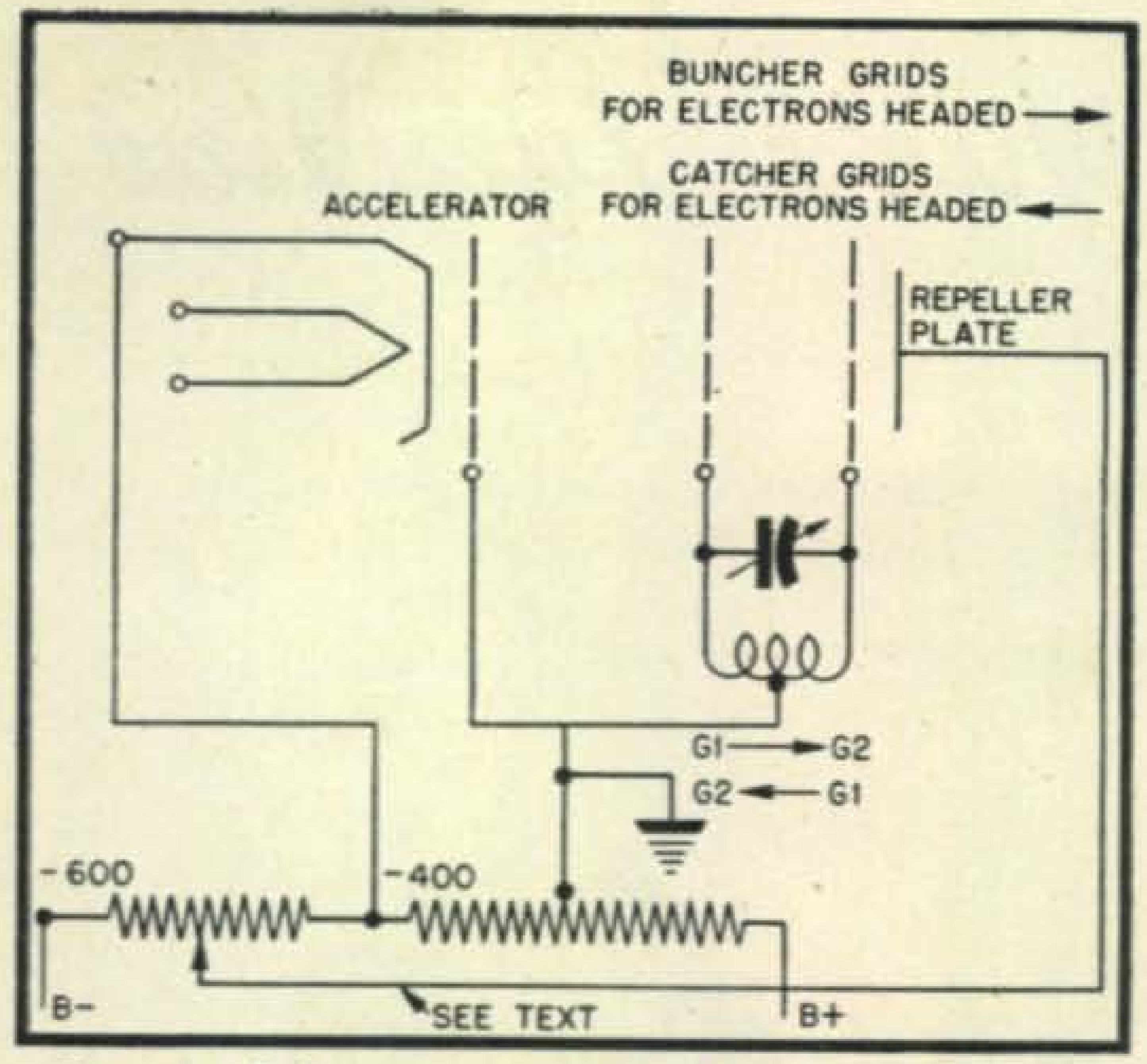
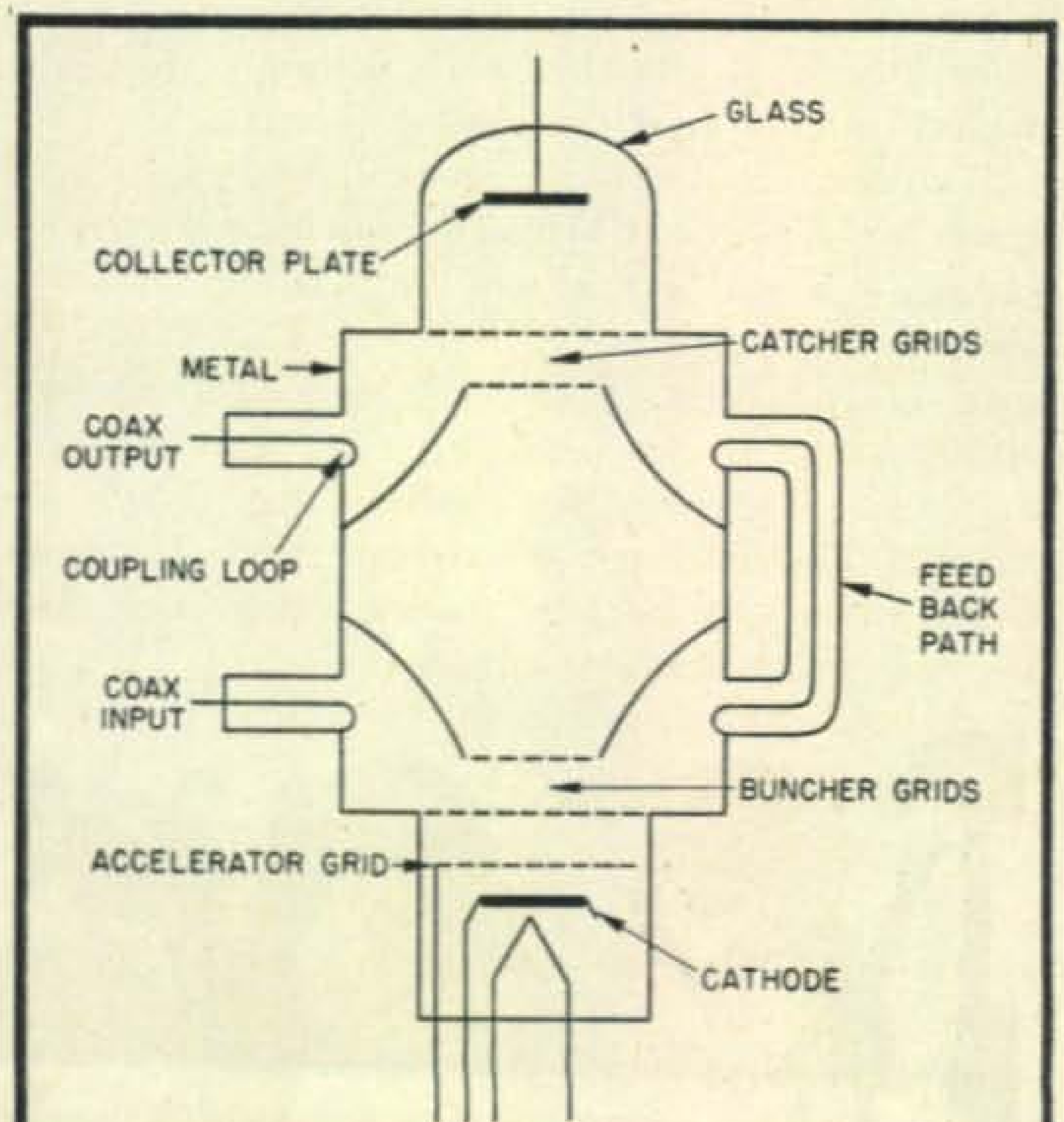


Fig. 3 Schematic diagram of reflex klystron

catcher grids. After the electrons in their accelerated and retarded states leave G2, they approach the repeller plate, which is at negative potential. By proper adjustment of the voltage on the negative reflector or repeller plate, the electrons are repelled, made to pass back through the same cavity. The distance they must travel being a function of repeller voltage, it merely requires a voltage change to set the point where bunching takes place at G1. Spent electrons are removed from the tube by the positive accelerator grid or by the grids of the resonator.

Three typical tubes of the reflex klystron type are the McNally tube, using an external cavity with paddles and screw plugs for tuning; the Pierce (Shepard) tube, using a cavity sealed

[*Continued on page 61*]



Simplified drawing of twin cavity klystron

Wife's Eye View ★ ★ ★

RUTH E. JOHNSON, W9IYK's XYL

WHAT MANNER of creature can this be? Who is that familiar-looking man in my basement muttering his strange cry, "CQ, CQ, hello CQ?"—now risking life and limb clambering about on my roof to mess with that weird

wire maze? Outwardly he has the same appearance as the husband I used to know 'way back in pre-2½, 10, and 80-meter days, before the bands were returned to these Indians. He is my ham-husband.

His personality is sullied and subjugated, his vocabulary unintelligible, his mind wedded forever, it seems, to his hobby. His whiskers grow long and fierce on week-ends; he is twisting dials and has no time for razors. A little stranger called "DX" has supplanted me as the love of his life.

The odor of burning resin drifts up and wafts its gentle way through the house—amateur incense. Diminutive silver splashes litter the floor, there to nestle cozily among the ashes which did not find their way to a tray.

The mail-man eyes me suspiciously as he hands me colorful post-card things scrawled with a queer jargon. These, I find, are something known to the brotherhood as "QSL's" and are perfectly innocent missives. Some day I may learn to quit shuddering every time I hear the words of J. Edgar Hoover. "Gtx, om yr sig fb Q5 R9" says he, this man-o-mine, is legitimate language.

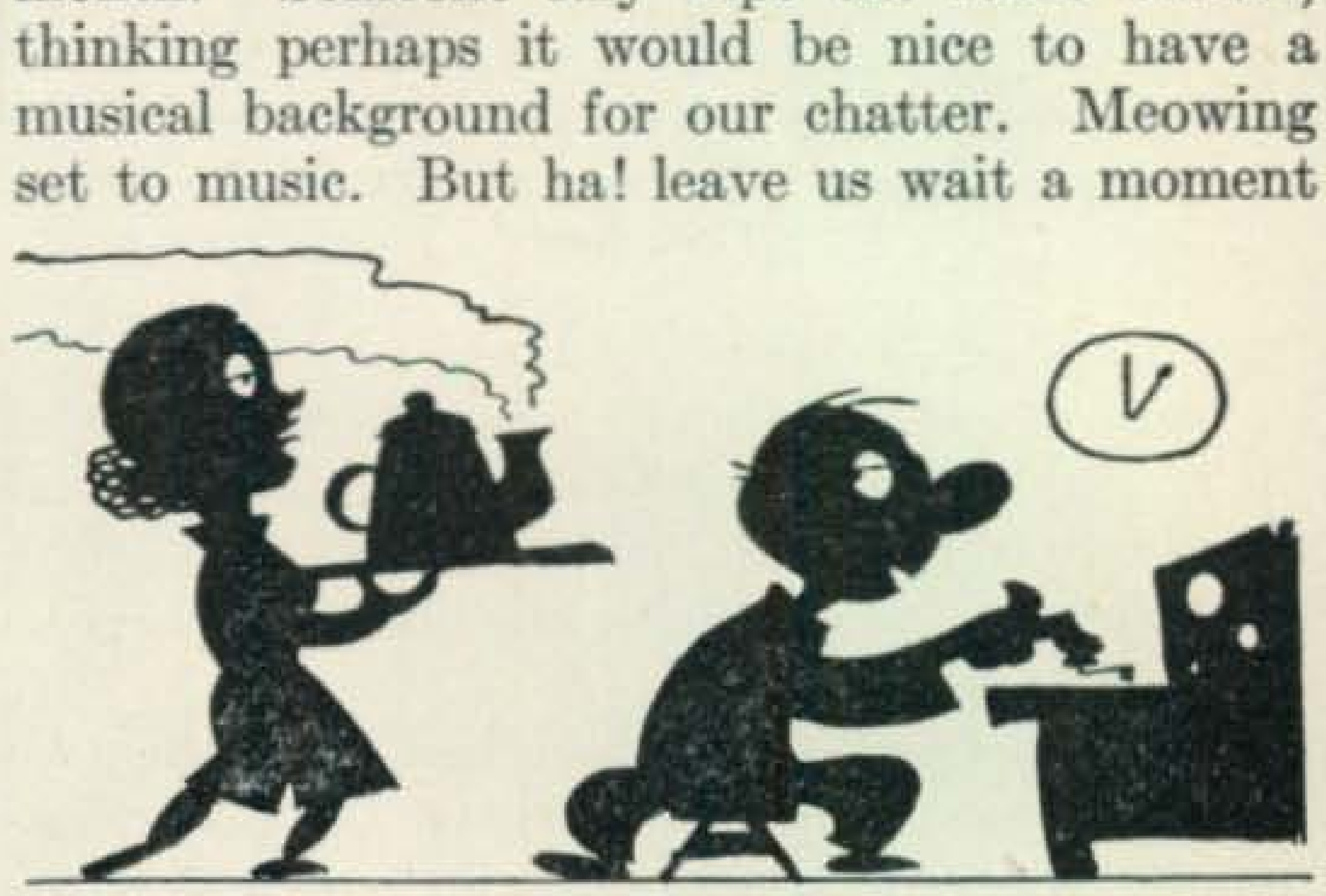
Reams of paper lie surrounding my little nicotine eater and creating a fire-trap. They are

"notes on transmissions" written also in a foreign tongue and persistently refer to "QTH's" and of all things, ANTS! This is the first inkling I have had of his interest in entomology, but being a good wife I shall bone up on bugs.

The ham may be located very easily when needed for small chores such as getting lids off cans, bottles, 'n stuff like that. He is an unusually consistent creature and is always found in the same locale—a room which is called a shack and which contains a rig. He is very docile when encountered thusly. After the ritual of, "QRT a minute, here's the XYL." he will do as requested so long as he is not required to leave said shack.

During the process of transmission the guy's absorption is so near to the ultimate ult that ye XYL, (of whom was said, "Let no man put asunder,") is greeted with a vacant stare which carries all the implications of a—"Haven't I seen you somewhere before??" But then ether waves are not human, are they? I have been bullied and put asunder by an ineffable substance called "Ether" and defined by good ole Webster as, "Name given to an imponderable medium presumed to permeate all matter and space. The ultimate dielectric medium to the action of which all electric and magnetic phenomena are to be referred." Noah, how *could* you!

I entertain my club, as is my duty every other month. Someone idly flips the radio switch, thinking perhaps it would be nice to have a musical background for our chatter. Meowing set to music. But ha! leave us wait a moment



till the set warms up—what is this we hear? "CQ, hello CQ" all over the dial. Something new, dear? No, it is something old, dear, something called BCI from the attic. BCI, bless it! I am at the point where I could welcome listening to an electrical transcription! It has come to that. I try to sound proud as I explain: that is my man. Yes, my husband is a ham. [*Continued on page 60*]

Putting the 1 MA Meter to Work

ATHAN COSMAS, W2PKD

and

WILLIAM F. KLUGH, W3HF/2

The completed tester has a professional appearance. Everything is home-constructed including the commercial looking name plates

THE METER described herein is designed parmarily for newcomers to ham radio, more particularly those with a limited hobby budget. We believe that this instrument puts a one-mil meter to maximum use, with the added feature that it is always readily available for other purposes.

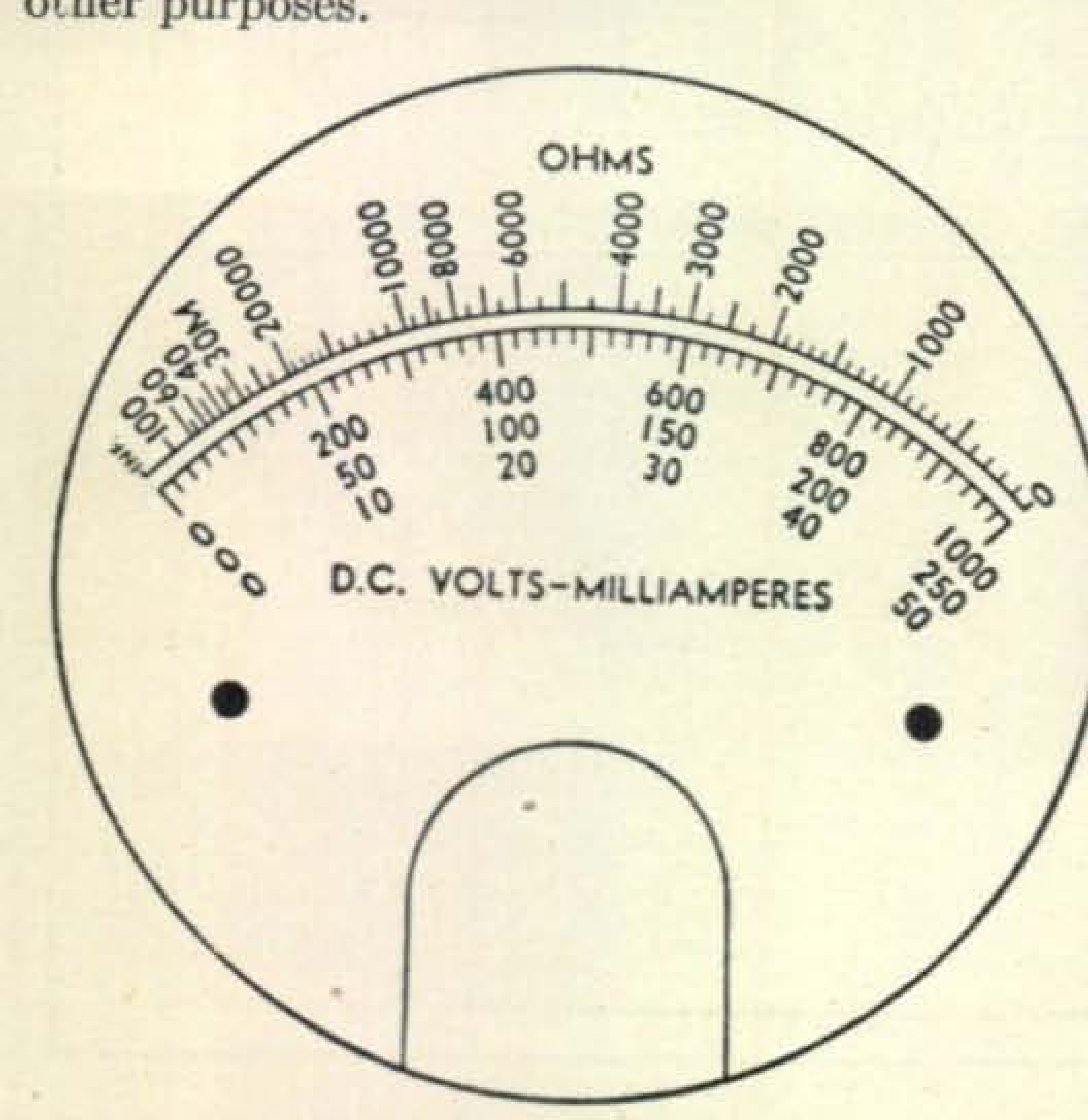


Fig. 1. 1 ma meter scale for universal tester

A major difficulty of most home-built multitesters is the inability to obtain a meter dial with the proper markings for the measurements and ranges desired. The average small meter with many ranges is also unsatisfactory because the crowded dial is difficult to read. Further, even if it could be obtained it would still not contain all the calibrations needed for this tester. *CQ* has more than partially solved this problem in Richard E. Nebel's "Know Your Meter," as published in the January, 1946, issue. We feel that the best compromise is the sample scale shown in *Fig. 1.* This scale has the correct calibration for d-c volts, milliamperes, and ohms. All other measurements are then calibrated on an eight-inch, easy-to-read "slide rule" chart in terms of one-mil meter deflection.

We used a Westinghouse type RC35 meter, having a 750-volt d-c and 125-volt a-c ranges. This meter has its own full-wave rectifier. Our multipliers and shunts were selected in terms of this dial. However, as can be seen from the diagram and parts list, any one-mil meter and full-wave rectifier can be used.

The Selector Switch

The selector switch consists of six sections, two for the meter, two for the rectifier and two for

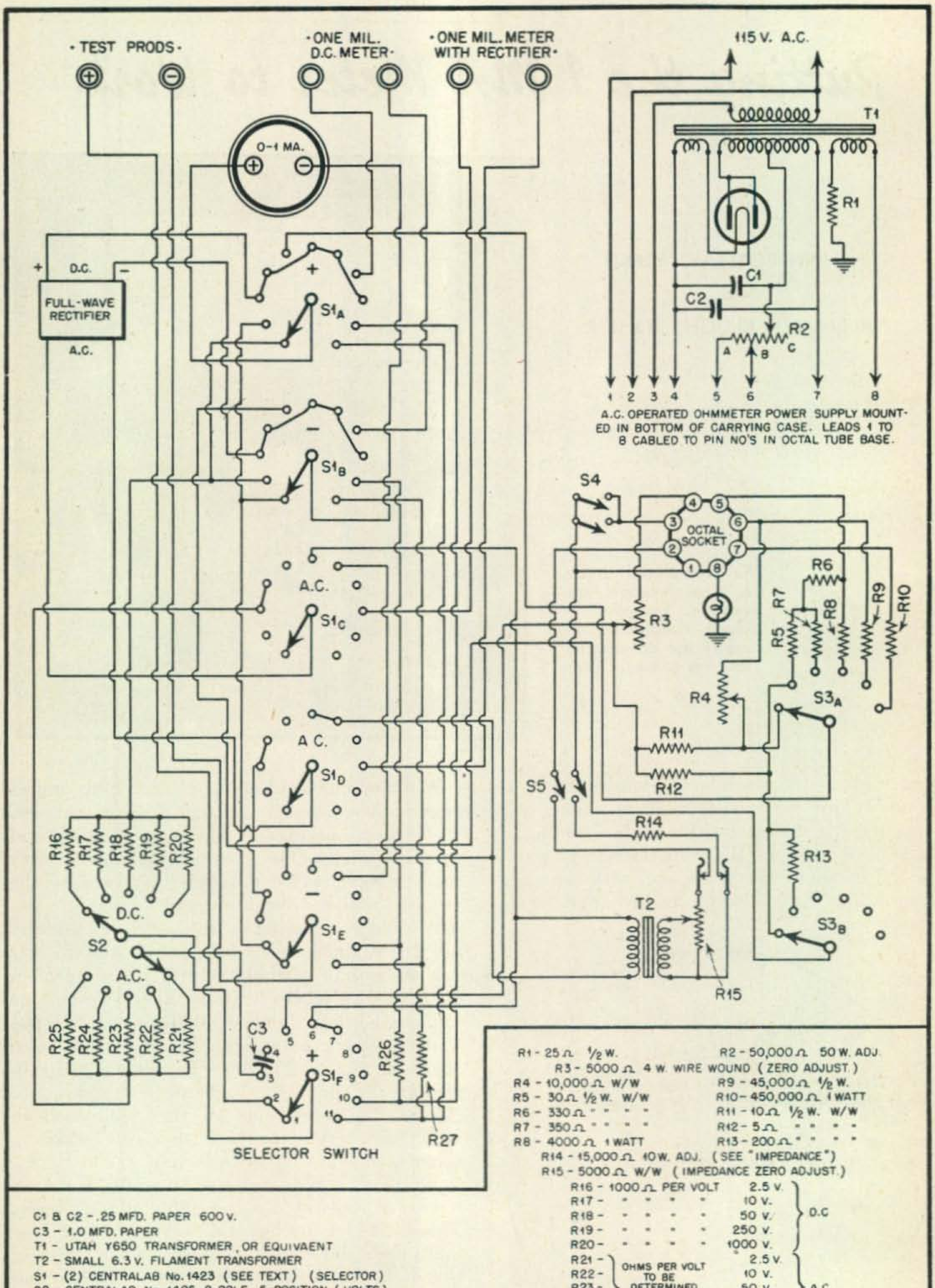


Fig. 2. Circuit diagram of multi-tester constructed around a 1 ma meter

the test prods. It is made up of two Centralab #1423 switches. The switches are taken apart and the spacers from one are cut in half. The switch is reassembled with the six sections all mounted on one frame. To simplify wiring, it is recommended that a different color wire be used for the switch arm of each section.

D-C Volts

Position 1: (See *Fig. 2*). This circuit is conventional. Starting at the positive test prod terminal, through the plus test prod section $S1_f$, through the d-c multiplier position of S_2, through the plus meter section $S1_a$, through the meter, through the minus meter section $S1_b$ to the minus test pro section $S1_e$ and thence to the minus test prod terminal. Position 2 of *S1* is the same, except that, through $S1_a$ and $S1_b$, the polarity to the meter is reversed.

Multipliers

Standard one-watt metallized resistors were used for the multipliers, and rather than the usual arrangement in series, it was decided to use separate resistors for each range. If you have a good supply of resistors to choose from it is easy to arrive at the required value. For example, an accurate 10,000-ohm multiplier may be made by matching "high" and "low" 5000-ohm resistors. The higher range multipliers should be made up of several resistors in series.

A-C Volts and Output

Positions 3 and 4: Tracing the circuit through, starting at the positive test prod, through $S1_f$ to the a-c multiplier portion of S_2, through the rectifier section $S1_c$ to the rectifier; from the d.c. plus terminal on the rectifier to $S1_a$ to the plus terminal of the meter. Through the meter minus terminal to the minus terminal of the rectifier through *S1* ; from the other a-c side of the rectifier through $S1_d$ to $S1_e$ and thence to the negative test prod terminal.

Position 4 is the same as position 3 except that the circuit is blocked to d.c. by the condenser C_3.

As is customary in most multi-testers, the a-c voltage ranges are used for output measurements, as well as standard a-c voltage tests.

The a-c multipliers will of course depend upon the type of rectifier used.

Using the best available a-c meter as a standard, and as a voltage source a broadcast receiver power transformer with a variac or variable resistance in the primary, select the necessary multipliers for equivalent readings on both meters.

B-C Transformer as a Voltage Source

The rectifier winding may be used for the 2.5-volt source while the rectifier winding in series with the 6.3-volt filament winding may be used as a 10-volt source. One-half the high-voltage winding may be used for the 50 and 250-volt sources while the entire HV winding is used for the HV range. In making these measurements AVOID HAYWIRE CONNECTIONS! Mount the transformer on a board, bringing the leads to well-spaced Fahnestock clips. Insert an ON-OFF switch in the primary and hang a warning lamp across the 6.3-volt winding. It is far better to put a little time on this than to risk shock by careless handling.

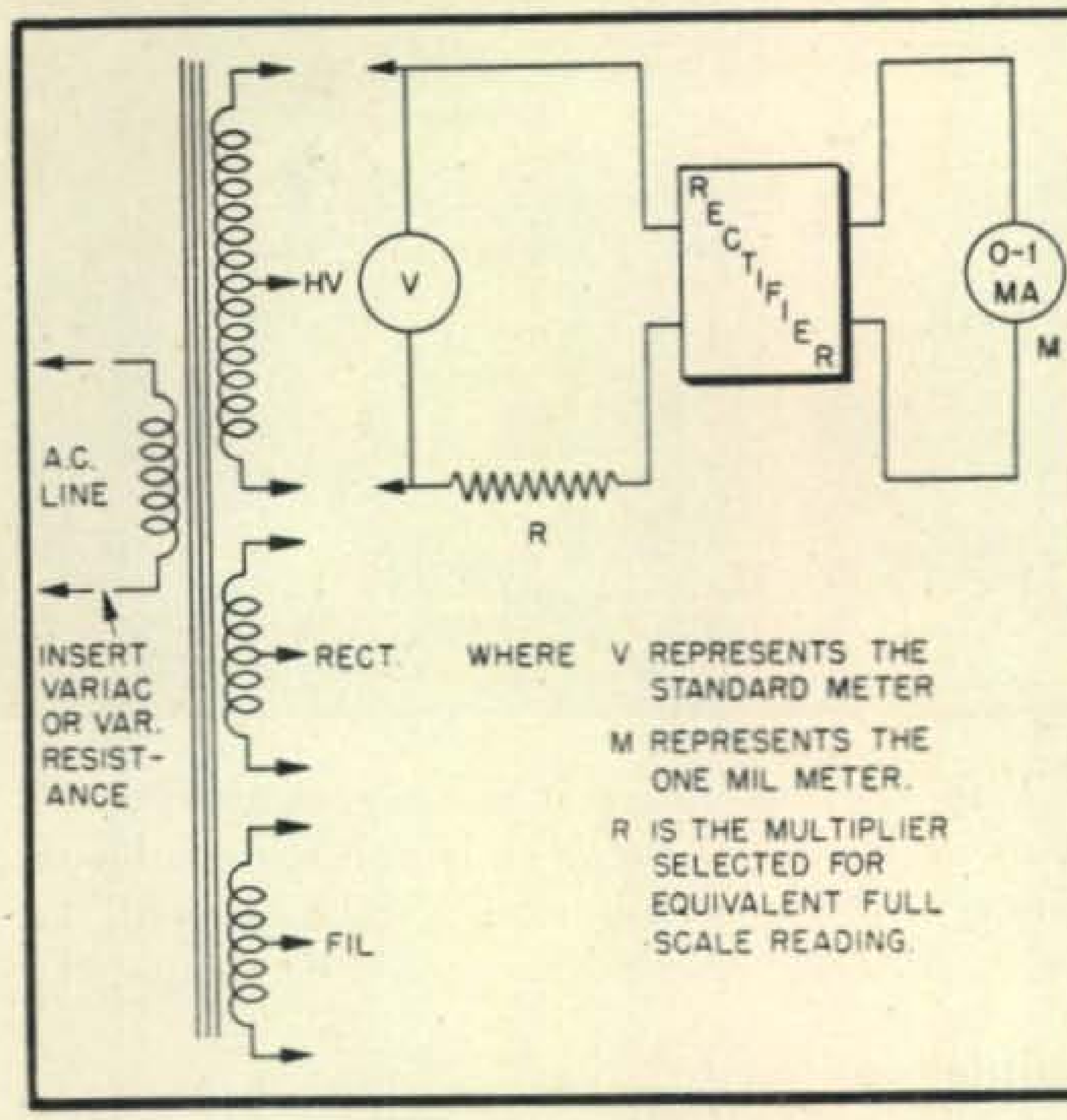


Fig. 3. Circuit for calibrating a-c ranges on the 1 ma meter. See text for details of the method

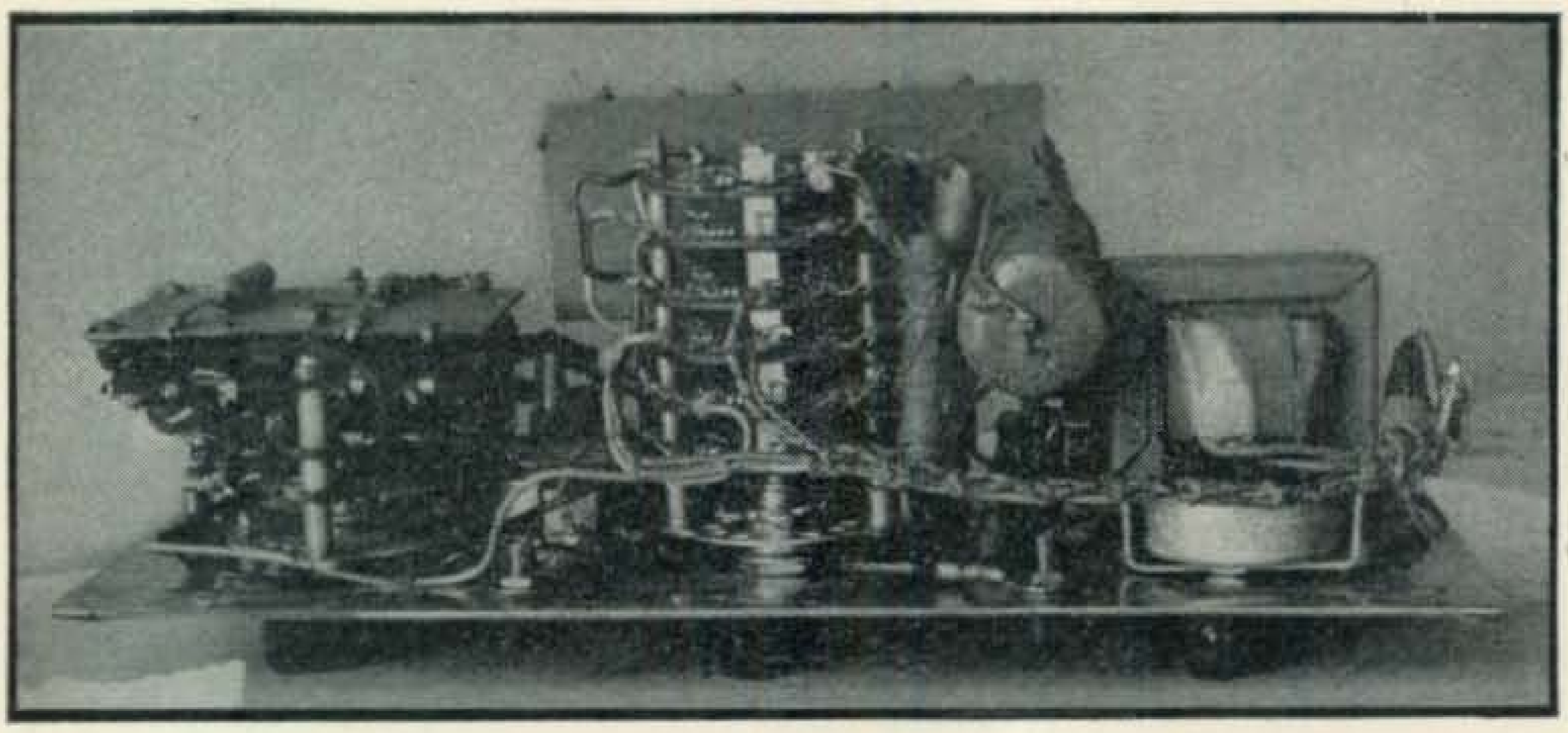
After the multipliers are wired up, the a-c source and the standard meter may be used for the calibration of the a-c ranges. (*Fig. 3.*) Make a table of a-c voltage vs. readings on the one-ma meter. Two tables will be required, one for the two-and-one-half volt range and another for the 10-volt range. The higher ranges should be even multiples of the 10-volt range. When the tables are completed the values can easily be transferred to the "slide rule" chart.

Once the a-c calibration is completed, it may be used with voltage-gain vs. db tables for db calibration, if desired. These tables are available in Daven, Kenyon, Weston (etc.) literature.

A-C Operated Ohmmeter

Position 5 of the selector switch connects up the test prods and meter to the circuit of an a-c operated ohmmeter, first described in *Radio* for November, 1940, by Carl J. Swenson, W9RFV.

All ohm ranges are read on the same scale, which is marked 100,000 ohms at the extreme left. The six ranges of this ohmmeter are 100, 1000, 10,000, 100,000, 1 megohm and 10 megohms, which correspond to 4.5, 45, 450, 4500. 45,000 and 450,000 ohms at center scale.



Looking at the test instrument from the top. Parts, from left to right are: ohmmeter range switch and resistance plates, selector switch, shunts, C3, impedance meter zero-adjust reheostat illustrating how the transformer is supported behind it

With the low range it is very easy to check filament windings, voice coils and even soldered joints, while the high range will be useful for testing leakage of condensers, a-v-c circuits, etc.

Calibration

The first step in the calibration, if the meter resistance is not known, is to hook it up in a circuit as shown in *Fig. 4a.* The variable resistance is adjusted until the meter indicates exactly one milliampere. The meter is left at this position and an accurate resistance of 50 or 100 ohms is connected across the meter terminals. The meter reading will drop when this is done.

The graph of *Fig. 4b* should then be consulted and from the meter reading the value of its resistance can be read from the curve. If a 50-ohm resistance is used curve *B* should be used. If the shunting resistance is 100 ohms, then use curve *A* to determine the meter resistance. If a resistance value of less than 50 ohms is obtained, a resistance must be added in series with the meter to bring its resistance up to 50 ohms. The only precaution it is necessary to observe is that the meter must be adjusted to full scale or one milliampere before the 50 or 100 ohm shunt is connected to the meter terminals.

After the meter has been adjusted to 50 ohms resistance, the adjustable resistor (R_2 in *Fig. 2*) should be set approximately with another ohm meter. Starting at point (A) the first slider should be set at approximately 3600 ohms, which is then connection (B). Slider (*C*) should then be set so that the resistance between (*A*) and (*C*) is 25,000 ohms. Resistance R_4 should be adjusted to approximately 8600 ohms. A 10,000 or 15,000 ohm wire-wound potentiometer can be used for R_4.

Now the parts may be wired, locating the rectifier tube and adjustable resistance so that they do not heat the meter or other resistors. If the transformer used has a higher voltage rating than the one shown the tap (*C*) should be set at 30,000 ohms for a preliminary check.

The ohms range switch S_3 should now be set at the 100 ohms position. The line switch should be left in the "off" position except when an actual test is being made. It may be found that the meter reads even though the test prods are not shorted. Resistance R_4 should now be adjusted until no reading is obtained. The test prods may now be shorted and the reading noted. If the pointer does not deflect to zero ohms the tap (*C*) should be moved toward (*A*) a small amount; or if it deflects too far beyond zero ohms, it should be moved away from (*A*).

The ohms range switch is next set at the 1-megohm position and the test prods again shorted. (Ranges should never be changed while the test prods are shorted as this may damage the instrument.) If the pointer does not deflect to zero ohms the tap (*B*) should be moved away from (*A*); if it deflects beyond zero, it should be moved toward (*A*).

If the resistors are of the values specified the 1M, 10M and 100M ranges should indicate zero

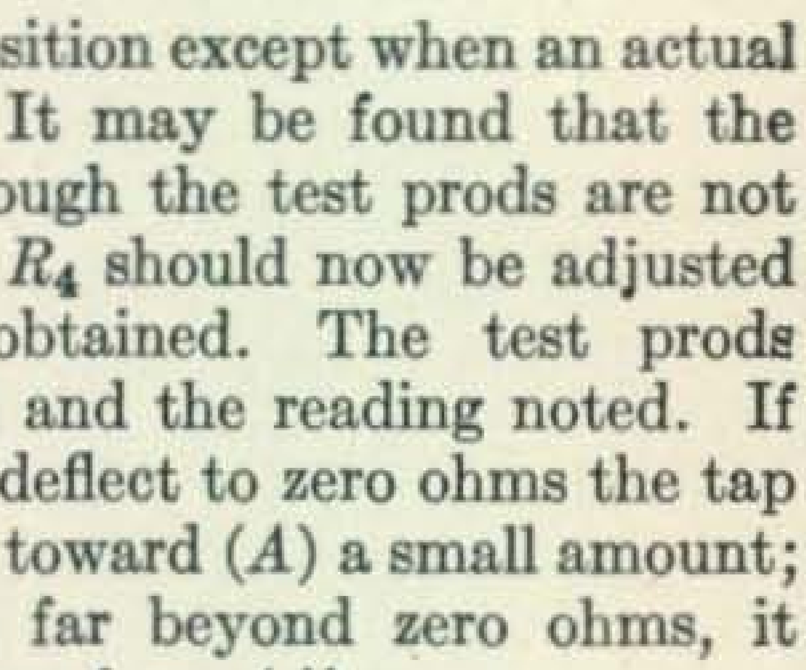


Fig. 4a. Circuit for determining the d-c resistance of the meter. See text for details of the method

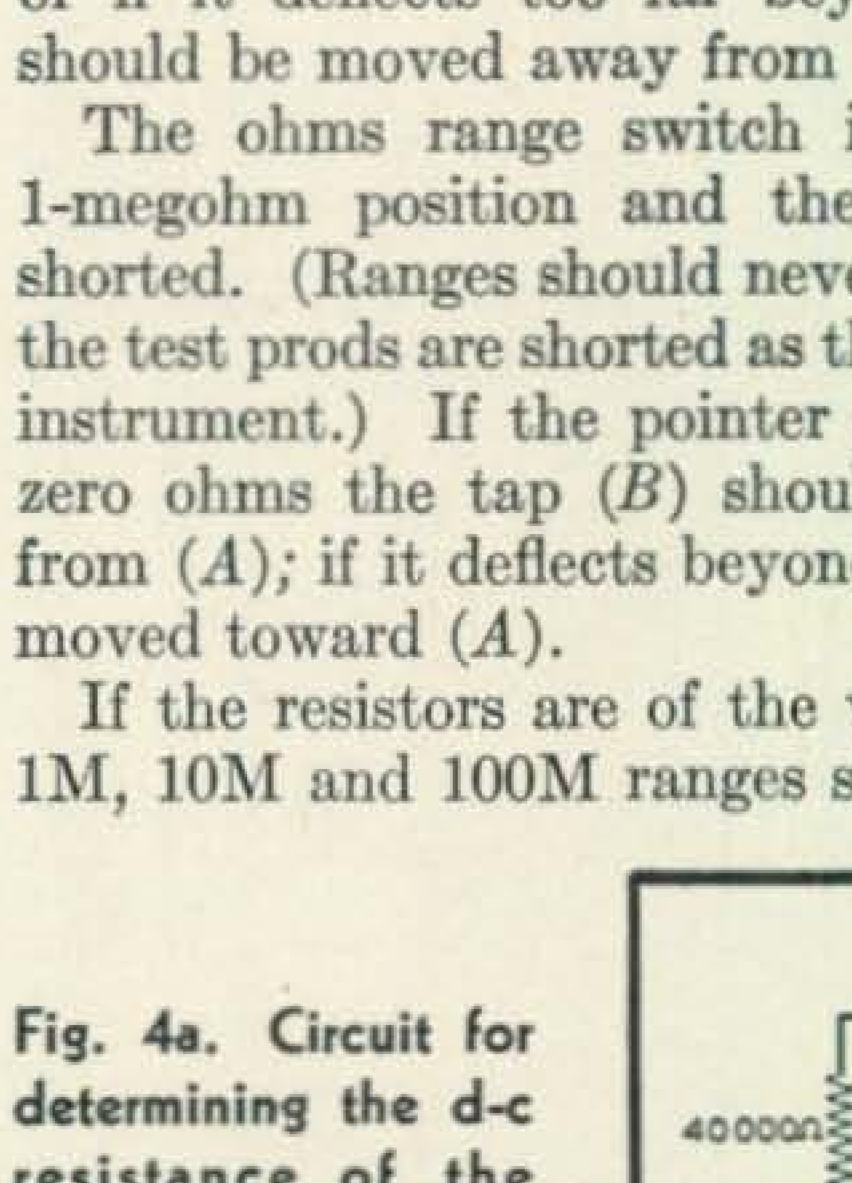


Fig. 4b. Chart for determining meter d-c resistance from the change in indication when the circuit of Fig. 4 is used

ohms also—when the test prods are shorted—with perhaps a difference of three or four dial divisions. The zero adjuster R_3 is for the purpose of adjusting this difference.

The range switch should now be set at the 10-megohm postion. The test prods should be momentarily shorted and the deflection noted. If the transformer voltage is too high the pointer will deflect too far—in which case the value of C_2 should be reduced. If, however, the pointer does not deflect to zero ohms, C_2 should be made larger. C_1 and C_2 should be paper condensers, not electrolytics.

When this range has been properly adjusted with the zero adjuster rheostat still set at mid-scale, the 100-ohm range should again be checked to see if the reading, (with the test prods separated) is still zero. If not, it should be set to zero by means of R_4. The circuit of the 100-ohm range is a modified form of Wheatstone Bridge, and by adjusting R_4 the bridge is brought in balance. The 100-ohm range should now be tested at zero ohms and if different from the original adjustment, slider (C) on R_2 should be adjusted until all the ranges are close to zero. From then on each individual range can be adjusted to zero with the zero adjuster. The preceding checks and adjustments may seem complicated but they are in reality very simple.

The 100-ohm range operates as a Wheatstone Bridge with the meter as a galvanometer and the unknown resistor shunted across one leg of the bridge. With this system it is possible to get by with a current drain of only about 15 ma for the range. If an ordinary series type ohmmeter using a 4.5-volt battery for this range were made, it would require a current drain of one ampere!

The other ranges merely consist of fixed series resistances, with a variable voltage supply to compensate for line voltage variations. The 10-megohm range operates at a potential of 450 volts which can cause a shock if the test prods are touched, but this is not dangerous since the current cannot exceed one milliampere. The filter system may seem inadequate but it is sufficient for the purpose.

Ohmmeter Construction

As can be seen from the photographs, the ohmmeter power supply, condensers and the 50-watt adjustable resistor (R_2) should be mounted in the bottom of the carrying case. Leads from the power supply should be cabled and connected to the appropriate pins of an octal tube base, as indicated in the main diagram. A bracket on the zero adjuster R_3 holds the socket, while another bracket under the R_3 mounting nut holds R_4. The various ohmmeter resistances should be mounted on thin bakelite plates supported on brackets mounted on the ohms range switch. It is suggested that the ohmmeter be set up "breadboard" and the required resistors carefully selected and tested. When the tests are completed, the two units, R_3 supporting R_4 and the octal socket and the range switch supporting the resistance plates, should be mounted on the panel and the ohmmeter wiring completed.

Impedance Meter

In position 6 a parallel circuit is used, wherein the impedance being measured is placed in shunt with the a-c voltage source, the rectifier and one mil meter. Position 7, for High-Z measurements, uses a series circuit wherein the impedance being measured is placed in series with the a-c voltage source and rectifier.

A small 6.3 filament transformer or a small microphone transformer might be used for T_2. The potentiometer in the primary is used to deliver the required voltage to the rectifier for full scale deflection of the meter. The double-circuit jack permits measurement from a source other

[*Continued on page 56*]

The tester removed from carrying case clearly shows location of major components. Power supply is in bottom of case. A-c and d-c voltage multipliers are mounted in flat bakelite channels supported on the meter

FCC RULES GOVERNING AMATEUR RADIO SERVICE

APPENDIX

EXAMINING POINTS

Amateur operator examinations are given frequently, under announced schedules, at the Commission's office in Washington, D. C., and at each of its district offices. For a list of such offices see the following pages.

Examinations are also given frequently, by appointment, at the Commission's offices at the following points:

Cleveland, Ohio
Savannah, Ga.
San Diego, Calif.
Tampa, Fla.
Juneau, Alaska

Examinations are also given at greater intervals at the places named below, which are visited for that purpose by Commission examiners from the district offices for such locations. For current schedules, exact time, place and other details, inquiry should be addressed to the office conducting examinations at the chosen point.

Quarterly Examinations

Birmingham, Alabama
Charleston, West Virginia
Cincinnati, Ohio
Columbus, Ohio
Corpus Christi, Texas
Davenport, Iowa
Des Moines, Iowa
Fort Wayne, Indiana
Fresno, California
Grand Rapids, Michigan
Indianapolis, Indiana
Little Rock, Arkansas
Memphis, Tennessee
Milwaukee, Wisconsin
Nashville, Tennessee
Oklahoma City, Oklahoma
Omaha, Nebraska
Pittsburgh, Pennsylvania
St. Louis, Missouri
Salt Lake City, Utah
San Antonio, Texas
Schenectady, New York
Sioux Falls, South Dakota
Syracuse, New York
Tulsa, Oklahoma
Williamsport, Pennsylvania
Winston-Salem, North Carolina

Semi-annual Examinations

Albuquerque, New Mexico
Amarillo, Texas
Bakersfield, California
Bangor, Maine
Billings, Montana
Bismarck, North Dakota
Boise, Idaho
Butte, Montana
Cumberland, Maryland
El Paso, Texas
Hartford, Connecticut
Hilo, T. H.
Jacksonville, Florida
Klamath Falls, Oregon
Las Vegas, Nevada
Lihue, T. H.
Mobile, Alabama
Phoenix, Arizona
Portland, Maine
Reno, Nevada
Roanoke, Virginia
Salisbury, Maryland
Spokane, Washington
Tucson, Arizona
Wichita, Kansas
Wilmington, North Carolina

Annual Examinations

Kaunakakai, T. H.
Lanai, T. H.
Wailuku, T. H.

Arrangements have also been made, including cooperation of other Federal agencies, for classes A and B examinations in outlying areas as follows:

Alaska: United States Signal Corps stations; at other points by coast guard officers.
Guam: District communications officer, United States naval station.
Hawaii: At not exceeding one point on any island, by the inspector in charge (Honolulu).

Radio Districts

Radio District	Address of the Inspector in Charge	Territory within District: States, etc.	Territory within District: Counties
1	Seventh Floor Custom-house, Boston 9, Mass.	Connecticut	All counties
		Maine	do
		Massachusetts	do
		New Hampshire	do
		Rhode Island	do
		Vermont	do
2	748 Federal Building 641 Washington Street New York 14, New York	New Jersey	Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Passaic, Somerset, Sussex, Union and Warren.
		New York	Albany, Bronx, Columbia, Delaware, Dutchess, Green, Kings, Nassau, New York, Orange, Putnam, Queens, Rensselaer, Richmond, Rockland, Schenectady, Suffolk, Sullivan, Ulster and Westchester.
3	Room 1200, New United States Customhouse, 2nd & Chestnut Streets, Philadelphia 6, Pa.	Delaware	Newcastle
		New Jersey	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, and Salem.
		Pennsylvania	Adams, Berks, Bucks, Carbon, Chester, Cumberand, Dauphin, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Perry, Philadelphia, Schuylkill and New York.
4	508 Old Town Bank Bldg. Gay Street & Falsway Baltimore 2, Maryland	Delaware	Kent and Sussex
		District of Columbia	All
		Maryland	All counties.
		Virginia	Arlington, Clark, Fairfax, Fauquier, Frederick, Loudoun, Page, Prince William, Rappahannock, Shenandoah and Warren.
5	Room 402 New Post Office Building Norfolk 10, Virginia	North Carolina	All except district 6.
		Virginia	All except district 4.

Radio Districts

Radio District	Address of the Inspector in Charge	Territory within District	
		States, etc.	Counties
6	411 Federal Annex Atlanta 3, Georgia	Alabama	All except district 8.
		Georgia	All counties.
		North Carolina	Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, and Yancey.
		South Carolina	All counties.
		Tennessee	do
	Sub-Office P. O. Box 77 214-218 Post Office Bldg. Savannah, Georgia		
7	P. O. Box 150 312 Federal Building Miami 1, Florida	Florida	All except district 8.
	Sub-Office 409-410 Post Office Bldg. Tampa 2, Florida		
8	400 Audubon Building New Orleans 16, Louisiana	Alabama	Baldwin and Mobile
		Arkansas	All counties.
		Florida	Escambia
		Louisiana	All counties.
		Mississippi	do
		Texas	City of Texarkana only.
9	404 Post Office Building Galveston, Texas	Texas	Arkansas, Brazoria, Brooks, Calhoun, Cameron, Chamber, Fort Bend, Galveston, Goliad, Harris, Hidalgo, Jackson, Jefferson, Jim Wells, Kenedy, Kleberg, Matagorda, Nueces, Refugio, San Patricio, Victoria, Wharton and Willacy.
10	P. O. Box 5238 500 U. S. Terminal Annex Dallas 2, Texas	New Mexico	All counties.
		Oklahoma	do
		Texas	All except district 9 and the city of Texarkana.
11	539 U. S. Post Office & Courthouse Bldg., Temple and Spring Streets Los Angeles 12, Calif.	Arizona	All counties.
		California	Imperial, Inyo, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara and Ventura.
	Sub-Office 307 U. S. Customhouse & Courthouse Bldg. Union & "F" Streets San Diego 1, California	Nevada	Clarke.
12	328 Customhouse San Francisco 26, Calif.	California	All except district 11.
		Nevada	All except Clarke.
13	805 Terminal Sales Bldg. Portland 5, Oregon	Idaho	All except district 14.
		Oregon	All counties.
		Washington	Wahkiakum, Cowlitz, Clark, Skamania, and Klickitat.
14	808 Federal Office Bldg. Seattle 4, Washington	Idaho	Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, Nez Perce, Shoshone.
		Montana	All counties.
		Washington	All except district 13.
15	504 Customhouse Denver 2, Colorado	Colorado	All counties.
		Utah	do.
		Wyoming	do.
16	208 Uptown Post Office & Federal Courts Bldg. 5th & Washington Streets St. Paul 2, Minnesota	Minnesota	All counties.
		Michigan	Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft.
		North Dakota	All counties.
		South Dakota	do.
		Wisconsin	All except district 18.
17	809 U. S. Court House Kansas City 6, Missouri	Iowa	All except district 18.
		Kansas	All counties.
		Missouri	do.
		Nebraska	do.
18	246 U. S. Court House Chicago 4, Illinois	Illinois	All counties.
		Indiana	do.
		Iowa	Allamakee, Buchanan, Cedar, Clayton, Clinton, Delaware, Des Moines, Dubuque, Fayette, Henry, Jackson, Johnson, Jones, Lee, Linn, Louisa, Muscatine, Scott, Washington and Winneshiek.
		Wisconsin	Columbia, Crawford, Dane, Dodge, Grant, Green, Iowa, Jefferson, Kenosha, Lafayette, Milwaukee, Ozaukee, Racine, Richland, Rock, Sauk, Walworth, Washington, and Waukesha.
19	1029 New Federal Building Detroit 26, Michigan	Kentucky	All counties.
		Michigan	All except district 16.
		Ohio	All counties.
		West Virginia	do.
	Sub-Office 541 Old Post Office Bldg. Cleveland 14, Ohio		
20	328 Federal Building Buffalo 3, New York	New York	All except district 2.
		Pennsylvania	All except district 3.
21	609 Stangenwald Building Honolulu 1, Territory of Hawaii	Territory of Hawaii	
		Guam	
		Midway	
		Wake	
		American Samoa	
22	P. O. Box 2987 322-323 Federal Bldg. San Juan 13, Puerto Rico	Puerto Rico	
		Virgin Islands	
23	P. O. Box 1421 7-8 Shattuck Bldg. Juneau, Alaska	Alaska	

EXTRACTS FROM GENERAL RADIO REGULATIONS
(Cairo Revision)

ARTICLE 5 — Classification of Emissions

¶1. Emissions shall be classified below according to the purpose for which they are used, assuming their modulation or their possible keying to be only in amplitude.

1. Continuous waves:
   - Type A0.—Waves the successive oscillations of which are identical under fixed conditions.[1]
   - Type A1.—Telegraphy on pure continuous waves. A continuous wave which is keyed according to a telegraph code.
   - Type A2.—Modulated telegraphy. A carrier wave modulated at one or more audible frequencies, the audible frequency or frequencies or their combination with the carrier wave being keyed according to a telegraph code.
   - Type A3.—Telephony. Waves resulting from the modulation of a carrier wave by frequencies corresponding to the voice, to music, or to other sounds.
   - Type A4.—Facsimile. Waves resulting from the modulation of a carrier wave by frequencies produced at the time of the scanning of a fixed image with a view to its reproduction in a permanent form.
   - Type A5.—Television. Waves resulting from the modulation of a carrier wave by frequencies produced at the time of the scanning of fixed or moving objects.[2]
   - Note.—The band widths to which these emissions correspond are indicated in appendix 3.
2. Damped waves:
   - Type B.—Waves composed of successive series of oscillations the amplitude of which, after attaining maximum, decreases gradually, the wave trains being keyed according to a telegraph code.

¶2. In the above classification, the presence of a carrier wave is assumed in all cases. However, such carrier wave may or may not be transmitted.

This classification does not contemplate exclusion of the use, by the administrations concerned, under specified conditions of types of waves not included in the foregoing definitions.

[1] *These waves are used only in special cases, such as standard frequency emissions.*
[2] *"Objects" is used here in the optical sense of the word.*

Table of Frequency-Band Widths Occupied by the Emissions

The frequency bands necessary for the various types of transmissions, at the present state of technical development, are in dicated below. This table is based solely upon amplitude modulation. For frequency or phase modulation, the band widths necessary for the various transmissions are many times greater.

Type of transmission	Total width of the band in cycles for transmission with 2 side bands.
A0 Continuous waves, no signaling..................	
A1 Telegraphy, pure, continuous wave.............. Morse code. Baudot code. Stop-start printer.	Numerically equal to the telegraph speed in bands for the fundamental frequency, 3 times this width for the 3rd harmonic, etc. (For a code of 8 time elements (dots or blanks) per letter and 48 time elements per word, the speed in bands shall be equal to 0.8 times the speed in words per minute.)
Scanning-type printer..............................	300-1,000, for speeds of 50 words per minute, according to the conditions of operation and the number of lines scanned (for example, 7 or 12). (Harmonics are not considered in the above values.)
A2 Telegraphy modulated to musical frequency......	Figures appearing under A1, plus twice the highest modulation frequency.
A3 Commercial radiotelephony.....................	Twice the number indicated by the C.C.I.F. opinions (about 6,000 to 8,000).[1]
Broadcasting................................	15,000 to 20,000.
A4 Facsimile......................................	Approximately the radio between the number of picture components[2] to be transmitted and the number of seconds necessary for the transmission.
A5 Television.....................................	Approximately the product of the number of picture components[2] multiplied by the number of pictures transmitted per second.

[1] *It is recognized that the band width may be wider for multiple-channel radio-telephony and secret radiotelephony.*
[2] *Two picture components, one black and one white, constitute a cycle: thus, the modulation frequency equals one-half the number of components per second.*

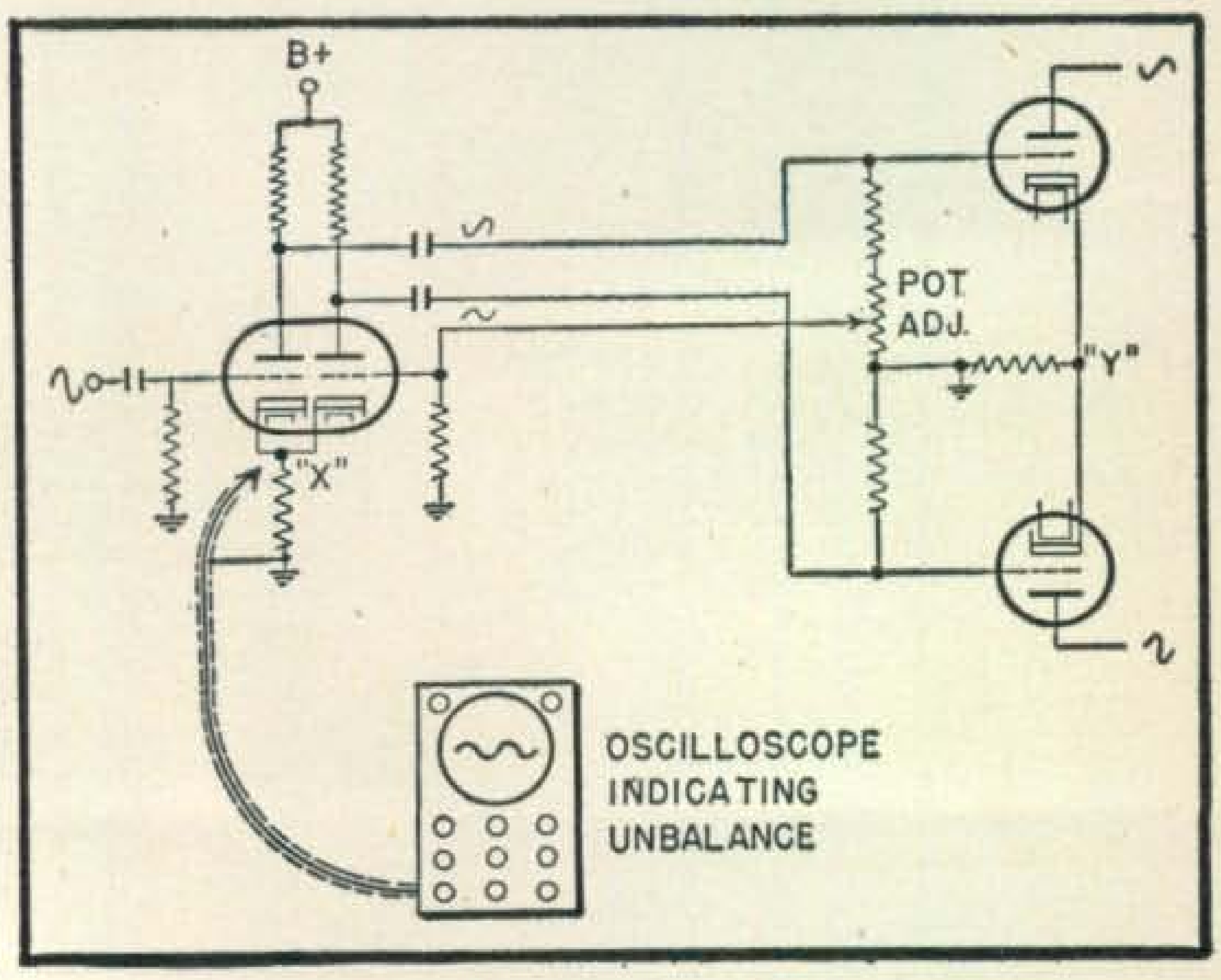
Phase Inverter Adjustment

Conventional phase-inverter amplifiers consist of two triodes, with single-ended input and double-ended output. Phase reversal is obtained by driving one triode with a portion of the output from the other triode.

The inverter shown in the diagram is an interesting circuit in which a two-tube paraphase amplifier affords double-ended drive from single-ended input. Unbalance in the cathode-coupled paraphase stage is adjusted by feeding back a small compensating signal from the potentiometer.

It is advantageous to make the cathode resistance of the paraphase stage sufficiently high that the first section is able to operate as a cathode follower with the second section disconnected. A good frequency characteristic is thus assured, and a minimum compensating signal required. This portion of the circuit is inherently highly degenerative and affords an output swing which would otherwise be obtained from one section in the absence of current feedback.

[*Continued on page 63*]



Practical vs. Theoretical Antennas

JAMES J. HILL, W2JIH

Continuing a topic close to the heart of every amateur, Part 2 of this series discusses a multitude of antenna problems ranging from matching unbalanced feeders to eliminating tuned feeders on a 3.5 mc Zepp

If one tunes across any amateur band for very long, he is sure to hear comments on antenna loading, impedance matching, and antenna gain problems. After listening to these troubles for so long, it seemed logical to tackle a few cures for the most common ailments.

Balancing Unbalanced Lines

Perhaps the most talked about ailment at the present time is that of balancing a coaxial fed dipole. A one-half wave vertically or horizontally polarized antenna system fed with a 72 ohm unbalanced coaxial cable is illustrated in *Fig. 1A*. An antenna of this type, having a nominal characteristic impedance at its center of 71.9 ohms, will match a 72-ohm coaxial cable and will give a minimum standing wave ratio on the line. However, despite this good antenna match, the antenna system, if operated slightly off frequency, becomes unbalanced in the sense that one dipole draws more antenna current than the other and r.f. will be present on the grounded outer conductor of the feeding transmission line. This unbalanced condition for a single-fed dipole does not cause too much loss in field strength although it gives a slightly distorted field pattern. The chief objection to this condition is its inability to operate efficiently over a wide range of frequencies.

A simple cure is illustrated in *Fig. 1B*. Here

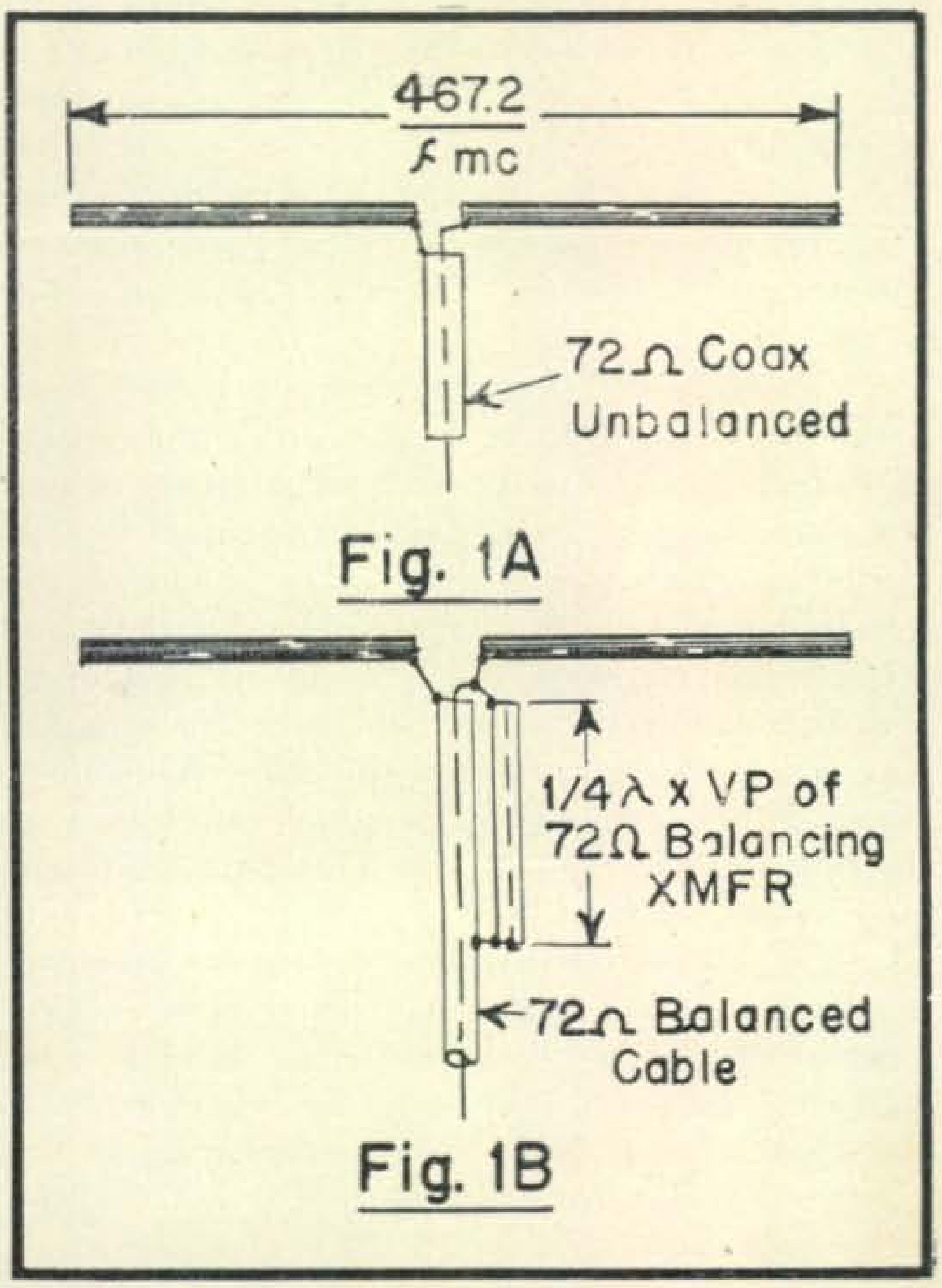
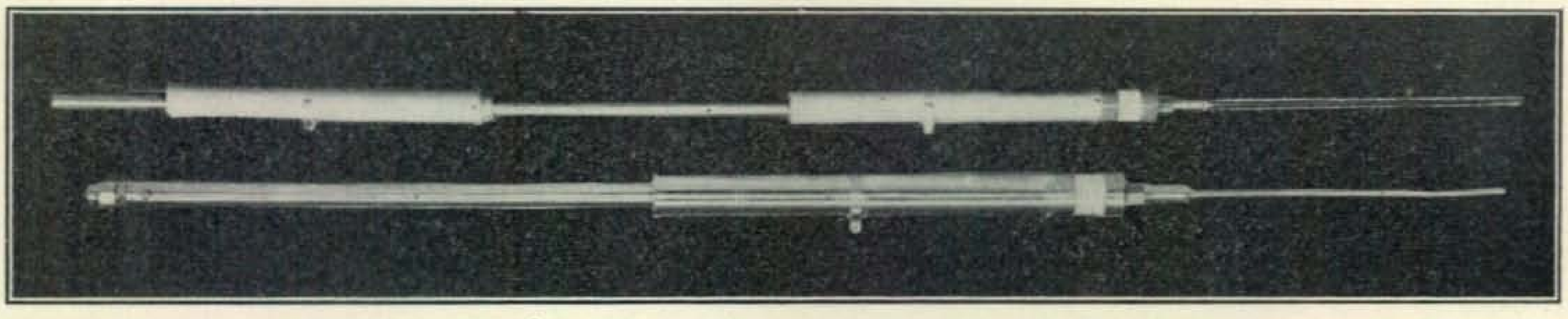


Fig. 1A. Conventional method of feeding half-wave. Fig. 1B. Method of attaching quarter wave length balancing transformer to compensate for off-frequency operation.



Two forms of coaxial antenna. The top model is a double-stacked coax, the lower one a single section coax. Constructional details are given in Fig. 4 and the text

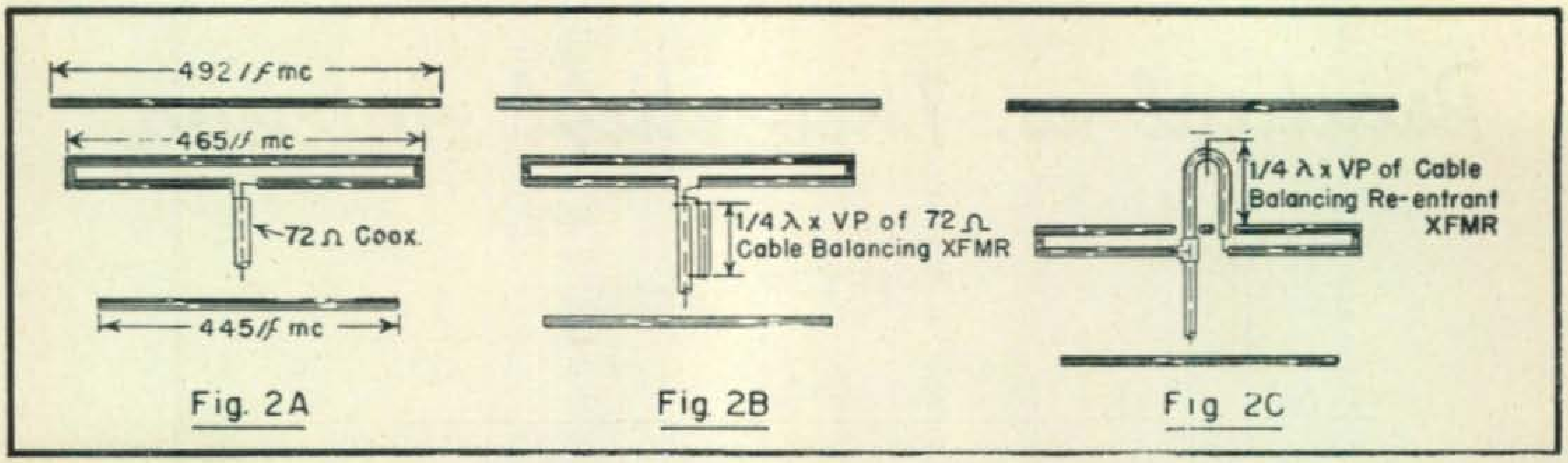


Fig. 2A. Three element beam fed with coaxial line. Fig. 2B. Quarter-wave balancing transformer. Fig. 2C. Matching with cable balancing re-entrant transformer

a half-wave dipole is fed with a 72-ohm coaxial cable, to which is attached a one-quarter wave length balancing transformer. Connection No. 1 is a 72-ohm coaxial cable, the inner conductor of which is shunted at the top to the shield of a similar piece of cable electrically one-quarter wavelength long. By the remark "electrically, one-quarter wavelength long," we mean that the transformer section is physically one-quarter wavelength times the velocity of propagation of the cable used.

To simplify this, assume that you have a half-wave dipole, an infinite length of 72-ohm cable. and an electrical quarter-wavelength piece of this same coaxial cable. One-half of the dipole is connected to the outer conductor or shield of the infinite length of line. The inner conductor of this infinite line connects both to the other half of the dipole and the outer shield of the quarter wavelength transformer at the top. The outer shield of the same transformer is connected at the bottom directly to the shield of the infinitely long feeding cable. This is accomplished by cutting a 1/16″ circular piece of vinylite covering out of the transmission line one quarter wavelength from the top end, and with a flexible wire, soldering the lower portion of the transformer at the bared point. The inner conductor of the quarter-wave transformer section is left floating at the top and is soldered at the bottom as shown in the sketch. This method of feeding establishes a balanced half-wave dipole system fed with a broad-band transformer capable of covering any range covered by the antenna itself, this range being directly proportional to the diameter of the elements used.

Feeding The Rotary Beam

Another much-talked-about problem these days—that of feeding a three-element or more beam with an unbalanced transmission line. A three-element beam fed with coaxial line utilizing a folded dipole as the center element is illustrated in *Fig. 2A*. The same transformer shown in *Figs. 1B* and *3A* may be used. An antenna of this type, despite its broad band folded dipole, will operate efficiently on but one frequency as a result of the unbalancing effect of the coaxial cable. This may easily be cured by the insertion of the previously mentioned balancing transformer. The method of insertion is illustrated in *Fig. 2B*. When a flexible coaxial transmission line is used for feeding the antenna system, it is a relatively simple matter to rotate the system. The transformer and the line may be coiled up directly below the antenna, taking up very little room and allowing free motion of the remaining feeding line. The same antenna fed with a re-entrant transformer one-half wavelength overall is shown in *Fig. 2C*. This will be explained at greater length.

There are two types of re-entrant and balancing transformers. *Figure 3A* is a brief schematic outline of the simpler of the two balancing systems. In the drawing, No. 1 is the connection for one side of the dipole to the shield of the feeding transmission line, No. 2 and No. 3 are the inner conductor of the same transmission line shunted to the top section of the quarter-wave transformer, No. 5. Connection No. 4 is tapped off at this shunted point and feeds the other half of the dipole. The inner conductor of the transforming section of the cable is No. 7, and may be left floating at the top and grounded at the bottom. The point of shunt for the shields of both the feeding transmission line and the bottom section of the transforming cable is at No. 6. A re-entrant transformer which has the advantage over the type shown in *Fig. 3A* in that the transmission line feeding the antenna system is entirely separate from the transforming section and may be brought out at a different angle to the antenna is illustrated in *Fig. 3B*. Mechanically, the transformer may be constructed as follows—No. 1 is an ordinary Amphenol, Ucinite or Navy Type N Tee-connector; No. 4 is the inner conductor feeding one-half of the dipole; and No. 3 is the inner conductor feeding the other half of the dipole. The infinite length of now balanced transmission line is No. 2.

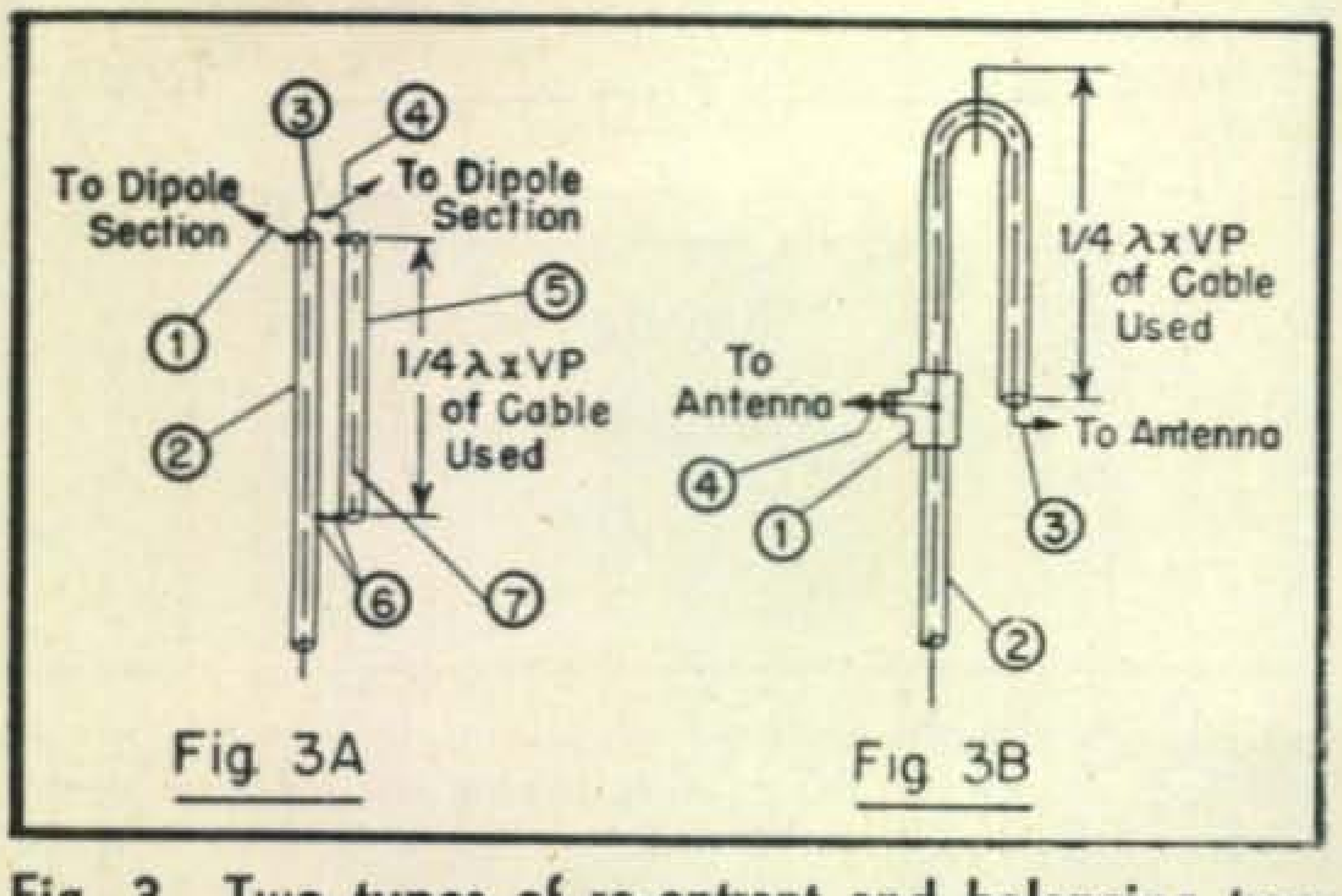


Fig. 3. Two types of re-entrant and balancing transformers. By using this type transformer it is possible to feed a multi-element beam with an unbalanced transmission line. Component parts are fully described in text.

Improving Performance of VHF Coaxial Antenna Systems

Many amateurs have tried coaxial antenna systems and discarded them after experiencing troubles with loading, inability to receive signals properly, and erratic performance due largely to improper mounting heights. Recently, detailed study has been made of this type antenna, and it has been proved far simpler than any other system. However, if the antenna is not properly cut to frequency or adjusted, it does not operate as efficiently as a simple one-half wave vertical radiator.

We have made laboratory measurements on a coaxial antenna in which the skirt, whip and supporting tube were as follows: Referring to *Fig. 4A*, No. 1 is the quarter wave whip, No. 2 is the supporting insulator, No. 3 is the skirt, No. 4 the supporting mast and No. 5 the feeding 72 ohm cable. Skirt diameter was 2″ and supporting tube a standard 1-1 8″ O.D. pipe, through which a 72 ohm cable (RG11U) was fed. We found that dimension A, the whip plus the mounting insulator length, should be 24″, and the length B, or the skirt length, should be 18.2″. Here it appears that the over-all whip length is a great deal longer than the skirt length. This fact, is caused by the larger diameter of the skirt and its existing capacity to ground through the supporting tube, No. 4. On frequency, the standing wave ratio of this antenna at 145 mc, the frequency for the dimensions given above, was less than 1.03 to 1. These measurements were made on highly accurate slotted lines using a VSWR bolometer amplifier, a field strength receiver, and a VSWR calibrated oscilloscope.

When this antenna was operated on frequency, (145 mc), its height above ground had no apparent effect, the impedance remained constant, and the supporting tube showed no signs of r.f. and remained at ground potential. As soon as we shifted frequency from 145 mc, either up or down, our center impedance changed so much that the antenna would not load, the supporting tube became part of the radiating system, and our field strength gain dropped 70 per cent. This indicated that the coaxial antenna would not serve as a broad-band antenna unless certain changes are made. It was determined that we could again obtain our impedance match off the original frequency by raising or lowering the antenna system.

A simple cure for this trouble is shown in *Figs. 4B* and *4C*. *Figure 4B* illustrates a coaxial antenna with two skirts inductively coupled, one one-quarter wave length below the other. Dimensions A and B of the excited antenna, No. 1, are the same as for those in *Fig. 4A*. Dimensions C and E are an exact quarter-wave length for the operating frequency of 145 mc. Dimensions D and F are the same as Dimension B. These skirts are shunted at the top to the supporting mast and floating at the bottom. With this antenna system constructed as shown, the stand-

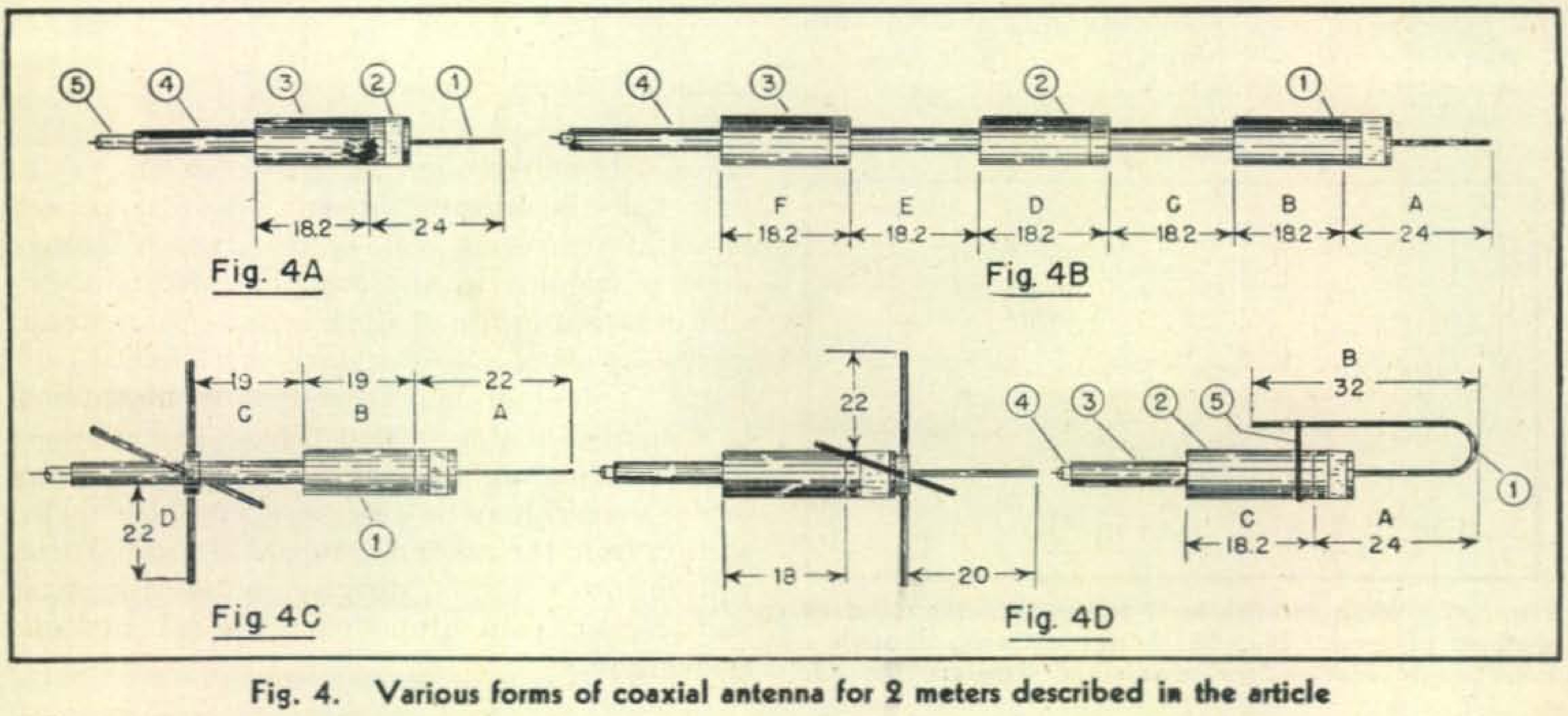


Fig. 4. Various forms of coaxial antenna for 2 meters described in the article

ing wave ratio was below 1.25 from a frequency range from 140 mc to 150 mc—a 10 mc coverage with no apparent change in field strength or loading impedance. The field strength gain of this antenna was approximately 18 per cent higher and the measured angle of radiation 7.5 degrees lower than a half wave vertical. Of the two systems, *Fig. 4B* showed an apparent signal gain over *Fig. 4C*, although the latter example is simpler. *Figure 4C* has approximately 10 per cent gain over *Fig. 4A* when adjusted to frequency.

Actually *Fig. 4C* consists of the same antenna as in *Fig. 4A* with a ground plane mounted one-quarter wave length below the lower section of the skirt, B. This ground plane is cheap and simple to construct and may readily be added to any existing coaxial antenna system. With an added ground plane a coaxial antenna has proved to be far superior in performance and field-strength gain over an ordinary ground plane antenna.

The next two coaxial antenna systems are somewhat unique and are designed more for those who like to experiment with various antenna systems. A coaxial antenna utilizing a folded unipole whip is shown in *Fig. 4D*. Dimension A is 24″, dimension B 32″, and dimension C 18.2″. No. 1 is the folded unipole whip; No. 2 the skirt; No. 3 the supporting tube; No. 4 the feeding cable; and No. 5 the sliding shunt which connects the unipole section B with the skirt, No. 2. This shunt may be adjusted up and down to realize a line match at the center of the system. This antenna may be used when reflectors and directors are added to the coaxial antenna system and constitutes a variable impedance matching device. *Figure 4E* illustrates a coaxial antenna system with a dispersion arrangement for a radiating whip. The whip is actually a turnstile type and gives amazing results in both the horizontal and vertical plane. Further discussion on high frequency coaxial antenna systems and directive arrays will be given at a later date.

As many operate mobile rigs on the 144 to 148

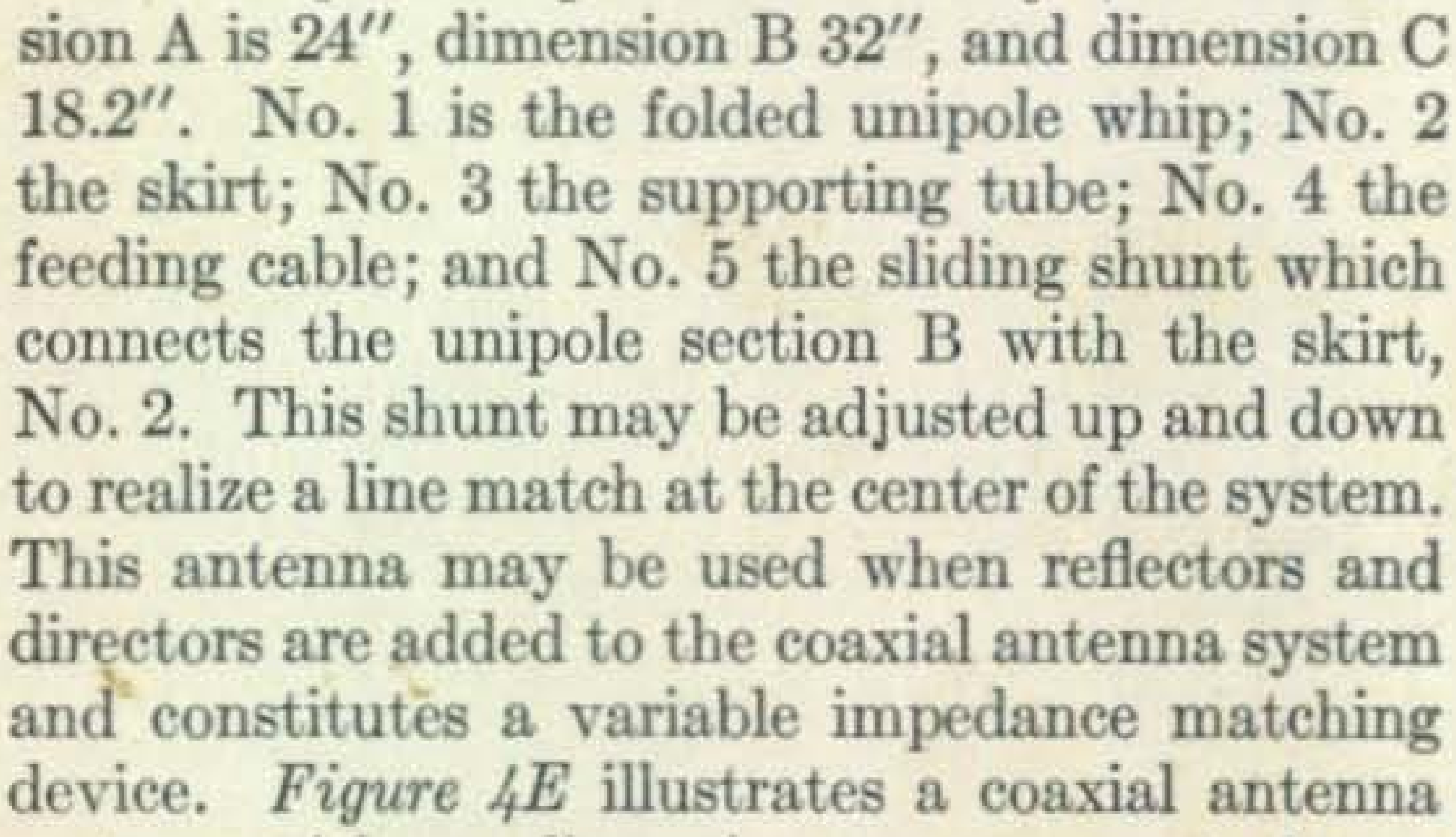


Fig. 5A. Whip antenna for 2 meters showing standard method of feed. Fig. 5B. Matching whip through a transformer section for maximum transfers for r.f.

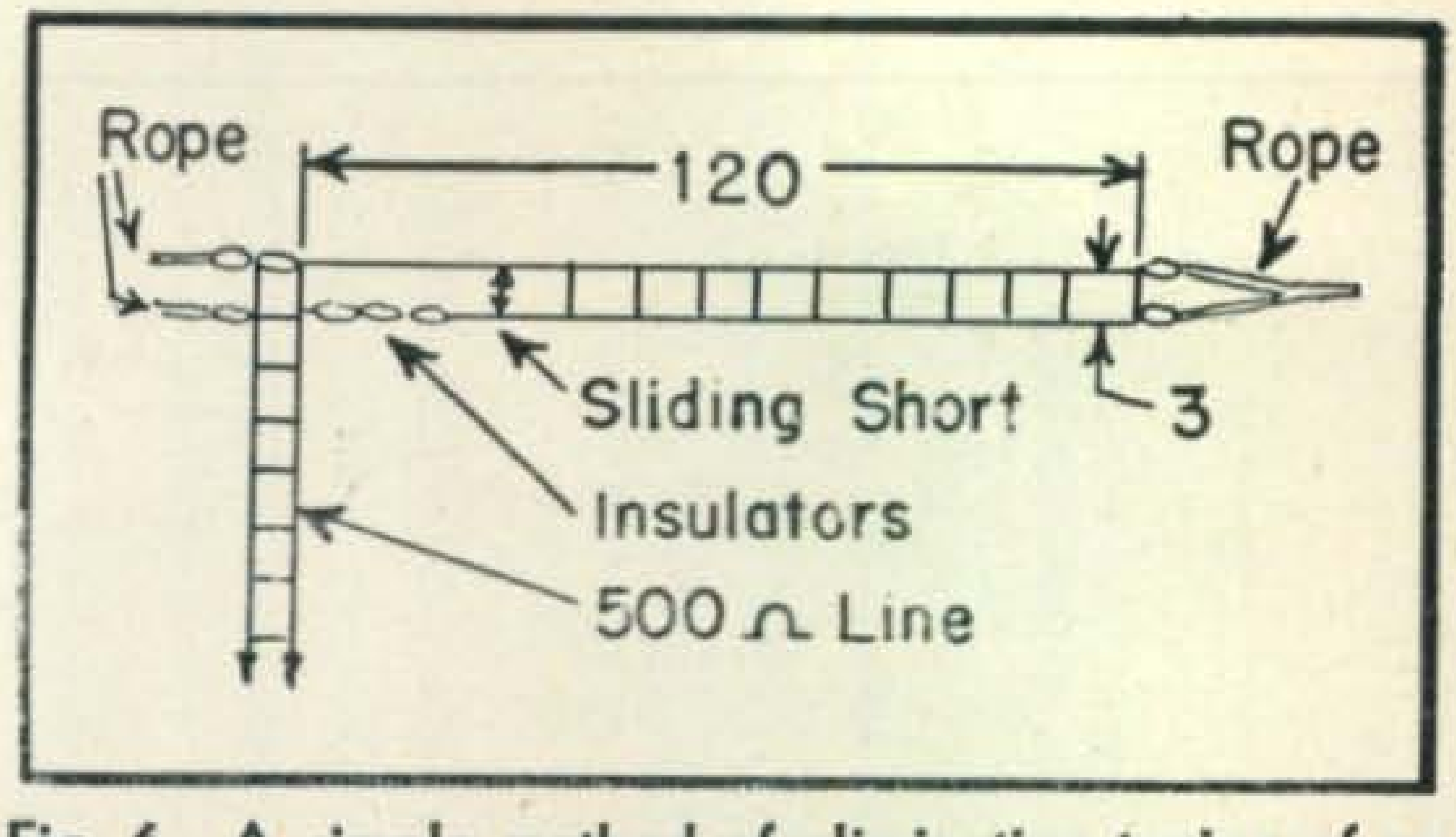


Fig. 6. A simple method of eliminating tuning of an end-fed Zepp for 80 meters. The impedance match is gained by folding the antenna back 3/8 of a wavelength.

mc band, we will briefly show how considerable gain may be realized with a quarter-wave whip. *Figure 5A* is a quarter-wave whip fed with a 50-ohm RG8 or 9U coaxial cable. To begin with, a slight mismatch occurs in this type of antenna. The antenna has a nominal impedance of 31 ohms and is fed with a 50-ohm cable. The standing wave ratio represented here is not very great, but due to this mismatch, maximum gain is not realized from the whip due to secondary radiation from the feeding coaxial line. In *Fig. 5B*, an electrical quarter wave length of 50 ohm cable is in series with the quarter-wave whip, and a feeding cable of 72 ohm RG11U. The RG11U cable is coupled into the one-quarter wave length transforming section of 50 ohm RG8 or 9U cable through a standard 50 ohm cable connector. The transforming section of cable should be one quarter wave length times the velocity of propagation of the cable long. This length includes the length to the extreme end of the 50 ohm connector: No. 1 is the whip; No. 2 the electrical quarter-wavelength of RG8 or 9U cable; No. 3 the Amphenol, Ucinite or Type N connector; and No. 4 the infinite length of 72 ohm feeding cable. This transformer is also broad band, and the standing wave ratio of the antenna was less than 1.06 to 1 over a 10 mc band width.

Untuned Zepp Feeders

One of the chief disadvantages of an end-fed Zepp is that it requires either series or parallel tuning at the transmitter end. A 75 meter antenna system using Zepp feeders, which may be directly coupled to any swinging link tank circuit is shown in *Fig. 6*. The impedance match is gained by using a 3/8ths wavelength folded back shunt. This shunt may be slid along the antenna to a point of match so that the loading is proper and the standing wave ratio lowest. Ordinary feeder spacers may be used to separate the folded section from the antenna proper. Future articles will go into detail on directive antenna systems and higher gain from conventional antenna systems.

Simple Transmitter Control Panel

HENRY T. HAYDEN, Jr., W2FO

An ideal solution to the problem of changing rigs and operating convenience is this simple panel which provides push-button control, time delay for the HV plate supply and overload protection. Best of all, it is equally satisfactory for use with low, medium, or high power rigs.

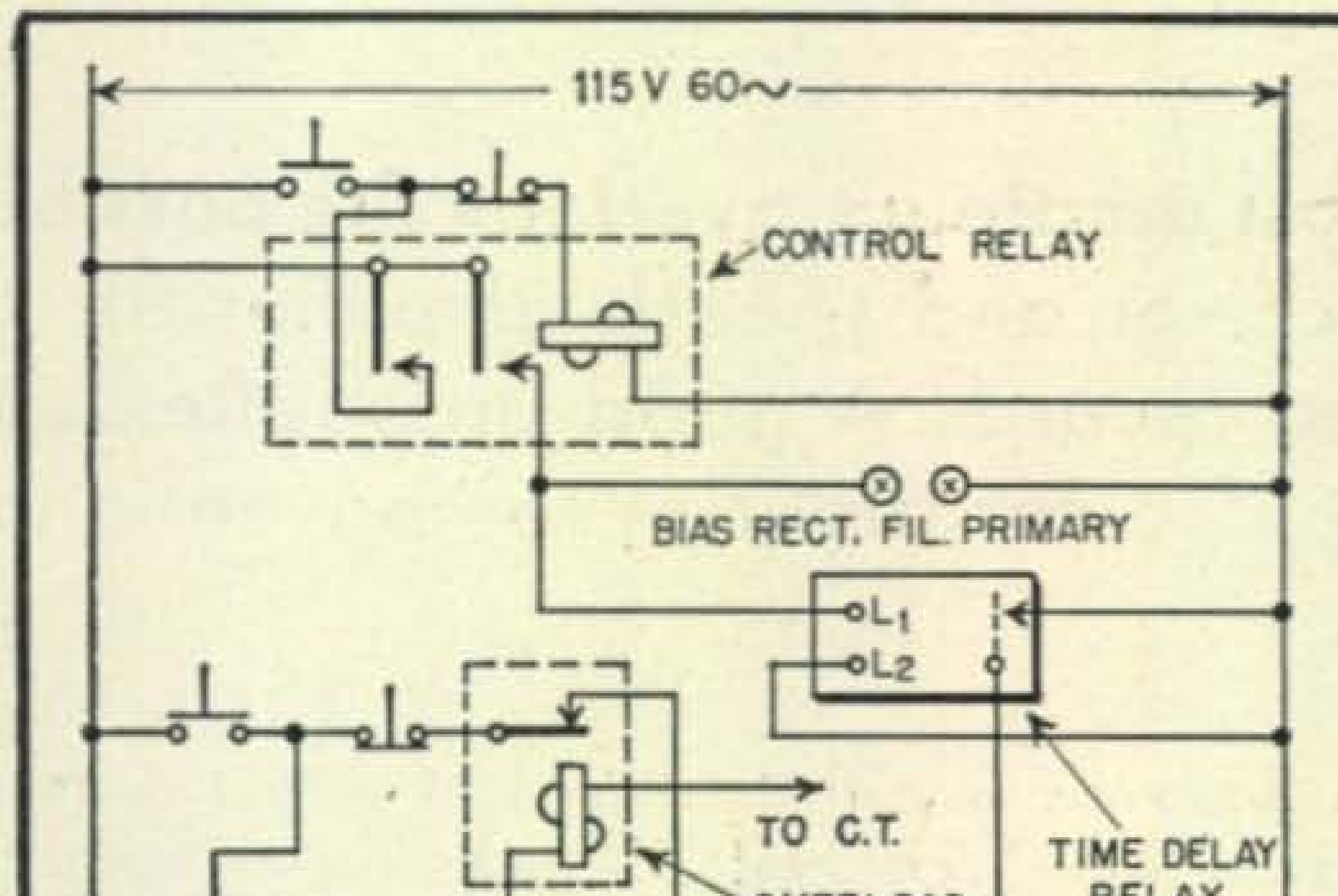


Fig. 2. Circuit diagram of transmitter control panel

Housing conditions being what they are these days, with families crowded into fewer rooms to make room for the returning veteran and his family, very little space is left available for ham gear. Relay rack assembly for the transmitter is one answer to the problem due to its appearance and compactness.

In the modern rig considerable thought could be given to control equipment. This includes power control relays, time delay relay for protecting rectifier tubes and overload relay for protection of transmitting tubes.

A compact transmitter control panel assembled on a standard relay rack panel 3½" x 19" is shown in *Fig. 1*. The finish may be either gray or black crackle paint to match the other panels on the rack.

Four push button stations are mounted on the front of the panel together with the rotary reset overload relay. Looking at the rear of the panel the first relay (double pole, normally open) is the plate control relay. The contacts are rated at 15 amperes. Next is the rotary reset overload relay. The coil of this relay should be selected to operate at a current value 25% over the normal plate current of the final r-f amplifier. The position of the arrow on the reset knob indicates whether the contacts are open or closed.

Next are mounted the four push button stations, two of these (ON) have normally open contacts while the other two (OFF) have normally closed contacts.

Next we have the thermal time delay relay and

[*Continued on page 55*]

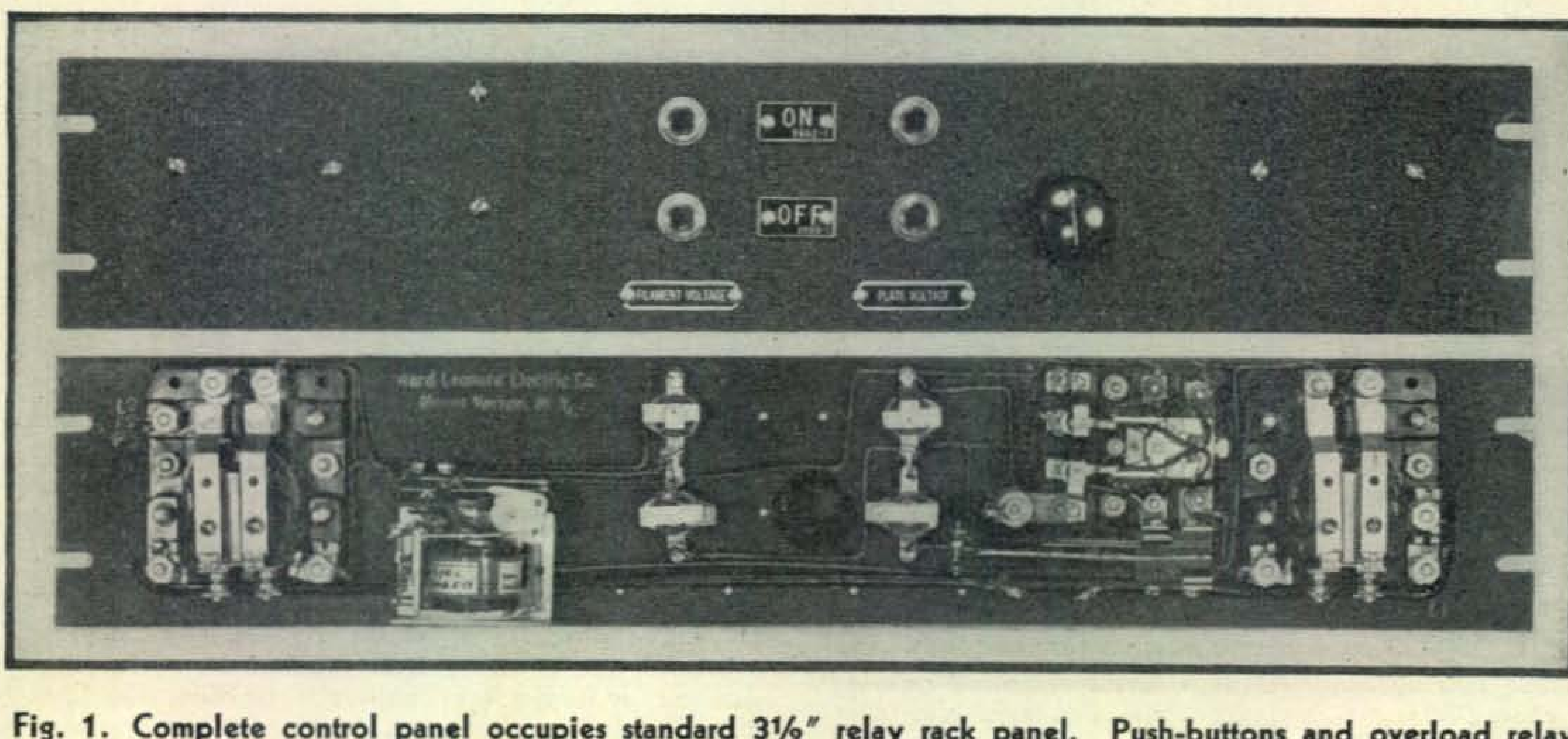


Fig. 1. Complete control panel occupies standard 3½" relay rack panel. Push-buttons and overload relay reset appear on front

BASS REFLEX LOUDSPEAKERS

In the Ham Shack

FRANK C. JONES, W6AJF

Most amateurs overlook the possibility of utilizing their communications receiver and speech amplifier for good quality reproduction of music and records. A good bass-reflex speaker will give reproduction quality far superior to conventional style cabinets and baffles

BASS-REFLEX or vented cabinets for loudspeakers have some very real advantages over open-back cabinets. Amateurs who are interested in good quality reproduction can use the bass-reflex system to advantage. Most ham communication receivers have an audio system with sufficiently broad frequency response to compare favorably with a good broadcast receiver. Reproduction of this audio is the problem.

Bass-reflex Cabinet Advantages

Proper design and "tuning" of an entirely closed cabinet with an air vent adjacent to the loudspeaker cone opening will extend the low frequency range, remove most of the low frequency peak, and greatly reduce harmonic distortion. *Fig. 1* indicates the reduction of harmonic distortion at frequencies below 200 cycles per second. At high levels of sound output an ordinary 12 inch loudspeaker may generate as much as 40 to 50% distortion near its low frequency resonant peak. This can be reduced to less than 10 or 15% by using a properly constructed bass-reflex cabinet in place of an open-back cabinet.

The bass-reflex cabinet may have a vent above,

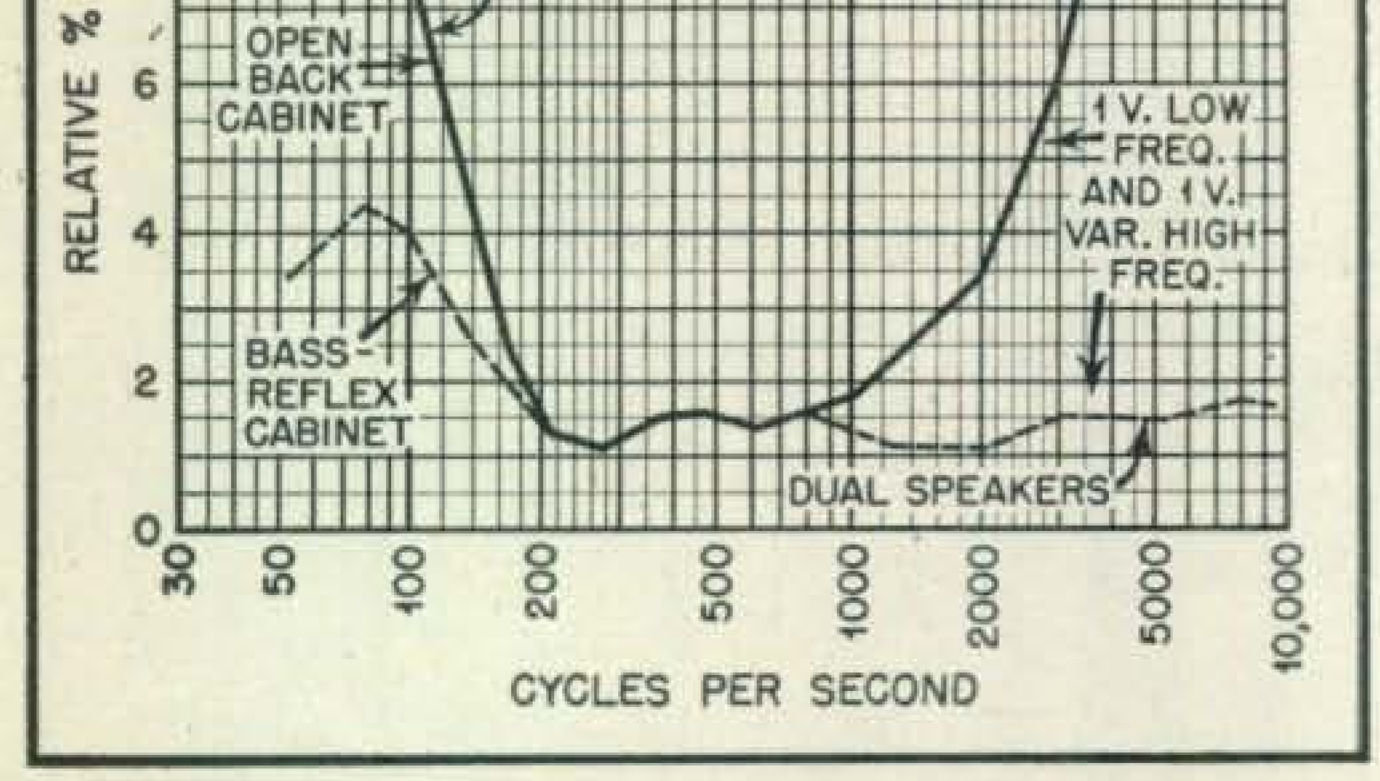


Fig. 1. Reduction of harmonic distortion at frequencies below 200 cycles. At high levels of sound output, distortion using bass-reflex cabinet is less than half of that produced when using ordinary loudspeaker

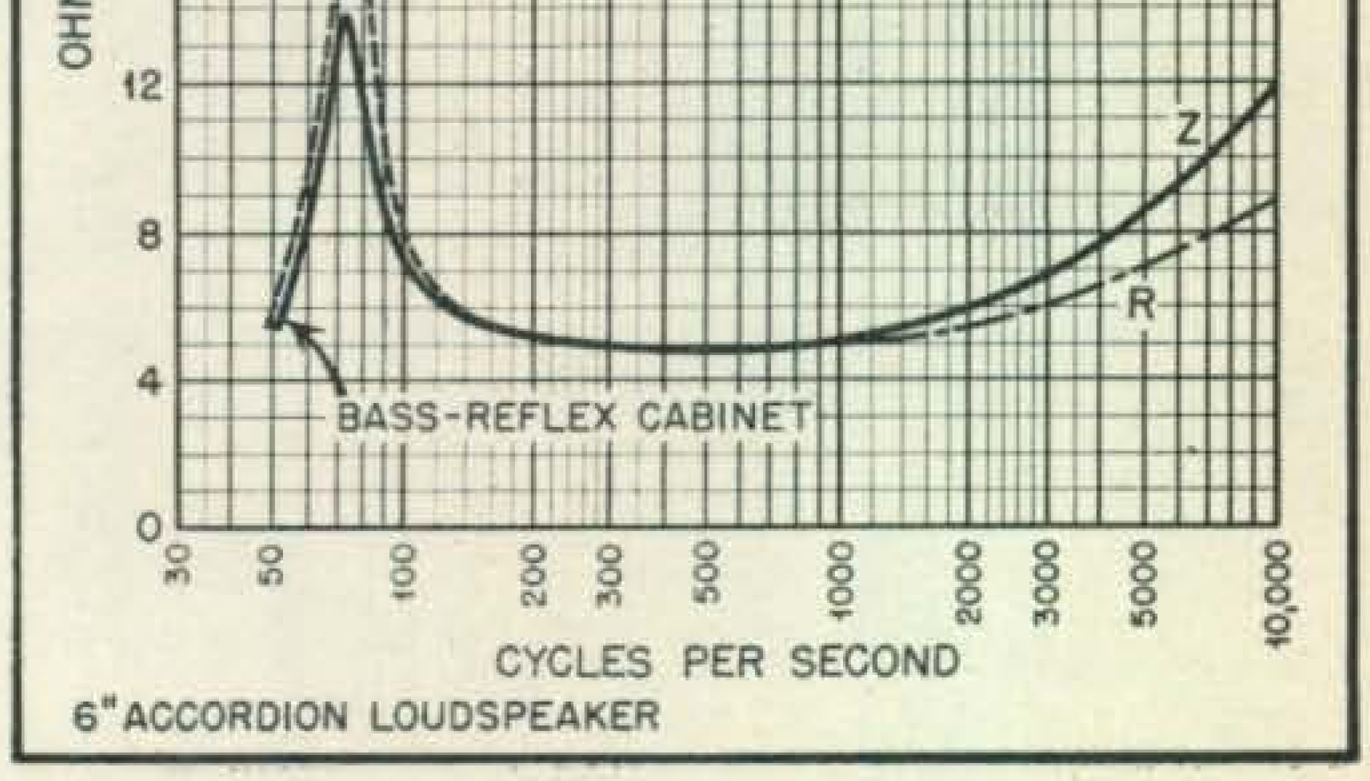


Fig. 2. Magnitude of resistance increase at low frequencies for 6″ accordion loudspeaker. Speaker resistance in bass-reflex cabinet is far less than unit with no cabinet or baffle. Lower resistance produces less harmonic distortion

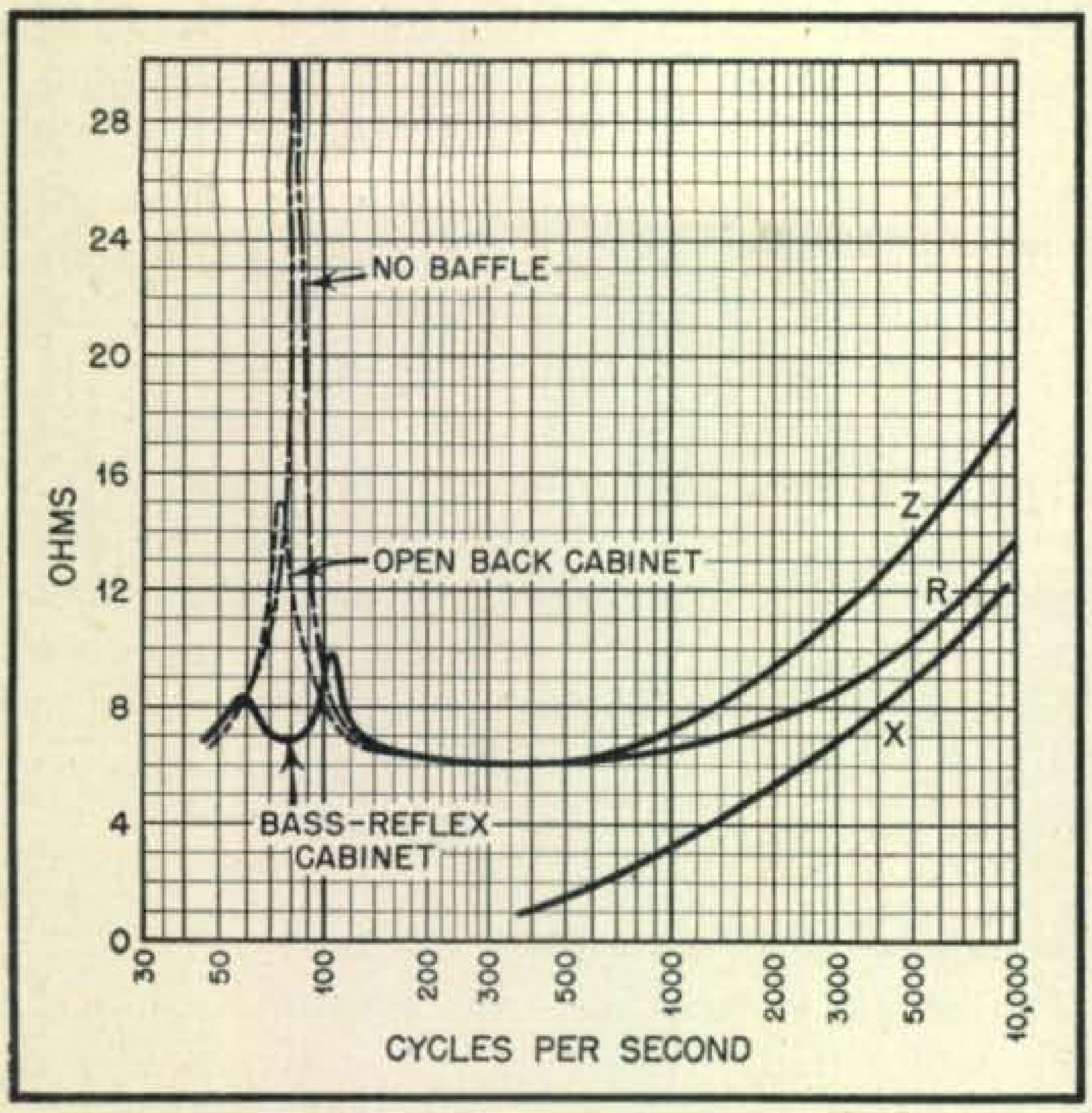


Fig. 3. Magnitude of resistance increase at low frequencies for another model speaker, indicating far less harmonic distortion as a result of lower speaker resistance in bass-reflex cabinet

below or on the sides of the loudspeaker opening. The size (and depth) of the vent can be varied to tune the cabinet cavity resonance to the loudspeaker low frequency resonant frequency. The latter can be obtained from the manufacturer or measured easily by means of an audio oscillator. If the voice coil is driven at moderate sound output, it will be found that at some low frequency the amplitude of motion will be very much greater than at other frequencies above or below this frequency. The loudspeaker should have its field excited (if it is not a PM speaker) and tested with *no* baffle. Small particles of paper, sawdust or common dust, will jump up and down violently on the cone diaphragm if one wishes to observe this phenomena with the speaker resting with its back on a table.

Design Considerations

Fig. 2 and *Fig. 3* indicate the magnitude of resistance increase at low frequencies for two types of loudspeakers. With no cabinet or baffle, this increase is 5 or 6 times its normal value of about 6 ohms, as measured with a Maxwell Impedance Bridge. Placing the loudspeaker in an open-back console cabinet reduces this peak to about 2 or 3 times normal, while a bass-reflex cabinet reduces it by another factor of two or more, or breaks it down into a pair of quite small peaks. The reduction in impedance corresponds to the decrease in harmonic distortion, but not in a direct ratio. The harmonic distortion seems to reduce about as the square of the decrease of the impedance peak at low frequencies, as indicated by *Fig. 1*.

The enclosure and air vent have the effect of adding an LCR circuit to the loudspeaker equivalent network. This effects a phase reversal of the back cone radiation at this frequency, over a fairly wide range, re-enforcing that coming out directly from the loudspeaker cone in front. This added sound is radiated by the vent and since it has no non-linear cone suspension stiffness to cause distortion, the overall distortion is less. Since the cone does not have to move as much to produce the same amplitude of sound, the distortion is further reduced. This provides a very great overall reduction in loudspeaker harmonic distortion at the low frequencies. The harmonic distortion at medium and high frequencies is normally quite small and the cross-modulation and frequency modulation can be minimized by using high and low frequency loudspeakers and a cross-over filter network to prevent the speakers from being energized by the improper frequencies.

The bass-reflex cabinet of the same relative size as an open-back cabinet not only reduces the low frequency distortion by a factor of about 4, but it also extends the response down to lower frequencies and gives much smoother response over all of the low frequency range.

Correct Cabinet Size and Vent Area

Loudspeakers are sold with their sizes designated as 3, 4, 5, 6, 8, 10, 12, etc., inches. This refers to the outside diameter of the speaker housing. The actual useful cone piston area is less, and the curve in *Fig. 4* was developed to approximate the useful area for the average loudspeaker. The equivalent area can be determined fairly well from this curve; for example; a 12 inch speaker has about 85 square inches of piston area.

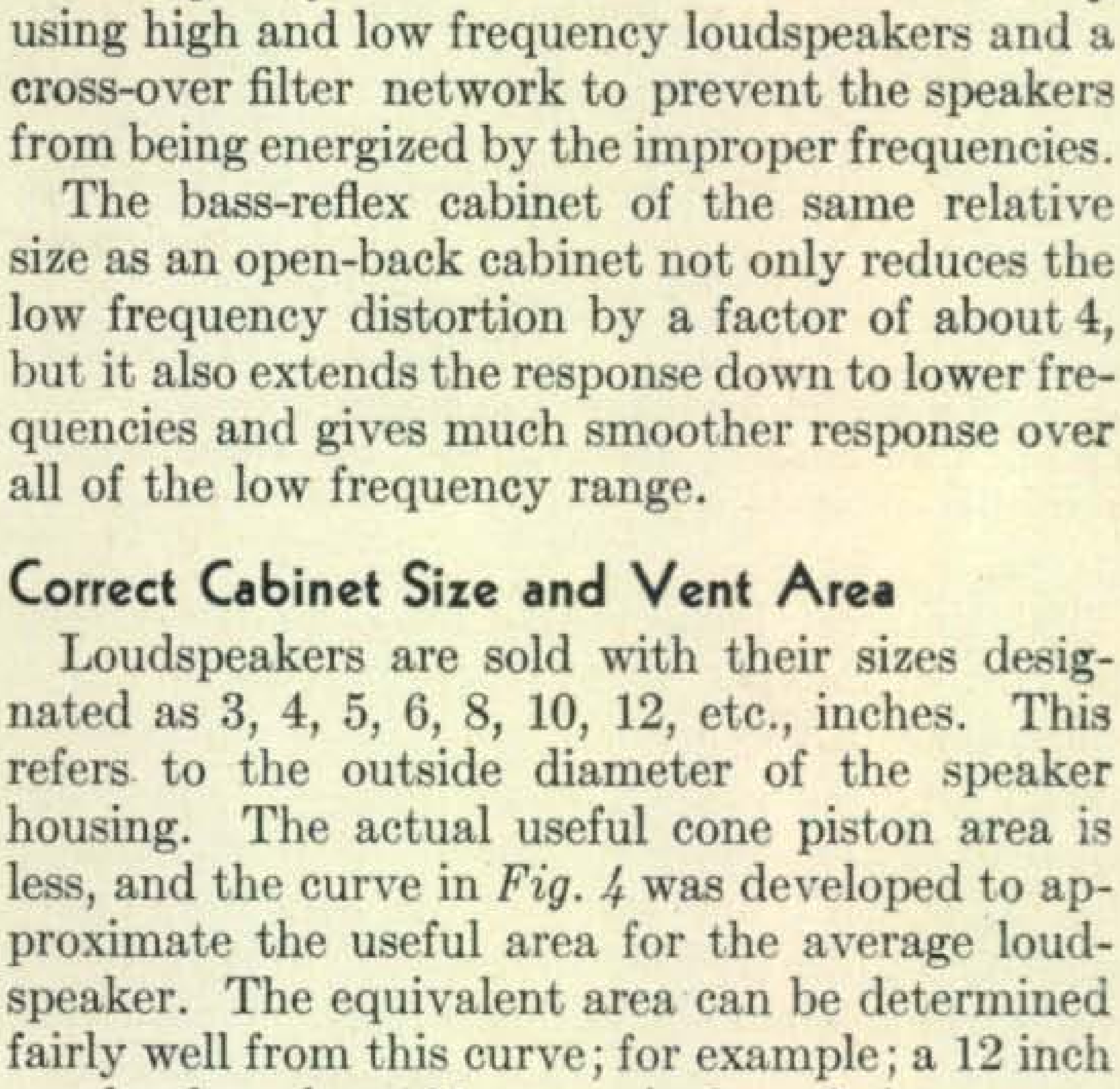


Fig. 4. Graph giving actual useful cone piston area. This data in conjunction with Fig. 5 may be used to determine correct cabinet size and vent area if the low frequency resonant period of the loudspeaker is known

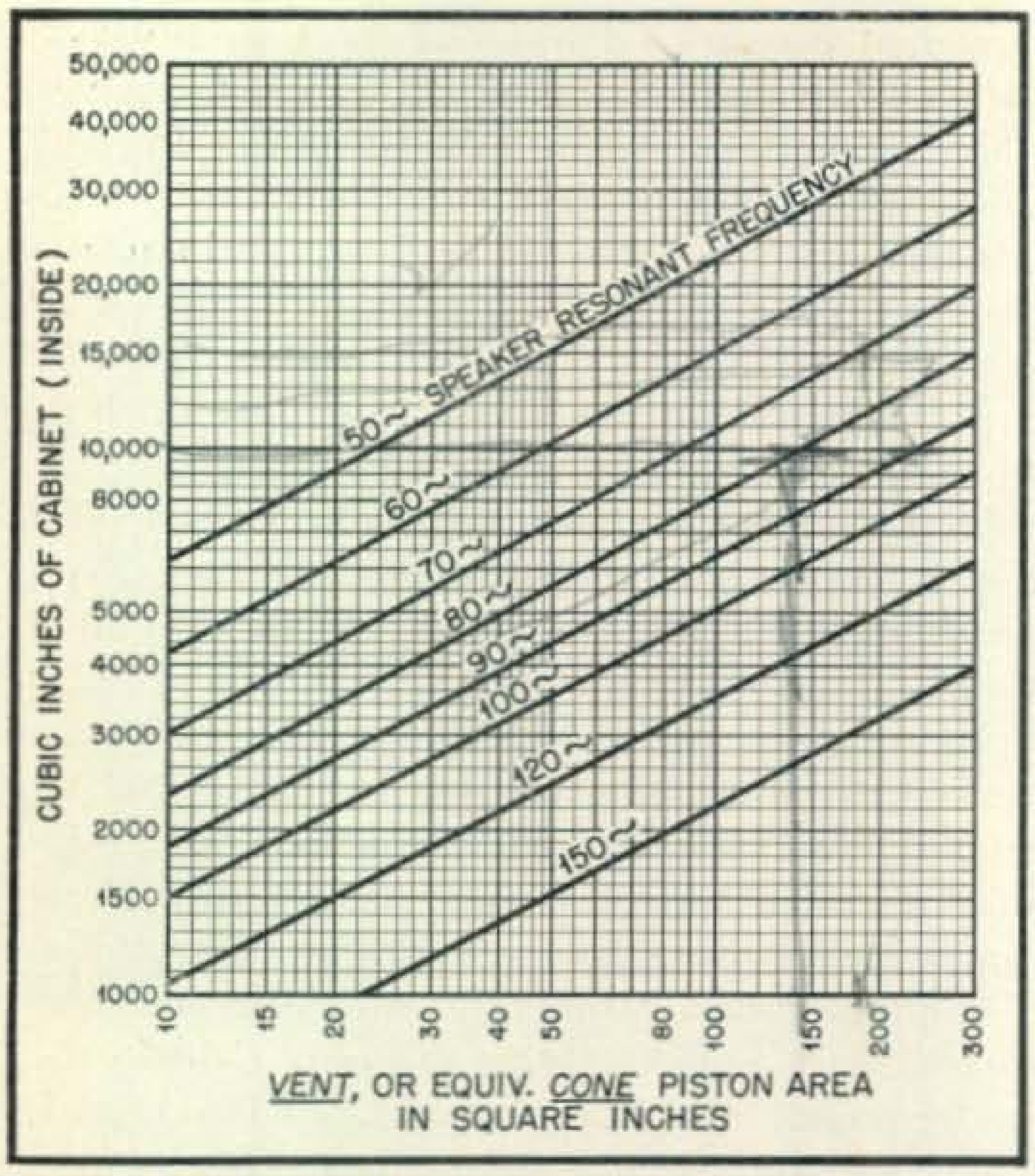


Fig. 5. Graph for determining vent area. Information is plotted for opening depth of 3/4", but either larger or smaller cabinets may be worked from cubic inch scale

This data can be used with *Fig. 5* to determine the correct cabinet size and vent area for any loudspeaker if the low frequency resonant period is known. One school of thought is to use a vent area equal to the loudspeaker piston cone area. From *Fig. 5*, if a 12 inch speaker (cone piston area equals 85), has a low frequency period of 80 cycles, the cabinet should have 7500 cubic inches of space inside. With this size, the vent area would also be 85 square inches, perhaps a slot 17" x 5". The "curves" of *Fig. 5* were plotted for a vent opening depth of ¾ inch, the average thickness of the front of the cabinet. If the cabinet size is larger or smaller, the proper vent opening can be obtained from *Fig. 5* by reading across and down, as for example with a 5000 cubic inch cabinet and a natural period in the speaker of 80 cycles, the vent area would be 40 square inches or a slot 10" x 4".

Alternate Size Vents

Another school of thought on bass-reflex design believes in using a vent area of about one-half of the loudspeaker piston cone area which was illustrated by the use of the last example of a 5000 cubic inch cabinet as against 7500 in the first example. The writer is inclined to believe that the half-size vent produces better overall results. The curves of speaker impedance in *Figs. 1* and *2* seem to bear out this theory. The curve shown in *Fig. 1* is obviously better than that of *Fig. 2*. The cabinet size in *Fig. 2* was such as to tune properly with a vent opening equal to the piston area with that particular loudspeaker. In *Fig. 1*, the vent area was about ½ of the piston area and the cabinet about 2/3 of the relative size, resulting in two very small peaks in place of one larger peak.

The curves of *Fig. 6* indicate another means of tuning the cabinet to the loudspeaker. The vent opening has an inner lip built inside to extend the average vent depth (¾ inch) up to any desired length *L*. The cabinet size can be reduced by this means or by decreasing the vent area, or both. Normally it is easier to make the vent slightly larger than the curves of *Fig. 5* indicate; then tune it by closing over a small part of the vent while listening to the output as an audio oscillator input frequency is varied. The slot can then be made this size permanently from the inside.

Mechanical Considerations

The inside of the bass-reflex cabinet should have some sound absorbing material placed on the rear cover opposite the loudspeaker. Usually the entire back is covered with a layer of mineral wool, or other sound absorbing material, which will prevent high frequency interference effects without any undesirable effect on the low audio frequencies. The cabinet should be heavily reinforced with cross-members and built of at least ¾ inch wood to avoid diaphragm resonances in the sides of the cabinet. The rear of the complete enclosure should be well fastened with wood screws around all four edges.

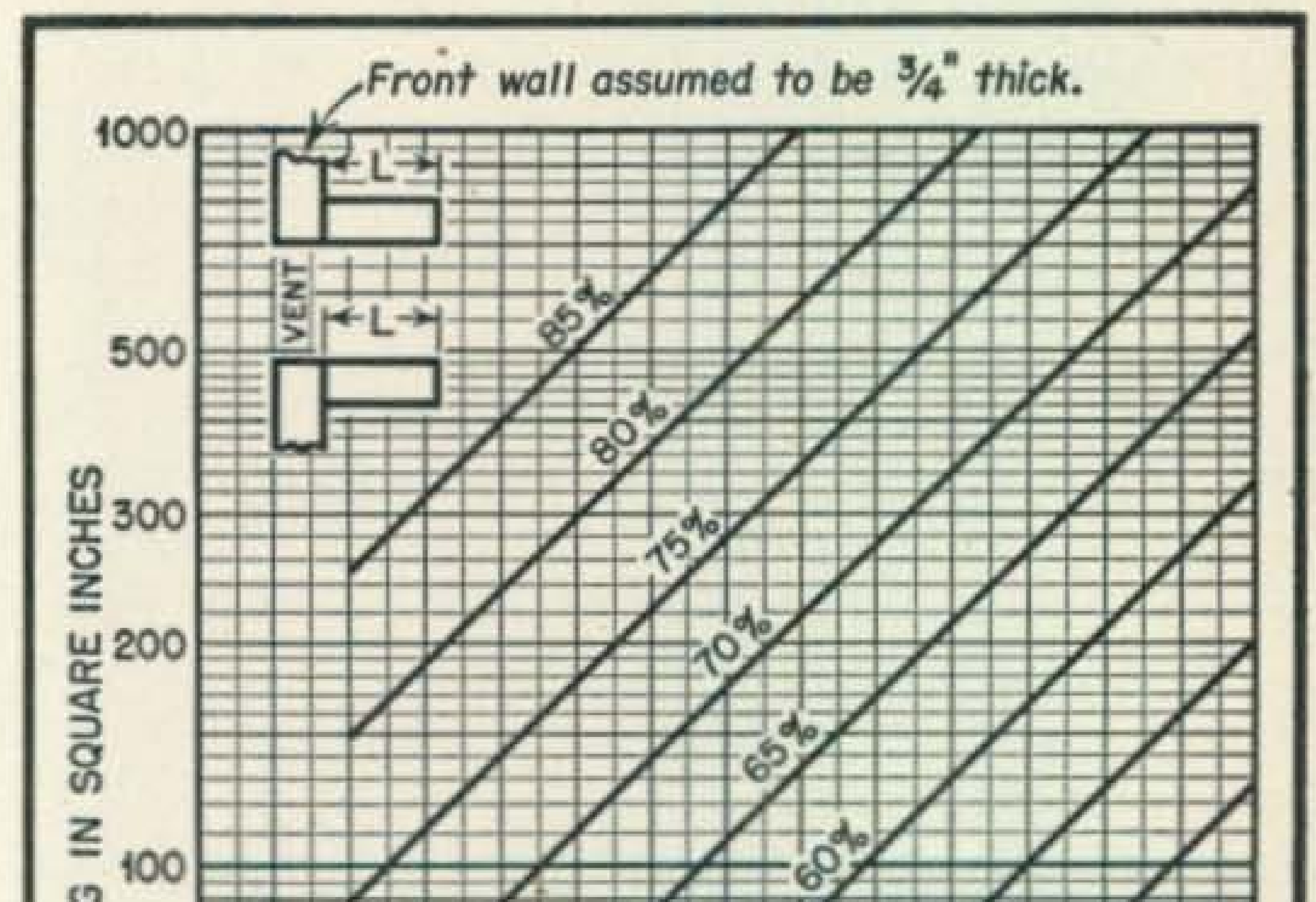


Fig. 6. Alternate method of tuning bass-reflex cabinet to the loudspeaker by extending inner lip. The cabinet size can be reduced by this means or by decreasing the vent area, or both

Monthly DX Predictions --- JULY

OLIVER PERRY FERRELL

For 1946, mid-July will represent the poorest normal conditions of the year. The low will fortunately be one of very short duration and by the fourth week of July and entering into August a considerable improvement will be noted.

The wave paths to Europe, which are not illustrated this month, will not permit the use of any frequency greater than 20.0 mc for normal f_2 layer transmission. In general, 20 meter signals will be far below normal strengths and, of course, 10 meters will be dead the entire month. From the eastern half of the United States to Central and South Africa conditions will be poor, although 20 meters should open slightly in this direction in mid and late afternoon. Much the same conditions will prevail from the west coast (W6) to Australia (*Fig. 1*), although a few signals may break through on 10 meters in the very late afternoon.

Considerably better DX can be expected from paths aiming directly south to stations on or below the equator. An example of this condition is shown in *Fig. 2*. Although designed specifically for the path from St. Louis, Mo. to Quito, Ecuador, this general condition will be found in W8, W5, W9, as well as WØ. With only a slight variation, similar conditions with corresponding time scales will be observed in W2, W3, W4 and W6. Working with the same time scale further into South America appears very possible, with frequencies up to and including 10 meters open to some extent, although the optimum working frequency will be generally 2 or 3 megacycles below those predicted in *Fig. 2*.

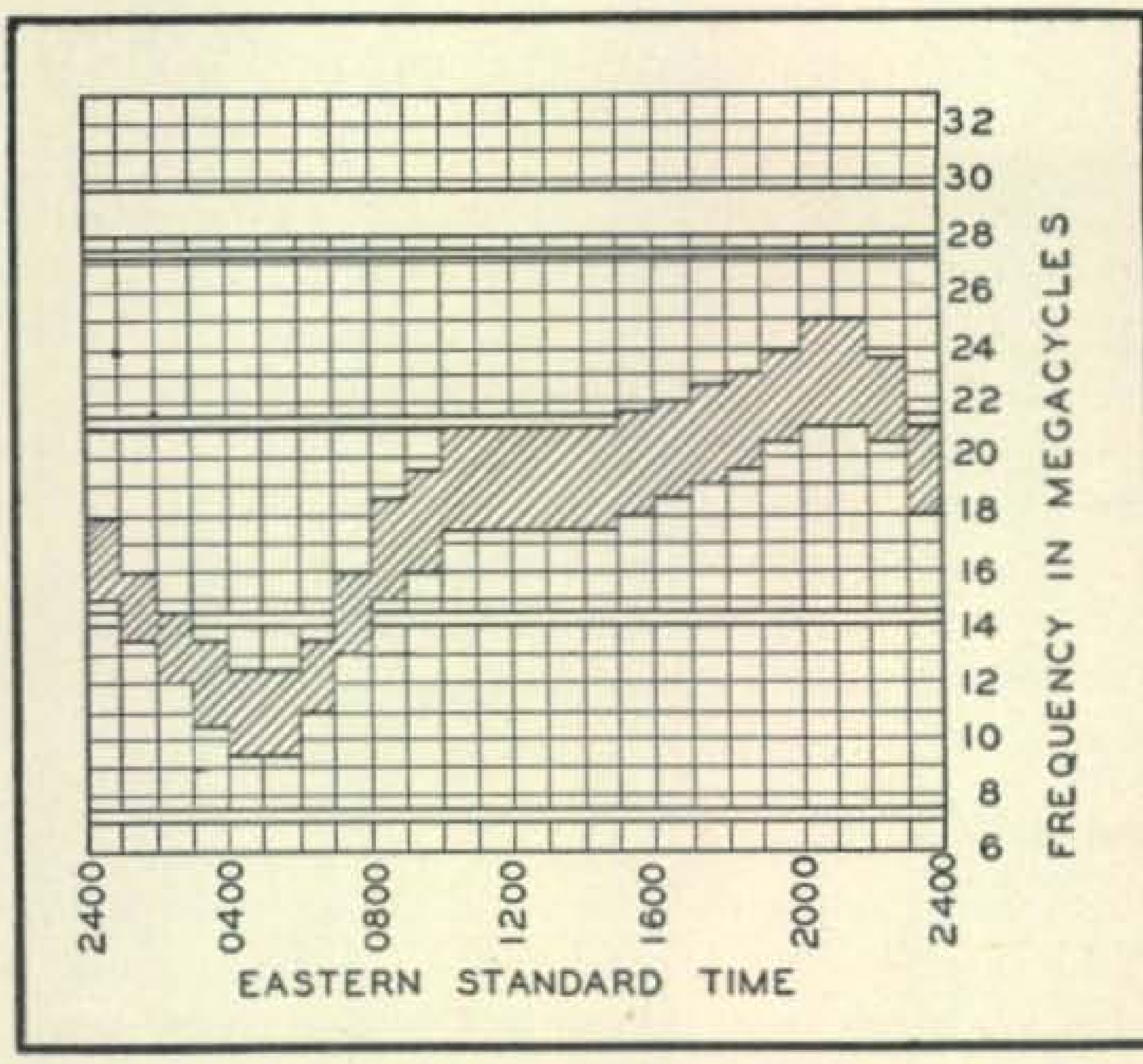


Fig. 3. MUF New York City to Los Angeles. July 1946 average.

In *Fig. 3* the trans-continental path from New York City to Los Angeles is predicted. Generally this chart will illustrate those conditions from W1, W2, W3 and W4 to W6 and W7. It is of particular note that the shift of best conditions towards midnight has reached its peak and by the first week of August 10 meters may be expected to open slightly around 1800 E.S.T.

By a little bit of adroit maneuvering, one of the scheduled improvements in the use of the prediction charts has been made possible this month. Since the charts employed here are indications

[*Continued on page 53*]

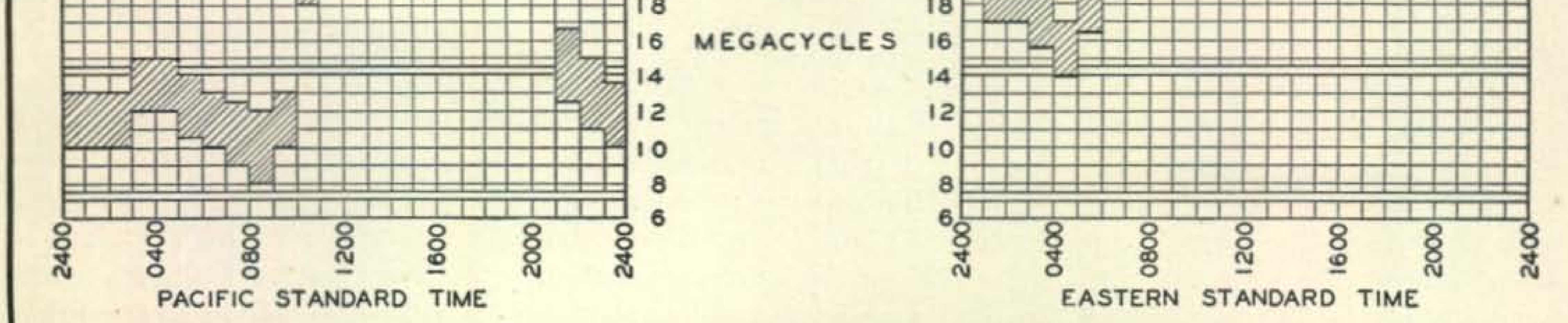


Fig. 1 (left). MUF West Coast to Australia. July 1946 average. Fig. 2 (right). MUF St. Louis, Mo. to Quito, Ecuador, July 1946 average.

CQ DX

By HERB BECKER, W6QD

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

Here we go right into the middle of the summer season, which in normal times would mean pretty poor DX on most bands. Right now I rather imagine a lot of you fellows are forgetting about ham radio and are either just returning from a swell vacation or just getting ready to shove off "to get away from it all." I do hope there are one or two within reach of this July issue because I would feel awfully silly writing this stuff with no one around to read it.

Mid-West Travels

Since grinding out the June DX column, "such as it was," old QD and the XYL have made a quick 3 week trip, taking in Chicago, New York, and Boston. In Chicago friendships were renewed with a lot of W9s, and I might add that I talked to enough W9s personally to fill a page or two in the log book. I saw W9TJ stumbling, that is, I mean walking through the Stevens Hotel and he managed to say something about "just wait till the 20 and 40 meter bands come back to us." No more c.w. for him he says. Then there was W9TB who is laying plans to get back on the air as soon as possible. W9AIO was hobbling around the same hotel for several days during the Radio Manufacturers Trade Show but he was not hobbling from what you might think, as he was just getting over a leg operation. You should see his hemstitching! Then, of course, there was W1GS and W1TS from QST. They were adding a little dignity to the occasion but I really think I outdid them on handing out subscription blanks. W1JPE was not there and as it turned out it was probably all to his good. By the way, W9AIO is about set with his new "Chicago Kilowatt." He plans running this kilowatt into a pair of 4–250As, using a pair of same for modulators. This touches very lightly on a few of the many hams who happened to be in Chicago at this time.

Down East

From Chicago we went to New York and while there I had a good session with Larry, W2IOP. From what I saw in the office and heard from Larry, it looks as though this little magazine will soon be out of the "little" classification. There wasn't much of an opportunity in New York to see many of the DX boys but I did have a short "landline" QSO with W6CUH who, as I've said before, is located on Long Island. Up Boston way or should I say "Down East," this guy Tim

HK1AB, Aurelio Parra, located in Barranquilla, Colombia

Coakley, W1KKP, outdid himself to show us around. He went so far as to poke a mike into my hand and the first thing I knew I was working another good c.w. man gone wrong, W1FH. At the same time W9CWX/W1 got in on the contact and after a little chatter we decided to make this QSO a little more personal so they barged in to Coakley's place. To show you the truly wonderful side of wireless, "or hadn't you heard," we received two more visitors, W1ADM and W1HKK, who had been eavesdropping on the QSO with 1FH. This was the beginning of a good time to be had by all. Later we proceeded to heckle Tim on the fact that he had no provisions for a key in his new rig. He plans on running a kilowatt into a pair of 4–250As and he hopes this will be enough power to be heard out on the West Coast. We also met W1LEN, W1RX, and W1ATD at National Co. These fellows although not in the DX category as yet hope to do a little blasting when the other bands open up.

I guess we had better stop the above chit chat and let's see what the DX situation does look like from here.

DX

W9PK sends in quite an imposing list of stations. Jack worked South Africa 7 consecutive days and Australia 12 consecutive days. VK4SA was worked as early as 2:15 P.M. CST 5 days in a row, and ZL1GI as early as 1:40 P. M. Jack is using a Sterba for most of his work with a Delta matched dipole and reflector rotatable filling in the gaps. W9PK has a grand total of 110 countries, with his postwar total at 49. He says he's going to work on 50,400 kc. and 51,600 kc for a while but will be able to make a quick change to 10 meters if necessary. He would like to have reports on his 6 meter signals. Other W9s active on 6 meters include MAT, CNO, CYT, and GRV.

Another W9 heard from. This time W9IU. Les has worked a total of 54 countries, some of the better ones being VQ3TOM 28010, VQ2PL 28100, KA1AW 28020, ON4MEI 28090, W2ILE (Palmyra) 28060, PAØBE 28050, ZE1JJ 28175, YV5AP 28030.

W9EGQ says that W8WSY/KP6 is located on Christmas Island and puts in a swell signal on phone. He often calls CQ Terre Haute which of course does absolutely no good so far as reducing the number of stations calling him outside of Terre Haute. As Herb says, the band can be absolutely dead in the evenings with only locals working each other and suddenly W8WSY comes through with a good signal. To top it off W9EGQ says many innocent hams have been mangled in the resulting confusion.

It is good to hear from W2BJ again. He says he's been banging away on 10 meter phone since the end of February and has worked about 20 countries. Ray says that he has been using W2BHW's receiver who, incidentally, is out Chicago way and will soon become a WØ. A couple of other fellows who Ray says are working good DX are W2EIE 48 countries and W2ALH. Ray also relates that Ossie Presnell, W8BCT, is back from overseas again and with CBS in their sportscasting department. Incidentally, his old side-kick, W8BTI, is still banging away in Cincinnati.

W6PBV of San Mateo sends in quite a list of DX heard and worked. Bob's transmitter winds up with a pair of 250THs, the receiver is a Super Pro with a 3-tube homemade converter. The antennae are a 3 element rotary and a fixed 10 meter 4 half waves in phase used for Asia and South America. Bob says he has worked 22 countries as of the first part of May but his friend W6GTI, located quite near him, has worked 38.

W9TCZ of Fort Wayne breaks forth with a few which he worked. VQ4AA 28,000, CN8AC 28075, G8AB 28060, who was working portable on Sardinia. Then there was SV1EC on phone 28090. Glenn says a friend of his, W8TDN/9, runs about a kilowatt and has worked ZB1E, FK8AN, and KA1ZU. TCZ himself is running a kilowatt with the antenna being a 4 element rotary. Before the war he used to be W8HYC with 35 zones and 90 countries. Now it's 40 countries.

Notes From DX

Another note from OK1AW says on May 5 there were 19 OK stations relicensed. These consisted of hams who were imprisoned during the German occupation. Other licenses will follow, at first to hams who were active in underground organization work, etc., and who were licensed before 1935. OK1AW hopes to get his license back within a few weeks and you can bet we all will hope with him. He says as yet OK1BC and OK2HX are not relicensed. 1BC is studying in Praha and is married. 2HX owns some sort of business and he likewise is married.

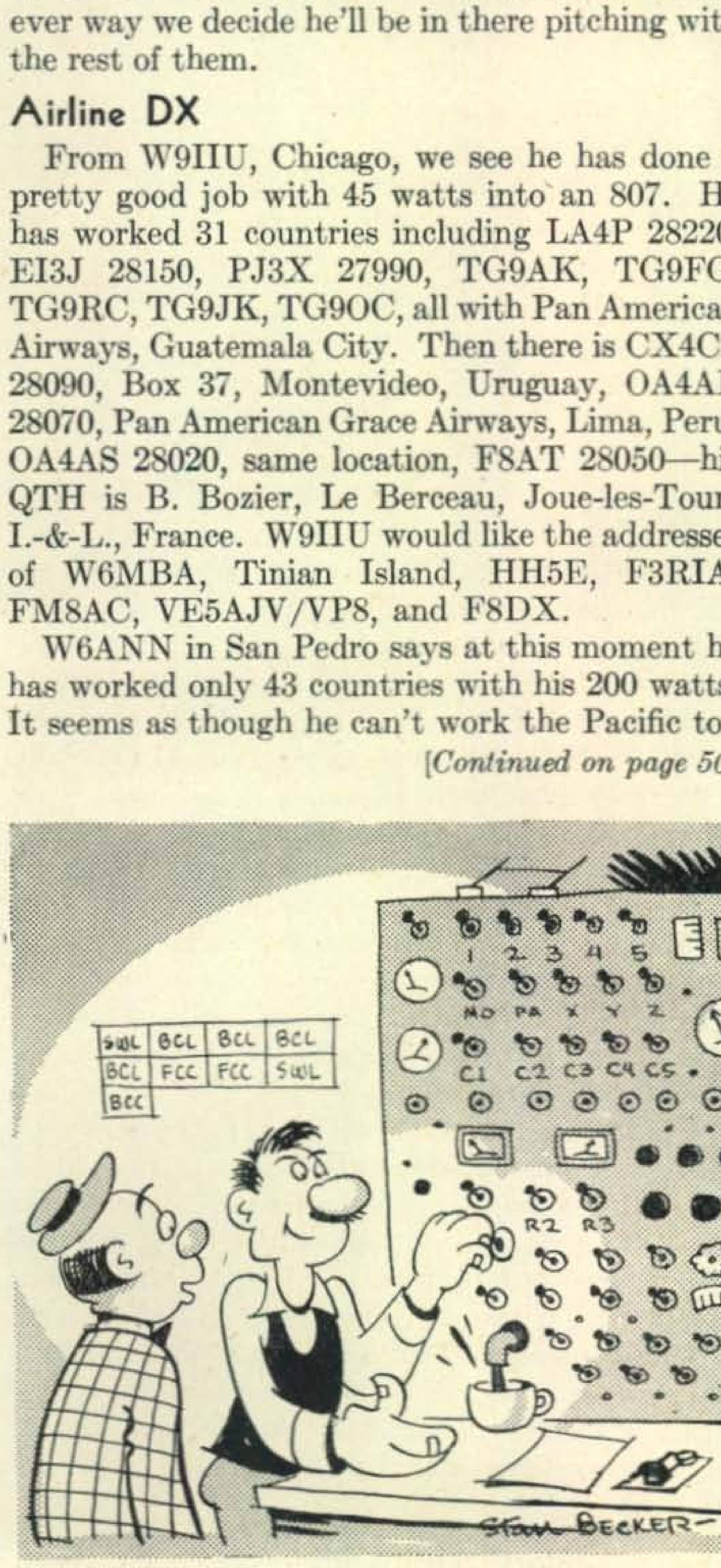
A new one to our fold is W1DYV of Taunton, Mass. He said he has never worked too much DX but now that he is back on the air and running 300 watts into a pair of 812s, he's getting a big kick out of it. His antenna is a 3 element beam. He would like to see everyone start over in countries and zones but also adds that whichever way we decide he'll be in there pitching with the rest of them.

Airline DX

From W9IIU, Chicago, we see he has done a pretty good job with 45 watts into an 807. He has worked 31 countries including LA4P 28220, EI3J 28150, PJ3X 27990, TG9AK, TG9FG, TG9RC, TG9JK, TG9OC, all with Pan American Airways, Guatemala City. Then there is CX4CZ 28090, Box 37, Montevideo, Uruguay, OA4AB 28070, Pan American Grace Airways, Lima, Peru. OA4AS 28020, same location, F8AT 28050—his QTH is B. Bozier, Le Berceau, Joue-les-Tours I.-&-L., France. W9IIU would like the addresses of W6MBA, Tinian Island, HH5E, F3RIA, FM8AC, VE5AJV/VP8, and F8DX.

W6ANN in San Pedro says at this moment he has worked only 43 countries with his 200 watts. It seems as though he can't work the Pacific too

[*Continued on page 50*]



—and this switch is for hot coffee ! "

UHF . . .

by Josephine Conklin, W9SLG*

THE MONTH OF MAY brought us the first report of skip openings of the new 6-meter band. The prize, so far, appears to go to the old tennis man, Colonel Wilmer Allison, W5VV, of Austin, Texas. He heard a station call "CQ 50 megacycles" and sign W9DGH so it seems, but the call was heard only once. Other reported openings were May 7, 12, 16 and 24. No doubt, when reports are mailed to us regularly, additional dates will appear to have opened. Also, when more stations are interested in skip DX on the six meter band, there will be more of it observed, as there was back in 1937

May also brought something exciting in the way of low-atmosphere-bending DX on two meters, when on the 15th at 11:30 EDST a contact was established between W3HWN in Mechanicsburg, Pennsylvania, and W2BRV in Huntington, Long Island, a distance of some 215 to 225 miles. The contact was held for over a half hour with a report of signals QSA 2/5, R3/9 plus. W2JN was also in on an exchange of calls as conditions were on the way out. However, more on these matters later.

50-Megacycle DX

Russell Law, W4FKN, went into the shack on May 12 and found the FM band wide open, then discovered the same on the 6-meter band so he called CQ. Then he worked the following: W1LLL, W8CLS/1, W1FJN, W2EUI, W1LSN, W1KJC, W1AEP, W1IN, W2JPX, VE3ANY, W8RUE and W8OMY. Russ also heard VE-3AEU and W2IQQ and many other stations which had not been identified in the flurry which ended at about 8:30 p.m. Eastern standard time. At the end, stations would call with an R9 signal and then be down to zero on the second reply.

Jack Woodruff, W9PK, out in Downers Grove, Illinois, had only one contact—W5AJG in Dallas on the 16th of May.

Jim Brannin, W6OVK, left Tucson for many parts during the war but has settled down in San Francisco. His listening on the six-meter band was rewarded on the 24th of May when he worked W6QAP/7 (pre-war W6QAP who was one of the Tucson, Arizona, gang on five meters) in Tucson on and off for several hours. Jim heard one other carrier but nothing else. Again, an indication that the six-meter band lacks activity, more than utility and thrill!

---

*Conklin Radio Company, 6800 Clarendon Road, Bethesda 14, Maryland

Six-meter Activity and Equipment

Wilmer Allison, W5VV, had his DM-36 converter moved to the new band. He uses it in front of his NC-240C. The transmitter recently has become an 800-watt job with a pair of 250TH tubes and a horizontal ½-wave antenna. He is putting up a "Vince Dawson W9ZJB" five-element array. Oh yes, Wilmer finds a panadaptor very useful for 50 megacycle work. He promises activity on the part of W5DNN, and also W5TG in Waco.

"Steve" Stevenson, W5DNN, had sold all of his gear to the Signal Corps and is starting over. He has his RME-45 and is waiting for the VHF-152 converter for it—that wait may keep him off the band until August unless he gets some stop-gap equipment. The four-element antenna is back up again, but he didn't have enough wire to feed it. He promises to be on about 52 megacycles in June.

All that nice DX that Leroy May worked from W5AJG was on a ten-meter vertical fed with 30 watts into an 807! We lay a bet that Leroy soups up this outfit for the June and July openings.

The crystal grinder man, Bill Copeland, says that he is still W9YKX at Woodbine, Iowa, in spite of the WØZJB call that Vince Dawson talks about out Kansas City way. Bill sent us a short note before leaving for the Mayo Clinic at Rochester, Minn., but he should be back on the air soon. Vince invited him to go along over to see W9ZHB in Zearing, Illinois—so it looks like Vince is out to rebuild the Topeka, Kansas to Chicago relay on a post-war basis. We have already seen signs of activity on the part of many of that gang, including W9ZJB in Missouri, W9YKX, W9NFM and W9HAQ in Iowa, and W9ZHB in Illinois.

Albert Bellamy of W6MYJ is off for a while due to going out to the A-bomb tests at Bikini. Al is with the Department of Zoology at the University of California at L.A. He should be back on the ultra-highs before fall.

Nearly everyone mentions "Robbie" of W4EDD. Robbie is still in Washington where his laboratory now has a 30 megacycle set, 300 watts on six meters, and 100-watters on 144 and 235 megacycles.

Walter Guise, W3BKB, writes from York, Penn., that he is very much interested in the new six-meter band and has been listening every night for quite a while, just itching to throw on a new 500-watt job, but not a peep out of the band for

[Continued on page 44]

Communications Receiver

The latest in its line of postwar radio receivers a new six-tube superheterodyne table model, capable of receiving standard broadcasts as well as foreign and domestic short-wave stations, is announced by the Hallicrafters Company, producers of high frequency radio equipment.

Designed for the ham as well as for the average listener, it provides continuous coverage in four frequency ranges from 540 kilocycles to 30 megacycles. All amateur bands are clearly indicated on the main tuning dial scale, with provision made for fine tuning of short wave stations.

The S-38 includes among its features an automatic noise limiter. A beat oscillator is provided for the reception of code signals.

The S-38 chassis is housed in a well ventilated sheet metal cabinet which provides mechanical strength and minimizes electrical interference. It is so constructed that access to it may be had without removing the chassis from the cabinet.

Coaxial Cable Connector

The new coaxial cable connector, "CC-50", just introduced by Barker & Williamson, 235 Fairfield Ave., Upper Darby, Pa., provides amateur operators with a means of making efficient, water-tight coaxial cable connections for antennas. It also serves as center insulator for a half-wave doublet.

The "CC-50" connector is made of aluminum

with steatite insulation and having two forged steel eyebolts that are equipped with convenient soldering connections. A bottle of weatherproof cement and a piece of 5/8" outside diameter rubber tubing, plus the necessary assembly screws are supplied with each connector. The assembled connector weighs only 12 ounces.

Amateur operators will welcome the "CC-50" connector because it eliminates the necessity for crude, inefficient coaxial cable connections, thus saving them time and headaches resulting from the inroads of weather on home-made connections. Professional operators will find that it provides a quick, well-engineered means of doing an essential job. Full details will be sent on request to the manufacturer.

Oscilloscope

The CRU oscilloscope, recently designed and now being manufactured by the National Company, Inc., of Malden, Mass., includes built-in power supply and input controls among its features. A panel switch also permits use of the built-in 60-

cycle sweep or external audio sweep for securing the familiar trapezoid pattern for modulation measurements. The 2AP - 1A with a 2 inch screen and the popular 6x5 rectifier are used.

This oscilloscope is supplied in a table model but may be converted to the rack model type by addition of a rack panel. It is finished in black wrinkle. Amateurs and experimenters will find the instrument a valuable tool in the adjustment of equipment because of its sensitivity.

3-Core Solder

Tri-Core, solder with three independently filled cores of pure rosin flux, is a new development of Alpha Metals, Inc., Brooklyn, N. Y. Advantages claimed for this solder are faster soldering and elimination of dry joints, in addition to a substantial savings in tin. Tri-Core solder exceeds A.S.T.M. Class A specifications.

Phone—C.W. Transmitter

A conservatively rated 75/100 watt amateur radio transmitter for telephone and telegraph operation featuring multi-frequency variable frequency oscillator and crystal control covering all five amateur bands from 3.5 to 28 megacycles is now being delivered by Transmitting Equipment Manufacturing Co., N. Y. C.

All tuning adjustments are on the front panel

[*Continued on page 44*]

Small "butterflies" in a convenient variety of capacities for VHF and UHF.

Flexible couplings in two types — insulated and non-insulated.

"RMC," a rugged midget for mobile and other uses requiring great mechanical rigidity.

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MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

The YL's Frequency . . .

by Amelia Black, W1NVP

On May 25 the YLRL group of New York City held a luncheon/hamfest, which was attended by 40 YLs. Yours truly was present and won a 40 meter xtal as a door prize, was heard to sigh about not winning one of the four pair of nylons given away — and was accused of being a woman woman first, and then a ham. (Admitted!)

An uninvited guest was a small mouse, which was chased all round the tables by the restaurant cat, and was promptly dubbed W2RAT by the girls. To prove how hardening ham radio is — not one of the YLs jumped or screamed, though there *were* a few agitated expressions.

DX was present in the form of K4FOW, who is here visiting her daughter.

Mary Ann Tatro, W7FWR

Our YL of this month certainly sets the pace for a real radio family. The OM, "Tate", is W7FWD, SCM of the state of Washington, and her youngest son is W7EKW, now a Lieutenant Commander in the U. S. Navy. It was her son who was responsible for Mary Ann's getting her ticket.

She says that she was interested in radio since World War I, and had been listening on the amateur phone bands for many years, but had not really thought of getting a call of her own. However, when her son went away to college to study engineering, she changed her mind. She says, "He tried to put one over on us and study radio on the side without telling us. Tate and I learned of this from one of his classmates, and that was all the start we needed. The boy was putting one over on us! Well, we bought a couple of keys and built a buzzer, procured a license manual, got a handbook, and started to school right in our own home. We set the buzzer on the table and at each plate was a key. If the old man wanted me to pass the butter, he asked for it in code, and I did the same. We were able, in time, to copy calls from the radio and at times would find a 'slow station' and practice that way. When the boy returned with his license and a station, he was surprised to find that we could copy about as well as he could. He was very proud of his Ma and Pa, and insisted that we continue with the theory and try for a ticket."

Mary Ann and Tate did continue, and received their tickets the same year, 1936. Ever since then they have each had separate stations complete in every detail.

Though she says that her sending is nothing to brag about, Mary Ann has a 30 WPM code proficiency certificate, and spends most of her time on cw. Pre-war her favorite band was 20 meters, although she also worked 40 and 80. She is again on the latter, and working DX again, including a QSO with FO8FN in Tahiti.

[*Continued on page 53*]

W7FWR, Mary Ann Tatro, at her rig.

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Bill Harrison, W2AVA

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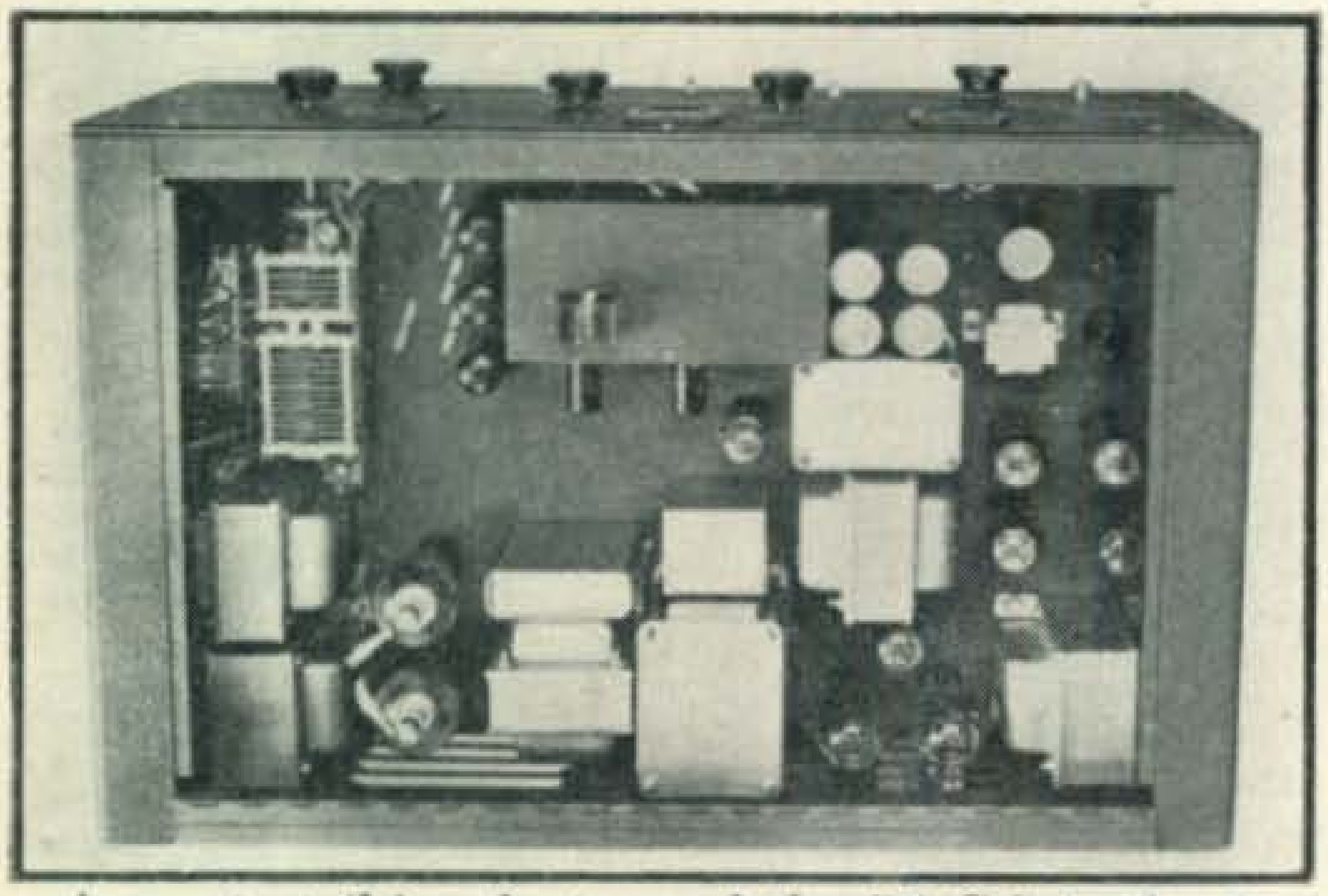
PARTS AND PRODUCTS

[from page 42]

and within easy reach of the operator. When using crystal control (the 75 GA accommodates two crystal holders) the transmitter becomes a one dial unit. For telegraph operation, break-in by grid block method is employed to assure clear-cut, clickless keying. On phone a high impedance crystal or dynamic microphone is used and a built-in relay transfers antenna from transmitter to receiver.



A most striking feature of the 75 GA is the fact that it is also the exciter unit for a 500 watt output power amplifier. This means that the initial investment in the 75 GA represents a substantial saving when stepping up to higher power since it has been engineered to be used in its entirety as an integral exciter unit for higher power. Complete information available in bulletin T-5.

U H F

[from page 38]

him up to the 18th of May. He feels certain that the band must have been open for someone on a few of these nights but his schedules with Vince Dawson, W9ZJB, have not materialized. He thinks that unless there is more activity on the band soon, 144 megacycles might take its place especially if some of the converters and receivers promised us actually materialize. Walt uses a Meissner converter and four-element horizontal beam, saying that quite a few of the boys plan to get on the band too whenever they can get a few much-needed parts, and he would appreciate receiving schedules and information so new contacts can be made within his range.

Ed McMahon, W2KLX, writes from St. Albans, Long Island. His "jalopy" superhet, as he calls it, is on the six-meter band where he finds plenty of hot harmonics from the ten-meter band originating from points in the greater New York area and Long Island but he has not run into signals from beyond that. He is looking at these surplus 205 megacycle receivers as a basic unit for a conversion with concentric line circuits so he can go into UHF in a big way.

G6OH picked up a copy of *CQ* in New York a short while ago and saw the initial UHF column

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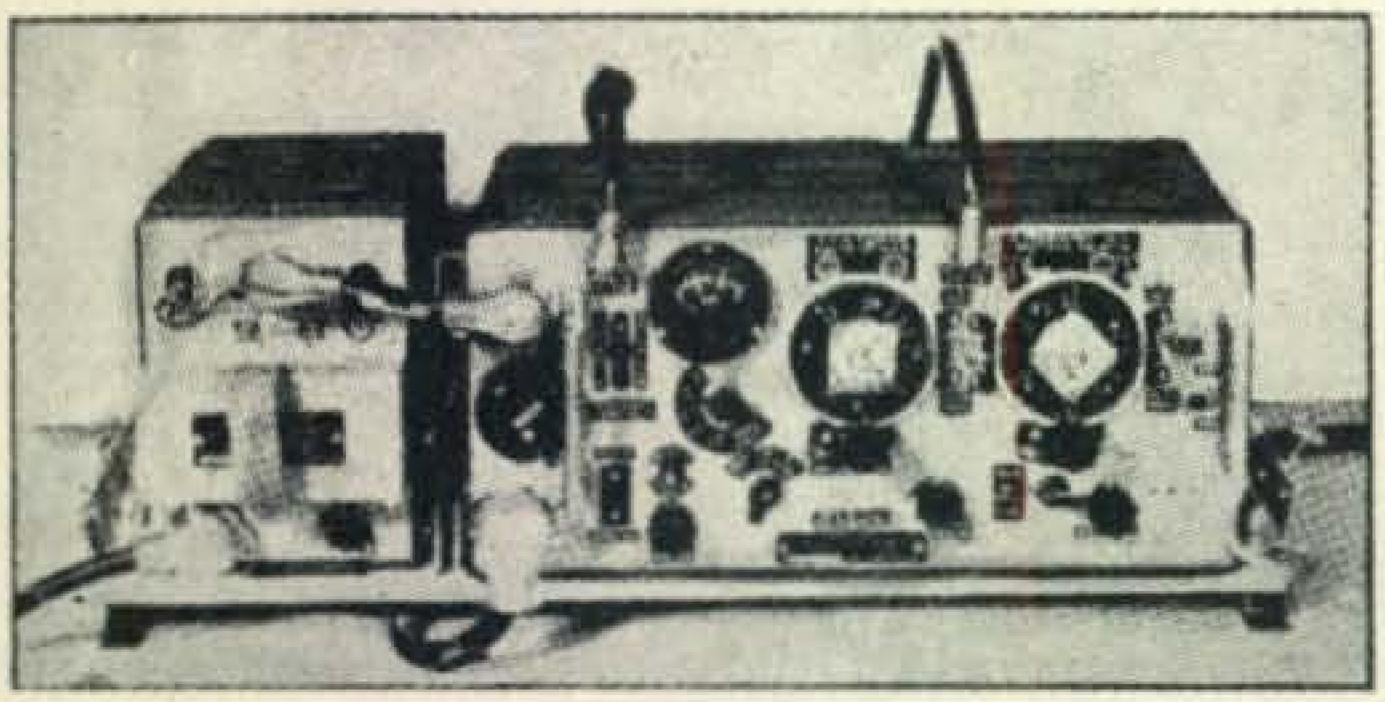

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(SEE MAY CQ)

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with its request for information. He mentions the fact that the G's in Great Britain will be on 58/60 megacycles with only 25 watts. Most of the pre-war stations are very active, led in London by G2NH, G6VA, G2MR, G5MA, G6VX, G2MR, G5CD and G5RD not to mention about 40 others and G6OH himself. They are doing consistent work for 40 to 50 miles, experimenting mainly on antennas in order to get the most out of the little power permitted. G6CW near Nottingham is very active and has worked London stations now and then, at a distance of 140 miles. G5BY is now in Devonshire (ah, that's why Bill couldn't find him in the Croydon telephone book last December) from where he has hooked G6VX in the London area, a distance of 190 miles which is not at all bad for 25 watts. G6DH, Dennis Heightman, is back on the air again—that's East Clacton, isn't it, Dennis? The G's are anxious to fix up schedules with the U. S. on 50 megacycles and wants to know how to go about it. What say, gang? We suggest picking a time that would be best for F_2 layer work—in winter—or a June date in the hope of a multiple-hop sporadic-E layer condition that might do it.

Activity on 2 and 1¼ Meters

The excellent DX work of W3HWN in Mechanicsburg, Pennsylvania, has been mentioned above. Paul also worked W3GQS in Feasterville, Penna., about 23 miles north of Philadelphia, on May 15 and subsequently. Mechanicsburg is near Harrisburg Paul puts about 250 watts into a pair of HK-54's, operating on 144.36 and 145.0 megacycles, using a sixteen-element beam. We are looking forward to receiving an article from Paul with full details.

In a letter from Ed Tilton, W1HDQ, Paul was informed that the W2BRV contact is definitely a new record which broke his old one with W3GMY of Vineland, New Jersey, a distance of 121 miles. Norm was running 60 watts into an 829B. Ed has been trying to cover the 285-mile hop from Hartford, Connecticut, but even with 16-element arrays at each end it may take a good night! Through 144-mc contacts, Paul has learned that he has been heard on ordinary nights in the Blue Mountains, Camden, Philadelphia and even Washington, D. C. Bob Elmer, W3BZJ, who has been active on the five-meter band, has been hearing Paul ever since the 16-element job went up. W3HJT in Washington says that W3HWN comes in as loud as W4CDG near Baltimore.

The receiver at W3HWN at present is a superheterodyne using a 954 r.f. stage, 954 mixer and 955 oscillator, two stages of i.f. amplification, diode and audio. He wants FM and AM with lots less noise, so has another receiver on the way with some unnumbered, new acorns which have a transconductance of over 9000. What are they,

Paul, those new remote-cutoff tubes we have been waiting for?

Bill Smith, W3GKP, is one of the Navy engineers in Washington. He lives at Silver Springs, Maryland, where he uses an 8-element curtain in front of a flat screen. The second strongest lobe is the back lobe which is down plenty of R's. He has worked Lancaster, Penna., and has heard Wilmington.

W3GF in Baltimore goes in for low-power rigs, he says, but is understood to have one of these very popular 829 tubes on the air. He says that Harry Densham, W3CUD, and Frank South, W3AIR, went down to some mountain in North Carolina and worked Washington on 112 megacycles a while ago. We should get after the details on this—we know that Harry is anxiously awaiting the VHF-152 converter.

Fred Evans of W1JFF writes from Newport, Rhode Island, that he is concentrating on 147 megacycles, using a master-oscillator, power-emplifier rig which is probably the 6E6-815 job that he had before; and a broad-beam four-element colinear antenna in a fixed position headed toward New York and Connecticut. He heard W2LXO in West Orange, New Jersey, R8 to 9 most all one night though he could not connect. He did work W1LAS/2 in Bedford, New York, with R7 signals both ways.

W1LPO has been working with W1JFF, both being in fayorable locations for temperature inversion hops. Doc has six W2 contacts to his credit together with W1's in Connecticut near New York City, using a rig similar to Fred's. Doc has two half-waves in phase, 50 feet high. Oh yes, Fred also heard W2MMY and W2LVQ in New York City the night W1LAS/2 was raised.

Lloyd Broderson, W6CLV, is back in Sacramento, California, with the State Department of Agriculture station, KRJ. He has been on 144-mc with a mobile rig since he came back from India, Persia and other outlandish places with the Signal Corps.

Don McClenon, W3EIS, with the Naval Research Laboratory has moved from Arlington, Virginia to Beltsville, Maryland. Probably wanted to keep his W3 call, and to get up out of the Potomac valley. He says that W3LM at York (W3LM or W3LN?) used to be heard only in Baltimore but now he is frequently heard in Washington. Don will get settled soon and get on the band.

Walt says that W3HVL in Temple, above Reading, can knock locals out in York, using crystal control on about 145 megacycles—and another 829. Either m.o.p.a. or crystal and an 829 is used by W3LN, W3KIE, W3DEI, W4-HXA/3 and W3ADM in York. Nearby crystal-controlled 829's are used by W3BPT in Marrita, W3CXA in Lebanon and W3GEJ in Lemoyne.

W3HWN mentions some of these as being in Lancaster, and adds that W8UUX/3—and his wife, W8UUY—are on from Mt. Penn, five miles east of Reading, almost every evening using a pair of HY-615's and a *J* antenna. They hope to travel most of the summer, working all states from their car on 144 megacycles.

425 Megacycles

Bernard Bates, W1BBM, has put many hours into his receiver in order to get it working the way he wants it. He is a strong advocate of using the 425 megacycle band and wants to hear from others whom he might help to get started on the band, probably so that he will have someone to talk with from North Harwich, Mass. We hope to bring you more details of his equipment, using 2C43 lighthouse tubes and 955 acorns in transmitters and receivers. He recommends the square-corner reflector as an easy way to get started on a directional antenna.

Bernie has heard signals from a westerly direction, with a tone of about 100 cycles. He has started daily schedules at six o'clock Eastern daylight time with W1KB of Haverhill, Mass., about 100 miles away. Perhaps when we have all the data on the rig, Bernie can add a report of a contact!

CQ DX

[from page 37]

well on account of a hill being on the west side of his antenna location, but as Bill says "you just wait until I get on 20 and start knocking off those European stations." Bill also mentions the fact that W6LRU in San Diego has worked 25 countries running 75 watts into an 809, and that LRU has worked W6POZ located a little north of Santa Barbara with an intervening distance of about 200 miles. He is wondering if this isn't some sort of a ground wave record on 10 meters. Could be?

W6AGG reports working PK6TC 28048, located on Biak Island. QSO was around 7:15 P.M.

G8MF

W2JIL has heard from G8MF and we will remember him as being the station to work in the Channel Islands. G8MF spent 3 months in a German prison camp and says he will QSL to all pre-war contacts that did not receive his card. For your information his QTH is as follows: Tom de Putron—G8MF, "Beverley," Les Hubits, St. Martin's, Island of Guernsey, Channel Islands.

W6PQV has worked W9SUI/KP6 located on Palmyra Island, the frequency being about 28060. He worked him about 3:00 P.M. after first hearing W9SUI calling "CQ A-Bomb."

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W9SUI is running 20 watts and uses a 3 element rotary beam.

Word from W8BF indicates he is just short of 50 countries on 10 meter phone. A couple of his latest are ZB2A 28060, and XACP on Sardinia 28090.

That just about does the DX reporting for this month. I surely hope by the time you fellows get around to reading this stuff we will have at least a portion of the 20 and 40 meter bands back with us. When we get these bands we will be in a much better position to judge the DX situation as well as give us a little better idea on what we are going to do with zones and countries. I rather imagine the DX news will be somewhat better for the next issue because during the past week or so the band has been very active again. That will give just about enough time for you fellows to kick through with what you have been working during the latter part of May and the first part of June. That's about it for this time and as one of the boys remarked "See you on the low end."

Key Clicks

"A 100 Watt Transmitter-Exciter Unit" appearing in May *CQ* has an error in the circuit diagram. Resistor *R115* in parts list, a 250 ohms, wire-wound resistor has been omitted from the cathodes of the 807 modulators. Bypass condenser *C122* is across the resistor.

In the article "Getting on the Super-High Frequencies", April *CQ*, drawings for *Fig.7* and *Fig.9* were interchanged.

Radio Propagation Forecast

Radio conditions for the first two weeks in July appear to be normal. No ionosphere storms have been predicted. The conditions on the St. Louis to Quito, Educator path will be a little below those illustrated especially in the early evening hours. A 5 to 10% increase in the maximum usable frequency over the path to Australia can be expected.

Specific ionospheric storm warnings are broadcast by the North American Service of the B.B.C. and by WWV, Washington, D. C. The latter is transmitting continuously on 5, 10 and 15 mc. A series of "w"s signifies that conditions are below normal. A series of "n"s will signify that conditions are normal. These broadcasts are made at the 20 and 50 minute interval, after each hour.

YL FREQUENCY

[from page 42]

Mary Ann is very proud of her first transmitter, a little 23 watter, for 20, 40, and 80 cw. On this she has worked WAC a number of times, and has confirming QSLs from all parts of the world.

She's a member of the YLRL, ROWH (Royal Order of the Woof-Hong), and a very active member of the Olympia Radio Club, of which she is a past secretary and treasurer. For many years her home has been the headquarters for the club, and some of the members and their friends are there almost daily.

W7EKW, W7FNR, and W7FWD

During the War, Mary Ann put her amateur training to use, and taught code and did monitoring work for the WERS. She also operated the local WERS control station, KFIQ.

Like most radio families, Mary Ann and Tate feel that their family is particularly happy because of the many things they enjoy in common. Of these hobbies radio has brought a great deal of pleasure and many friends, and helps keep both Mary Ann and Tate young. Mary Ann insists, however, that her five grandchildren prevent her from being a "glamor girl". But they can't keep her off 10 when the DX is rolling in!

DX PREDICTIONS

[from page 35]

of the average conditions, arrangements have been made to include a "Last Minute Notice" of poor transmission days. These predictions will be based upon past cyclic performances of existing ionospheric storms. Or in other words, predictions will be made for the two weeks following publication of *CQ*, of ionosphere storms likely to occur in such strength as to affect predicted conditions. This data does not include sudden ionosphere or radio fadeouts in the daylight hemisphere, but does cover disturbances of the storm type which will bring conditions below normal over periods of from one to four or five days.

Disturbances of the ionosphere type are more severe in considering paths which cross in or near the polar regions. The effects are known to taper off considerably toward the equator. Some unusual and misleading effects will be noted during the first phase of the ionosphere storm. Due to the mounting turbulence in the ionosphere, what will at first appear to be normal f_2 layer transmission may open the bands erratically for short periods at odd hours. On other occasions it is likely that all signals may gradually disappear or become weaker while strong sporadic E layer reflections, or "short-skip" is observed.

The predictions are based upon the work and publications of the Central Radio Propagation Laboratory of the National Bureau of Standards. Comments and inquiries from the users of the predictions are invited. Address, Propagation Editor, *CQ* Magazine, 342 Madison Ave., New York 17, N.Y. Please enclose a self-addressed envelope or postcard, if you desire a reply.

"UR SIGS ARE FB OM — I'M WORKING PORTABLE"

LAZY KILOWATT

[*from page 15*]

faint blush after operating into a dummy load for 45 minutes. On c.w., during normal keying, no color is visible.

Results

The transmitter was air tested under extremely unfavorable ten-meter conditions, but DX worked, including LU7AZ, HK1AB, G6ZO/I, etc., reported the signal comparing favorably with anything on the air. An ordinary Windom was used for a skywire, providing very slight gain. A full kw can be run with ease....the pair of tubes being rated for a good two kw.

Under no conditions could any trace of parasitic oscillation or feedback be observed. With excitation removed the final is as clean as a hounds tooth. Applying excitation, with plate voltage removed and swinging the tank condenser through a 360 degree arc, less than a one ma flicker was observed in the grid meter.

Other Stages

The power supplies used for the Lazy Kilowatt are quite conventional. There is a variac in the primary of the 807 plate supply for controlling excitation. It was found that by varying the plate voltage of the 807, and keeping the screen voltage (taken from the same supply) between 450 and 600 volts, satisfactory excitation control was obtained.

The exciter is a commercial unit manufactured by Millen. It uses a 6L6 tritet driving an 807. For tuning the final, a switch is provided to cut a resistance in series with the primary of the high voltage plate transformer. A 300 watt bulb is used, although a 300 watt heater unit is smaller and just as satisfactory.

All primary circuits are relay controlled so it is only necessary to run a light remote control line to the operating position. The low voltage supply is interlocked with the primary of the high voltage supply so it cannot be turned on independently.

TRANSMITTER CONTROL PANEL

[*from page 31*]

at the extreme right is the filament and master relay. This relay should also be double pole, normally open with contacts rated at 15 amperes.

The wiring of the complete panel is shown in *Fig. 2*. Terminals on the relays themselves are utilized to save space and the necessity of purchasing a multiple terminal block. All wires, with the exception of one lead so indicated on the drawing, may be #18. The power lead should be at least #14.

Operation

In operating the panel the filament "ON" button operates the line relay closing the filament transformer primary and the bias rectifier primary. At the same time, the time delay relay starts to function.

The knob of the overload relay is turned in a clockwise direction to close the contacts. The overload relay will, of course, not have to be reset unless tripped by an overload. After a delay of approximately 20 seconds, the plate "ON" button is operated. This closes the primary of the plate rectifier transformer and you are on the air. It is not possible for the plate power relay to operate until the time delay relay has completed its function.

To open the plate power relay simply push the plate "OFF" button. In the event of an overload, the contacts in series with the stop button open and the knob moves to the left. After the cause is determined and rectified, reset the overload relay and again push the plate "ON" button.

To shut down the station the filament "OFF" button is operated.

If remote push button controls are desired, the "ON" buttons are connected in series with and the "OFF" buttons in parallel with the buttons on the panel.

This panel as described should handle a 1 kw rig without trouble.

Parts Lists

1 Standard Relay panel 3" x 19"
2 Double pole—normally open control relay 20 amp contacts. Ward Leonard 105-6520 or equivalent
1 Overload relay 250 ma or 500 ma, as desired. Ward Leonard 507-512A or 507-513A or equivalent
1 Single pole-normally open thermal time delay relay (20 second) Ward Leonard 507-501 or equivalent
2 Push buttons-normally open. Utah 1S-13 or equivalent
2 Push buttons-normally closed. Utah 1S-21 or equivalent

1 MA METER

[*from page 23*]

than the 60-cycle supply line. It should be remembered that if, for example, 1000 cycles is used the 60-cycle calibration will not apply. A separate calibration must be made for this frequency. This, too, may be added to the slide rule chart, if desired. The resistor R_{14} in series with the line should be tapped off for full-scale deflection with the selector switch in the Low Ohms position and the Impedance Zero Adjust potentiometer R_{15} at mid-scale.

In the low ohms position zero impedance is meter zero. *DO NOT SHORT THE TEST PRODS*, but merely set the Impedance Zero Adjust R_{15} for full-scale deflection. The voice coil, transformer winding, etc., being measured is connected to the test prods. This in effect places a shunt across the meter, and consequently since another current path is provided, the deflection will decrease. The amount of decreased deflection is calibrated in terms of impedance.

The high Z position makes use of a series circuit. Before making a measurement, the test prods should be shorted to check the zero adjust for full-scale deflection. The insertion of the impedance being measured in the test prod circuit will cause a drop in the meter reading. This drop is calibrated in terms of impedance.

The impedance meter can be calibrated by means of a non-inductive resistance decade box or by use of carbon resistors of known value. Two tables (Low Z and High Z) should be made up, plotting impedance against one mil meter deflection. When the tables are completed, the values can be transferred to the "slide rule" chart.

Position 8 of the selector switch brings the meter terminals directly to the pair of terminals at the right hand side of the panel. In this position the one-mil meter is available for any purpose. For example, a plug-in field strength/frequency meter, or for any other type of measurement requiring its use, without permanently tieing up the meter to the instrument.

Position 9 of the selector switch brings the rectifier terminals directly to a pair of jacks at the left-hand side of the panel, while the meter is connected directly to the d-c output of the rectifier. In this way, the meter and rectifier are readily available for use as plug-in percentage modulation indicator or other special applications.

By merely flipping the selector switch from position 8 to 9 it is possible to change from field strength/frequency measurements, to a percentage of modulation indicator—and in no case tieing up a one mil meter for such measurements as may be made at infrequent intervals.

Positions 10 and 11 of the selector switch: As has been indicated earlier, our choice of multipliers and shunts was governed by the available meter scale. However, the discussion that follows applies to shunts in general. Our recommendation is that 100 ma and 10 ma be assigned to positions 10 and 11 of the selector switch.

To use the one mil meter as a higher scale milliammeter, it is necessary to provide shunts, as indicated in the main diagram.

The actual resistance value of the shunts will depend upon the resistance of the meter in use. If it is one having a 27 ohm movement the 10 ma shunt will be 1/9th of the meter resistance, or 3 ohms. The 100 mil shunt will be 1/99th of the meter resistance or 0.2727 ohms.

The general formula for shunt calculation is as follows:

$$R = \frac{R_m \times I_m}{I - I_m}$$

Where R is the resistance of the shunt in ohms
R_m is the meter resistance in ohms
I_m is the full scale current of the meter
I is the full scale current for the new calibration.

A neat home-made shunt can be wound over a high ohm carbon resistor, or in the space between the terminals of a lug type terminal strip. Copper magnet wire #34 was used for our shunts, although a study of the wire tables and your available supply may suggest another size. A little more than the required amount is wound on the support, with one end permanently soldered in place. The other end is clamped securely with a clip. Using a battery and a variable resistance (see *Fig. 5*), the current flow is adjusted for the desired reading on the standard. While this is being done a *heavy* short is placed across the one mil meter. When the standard is adjusted to the desired mil range, the shunt is substituted for the "short." The shunt is then carefully trimmed for equivalent full scale deflection so that the one mil meter and shunt accurately match the standard. The wire is then soldered and the clip removed. The fine wire

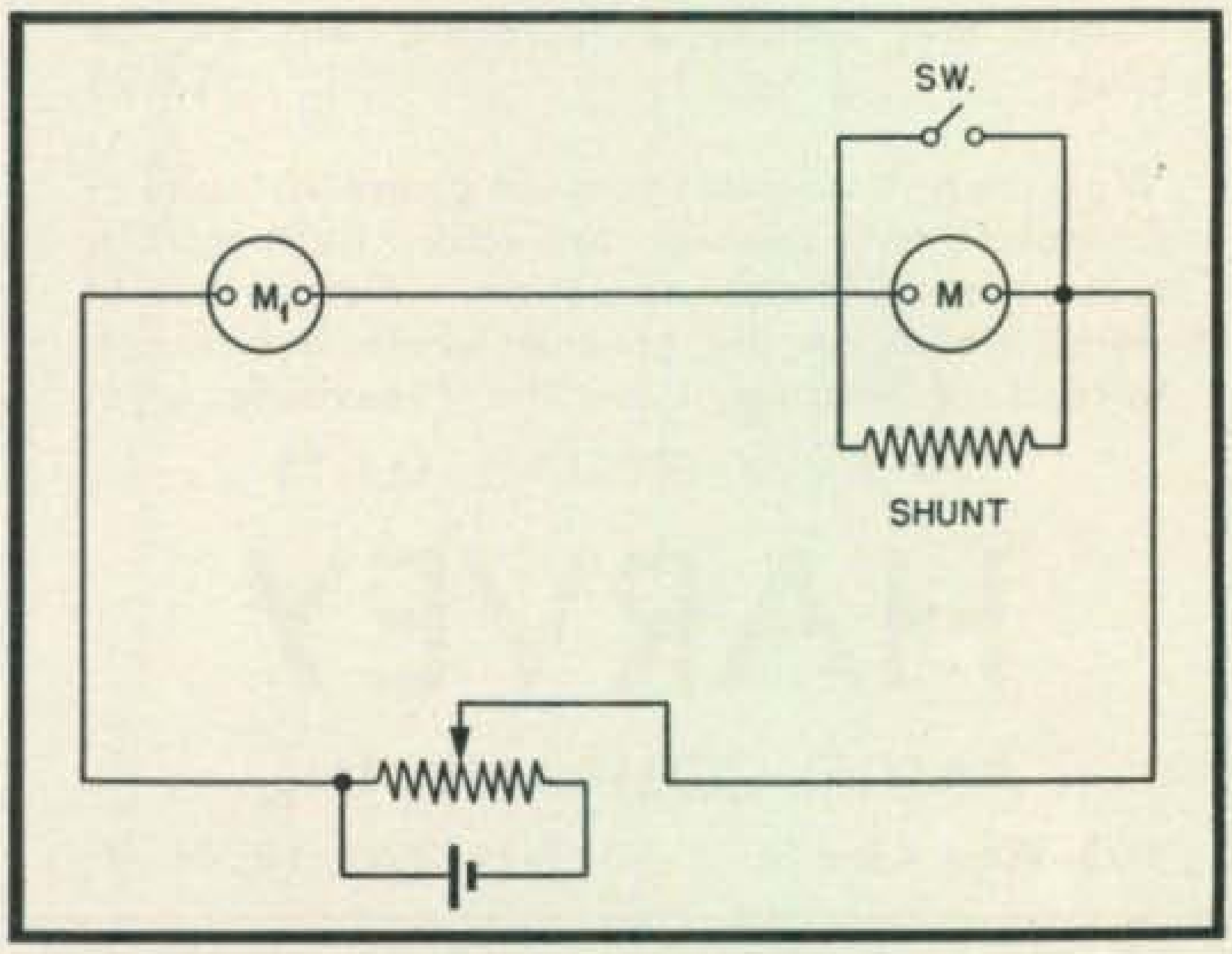

Fig. 5. Constructing 1 ma meter shunt. M1 is 100 ma meter, M and 1 ma meter. With switch closed, adjust pot for full scale deflection. Trim shunt for full scale deflection on M with switch open. For the 10 ma shunt close switch, adjust M1 to read 10 ma and trim 10 ma shunt for full scale deflection on M

may be held securely in place by the application of a little colorless nail polish.

Slide Rule Chart

Fig. 6 shows a sample of the slide rule chart. We believe that this type of chart is much easier to read than the usual graph of measurement versus mils.

A piece of cross-section paper can be used to accurately mark off the 50 spaces for the "straight line" duplication of the standard one mil scale. This scale is then used for one, ten and 100 ma. It can also be used for the 5 d-c voltage ranges.

All other calibrations are made on parallel lines below the one mil scale. If each calibration is made up in table form of measurement versus one mil deflection, it is then a simple matter, by use of a transparent straight edge, to step off the calibrations for each scale.

A flat piece of tin, slotted was cut to fit snugly on the inside cover of the carrying case. The finished chart is cemented on a "H" shaped piece, the legs of the H being one inch tabs. A piece of celluloid or thin pliofilm is then placed

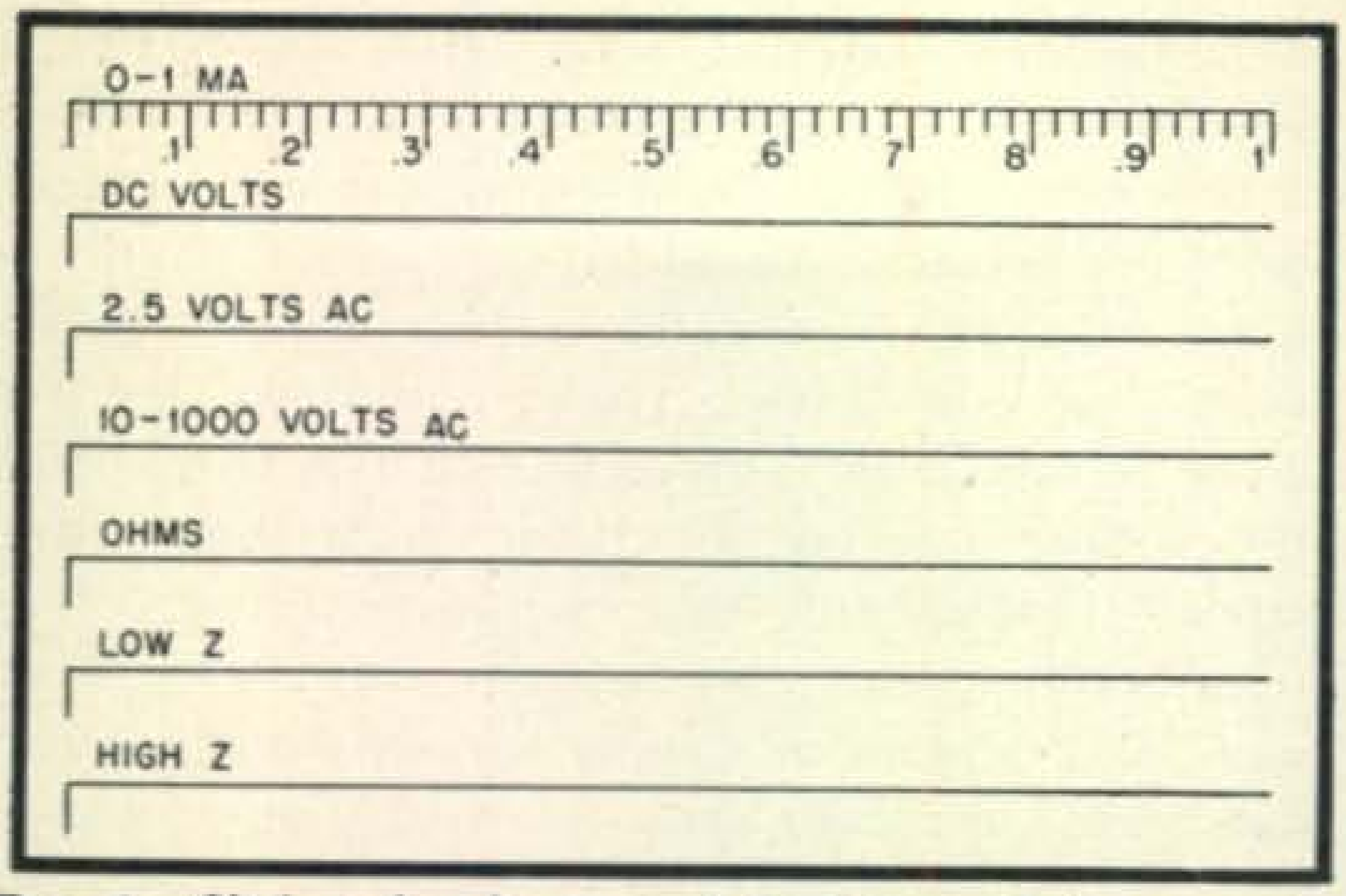

Fig. 6. Slide rule chart graph to interpret 1 ma meter readings into voltage, resistance, and impedance

over the chart, with the top and bottom folded over tightly and fastened with scotch tape on the back. The pliofilm can be creased if the fold is pressed gently between the fingers—in hot water. The "courser" or straight edge is made of a piece of pliofilm about ½ inch wide, folded over, its ends fastened together with scotch tape behind the chart. A line scratched in the courser with a scriber can be lightly filled in with india ink. The courser should be tight enough to lie flat across the chart and still loose enough to slide across the chart.

The one-inch tabs on the separate piece of tin holding the chart are bent at right angles, inserted in the slots until the chart is about ¼ inch from the bottom plate. The tabs are then bent flat and the finished unit is ready for the carrying case cover.

A small bottle of model airplane "paint" (quick drying and smooth) can be used to paint the tin.

Engraving the Panel

To add the commercial touch to our instrument panel, and save the expense of an engraving job, we resorted to simple photography. With this useful, inexpensive process, plus a little imagination and effort, you can make your own homemade receiver panels, precision dials, meter scales, name plates—and even design and print your own QSL cards.

Tracing paper is cut to the panel size and holes are cut in the paper to fit the panel over the potentiometer and selector switch shafts. Remove the knobs and bushing nuts and fit the panel in place. Replace the nuts and control knobs. Switches should be rotated and points marked for each position. The tracing paper is then removed and the panel layout lines are drawn in with precision. It is best to use india ink for this, but a fine pointed soft lead pencil will do. The important thing is to make the lines and letters clearly defined, sharp and opaque.

The lettering and numbers can be done free hand if desired, but we used a typewriter to insure uniformity. The more affluent might use their Le Roy lettering sets. If a typewriter is used, be sure to have a fresh, well inked ribbon in order to prevent light from passing through the typed letters. An added precaution would be to insert a sheet of good carbon paper (carbon side to back of tracing paper panel) so that the paper is inked on both sides, on the front from the ribbon and on the back from the carbon paper. This insures clean white lettering.

Remember that the neatness of the finished panel will depend in a large measure onthe effort spent in preparing the tracing paper panel. When completed, it may be used as a negative which can be printed by any photo funster or amateur photographer.

To protect the panel and add greatly to its wearing quality, cover with clear lacquer, or a piece of pliofilm.

WIFE'S EYE VIEW

[*from page 18*]

Remarks drift through the room, "Why, how INt'resting." It remains interesting for all of five minutes. From this the only deliverance is a poker game. We have degenerated from a happy group of gossip-mongers to cent – point card sharks. This always costs the 9IYK's a bit of their hard-earned. I am an inveterate loser, however my losses are but a trifle compared to those 807's or whathaveya's to the final upstairs.

I have discovered another peculiarity in my Particular party: he has developed an odd fondness for eating hot lunches and dinners after they are cold. And he almost always requires a pot of coffee at 2 a.m.

My new hat is a square-ish black thing with wires sticking out. It is a transformer. My sojourn into Cafe Society is two glasses of amber liquid consumed at the corner joint, because it seems the rig needs a new bottle...............

My ham is not exactly anti-social, but prefers to stick with those of his own kind. His hobby is his obsession. His idea of a bang-up time is spending an evening swapping rig-dope with unfortunates who have become infected with the deadly virus-amatueris. The little woman is "in the background," and from time to time may be included in the conversation with an:

"I know how you must be enjoying all this ......" The standard reply is an intelligent, "Uh huh," or in a particularly expansive mood:

"Oh, you just go right ahead—I don't mind a bit." The latter remark immediately stamps you as a good kid. Someone may even say,

"Now there is a good kid......so understanding." Greater love hath no woman.

There are hardened veterans to the cause, there are those who have served twenty-odd years, the martyrs, the good kids. From them we the youthful, the uninitiated, must learn. It is said that as the years roll by one develops an immunity to it all. A counter-offensive is begun, a tight little circle of wives who bleed as one, a crying-club, a world of our own. The Wise Ones say that, soon or late, one always finds she is fighting something bigger than she.

Just for a moment, let me weaken and bemoan a lost cause—my hat, my hat. Ah, that lovely, tricky $25.95 job in the window downtown—that sweet thing, (a girl is entitled to an extravagance once in a while, isn't she?) alas, it is gone from me forever in a cloud of copper tubing.

Prospective wives, does your young man have those ominous call letters plastered on the back window of his little lizzie? I ask you to stop, look, and think—oh, take a GOOD look. *That boy is taking time out from ham radio to do his courtin'!* And the day he tells you he guesses he'll take a look across the band to see how the boys are doing, the honeymoon is over and he is back to normal.

The evidence is in, and now I ask you: Is this a hobby, or is it rather, an obsession? The case rests.

KLYSTRONS

[*from page 17*]

within the tube and tuned by flexing the tube envelope which varies the grid spacing; and the klystron 417, a large tube with built-on cavity tuned by flexing the cavity sides. These reflex klystrons are mostly used as local oscillators in u-h-f receivers.

The entire field of velocity modulation is so new that new and different tubes using these principles may be expected.

Minimum Requirements

The minimum necessary requirements of satisfactory operation should be an important consideration to the amateur. Among the first things, if not the very first, it will be found that the reflex klystron, in the light of low frequency experience has many seemingly peculiar characteristics. The beam power input wattages may vary from 10 to 75 watts for 25 to 950 milliwatts output—if correctly terminated. Operational stability depends upon the resonant frequency of the klystron (i.e., physical separation between grids), the acceleration voltage and the reflector voltage. Because these are inter-related, the klystron may be driven into or out of oscillation by some purely unintentional adjustment. Frequency stability is difficult to obtain and minimum warmup time is about 9 minutes, during which the drift is between 1.5 and 2.5 megacycles.

For beam-power inputs over 10 watts, forced

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

RECEIVERS: New RME-45, NC-2-40D, HRO, HQ-129X, Super-pro. Roto-beams. Conklin Radio, Bethesda, Maryland.

NAVY RADAR OSCILLOSCOPES-ASB models, Complete with 5BP1 and 4 6AC7 tubes, high gain amplifiers, highest quality components. Tested before shipment. Special $25. Send for list of bargains in Navy radar equipment. Seaboard Surplus, PO Box 719, Jacksonville 4, Florida.

ALL ELECTRIC reversible 10 meter beam mount, finger tip control, selsyn indicated, weight 11 pounds rotates 300 pounds, surplus, immediate delivery. Write to W9OJU/Ø, 2768 South 13th, Omaha 9, Nebraska.

GE Pyranol condenser 2 mfd, 4000 VDC, ea. $5.50. Roller Smith or Weston meters 0-1 mil basic movement—3" 0-4000 VDC scale and external series multiplier complete $5.75.

Kenyon power transformer 115V-60Cyc. Primary, 3200V Secondary Use pair for full wave, at 300 mils. 2 for $12.00

General Radio Variac No. 200CU, 5 amps. Removed from Radar Equipment, electronically perfect . . .$10.00.

Cadmium plated steel chassis—17" x 13" x 2" punched —suitable for power supply, transmitter section, etc. 75c.

A kilowatt bottle assembly. Includes 304TL, filament transformer, tube socket, plate cap, filament bypass condensers, wired—ready to use—Perfect $15.00. Greenwich Sales Co., 59 Cortlandt St., New York 7, N.Y., WHitehall 3-3052.

CRYSTALS: Precision low drift units. Type 100A in 80, 40 and 20 meter bands. Two units plug in one octal socket. One dollar each. Rex Bassett, Incorporated, Fort Lauderdale, Florida.

QSLs . . . Samples. Carter . . . W8JOT, 747 S. Plymouth, Rochester 8, N.Y.

air cooling must be used between the flanges. The 417A, for example, will average about 0.3 mc per volt drift for the reflector voltage and 0.1 mc per volt drift for the acceleration or beam voltage, although the total electrical tuning range is about 3.0 mc when the klystron is oscillating. Power supply modulation must be kept to a very low order and is accomplished by regulation within 0.2 volt and a residual peak-to-peak ripple of less than 0.2 volt at maximum ratings.

Tuning

Electrical tuning over a range of more than 0.5 mc is not employed, since this would mean a comparatively large scale power output variation. Of the six klystrons seen on the market today, all may or may not come with the micrometer tuner, known as Sperry Model 12. Primarily these reflex klystrons are coarse-tuned by the spring-loaded screwdriver adjustments between the flanges. The screws rest upon temperature compensating struts, which offset some of the frequency drift. One of the struts in turn rests upon a lever which is pressed backward in the plane of the axis of the klystron and serves as a fine tuning adjustment.

The klystron is not as difficult to handle as one might first believe. War-stimulated development has drastically reduced the number of "bugs" and has certainly brought the price down. Though scarcely the instrument to experiment with if living 100 miles from the nearest ham (who probably is a die-hard 80-meter man, anyway), fellows in and around densely ham-populated big cities might easily find someone inclined to take a crack at the centimeter wavelengths.

PHASE INVERTER

[*from page 26*]

The output stage is not degenerative to an appreciable extent, since both grids are driven equally and oppositely.

In the absence of the compensating signal, a voltage will be seen at X on the scope screen; this is the grid-cathode voltage of the second section of the paraphase amplifier. To balance up the inverter, the compensating voltage is now increased until no voltage can be detected at X. The adjustment should be checked for a low, mid-range, and a high frequency. Otherwise, a square wave generator may be used for balancing adjustment.

Note that if the plate load resistance of the paraphase stage are selected for the purpose, that no compensating signal is required and the inverter is automatically balanced. However, when changing tubes, unbalance can easily arise, and the compensating signal adjustment will be needed.


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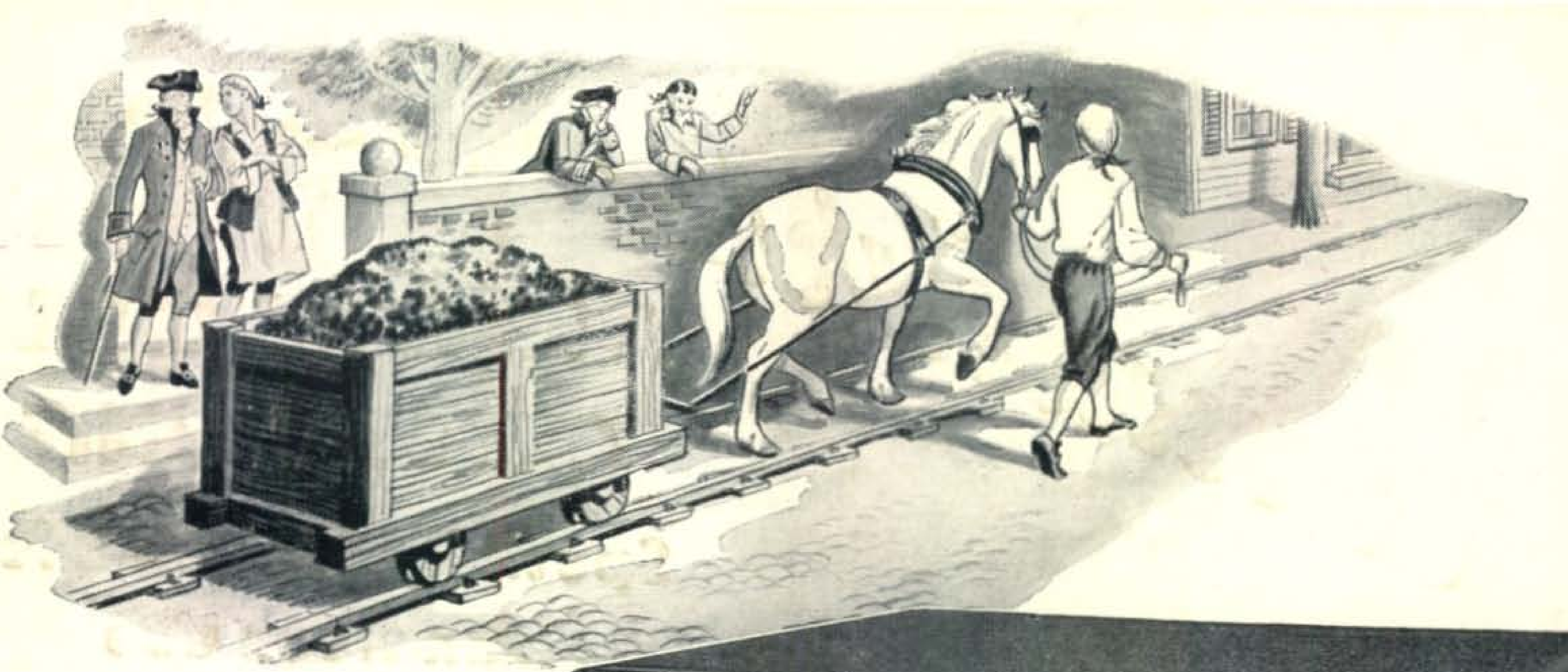

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