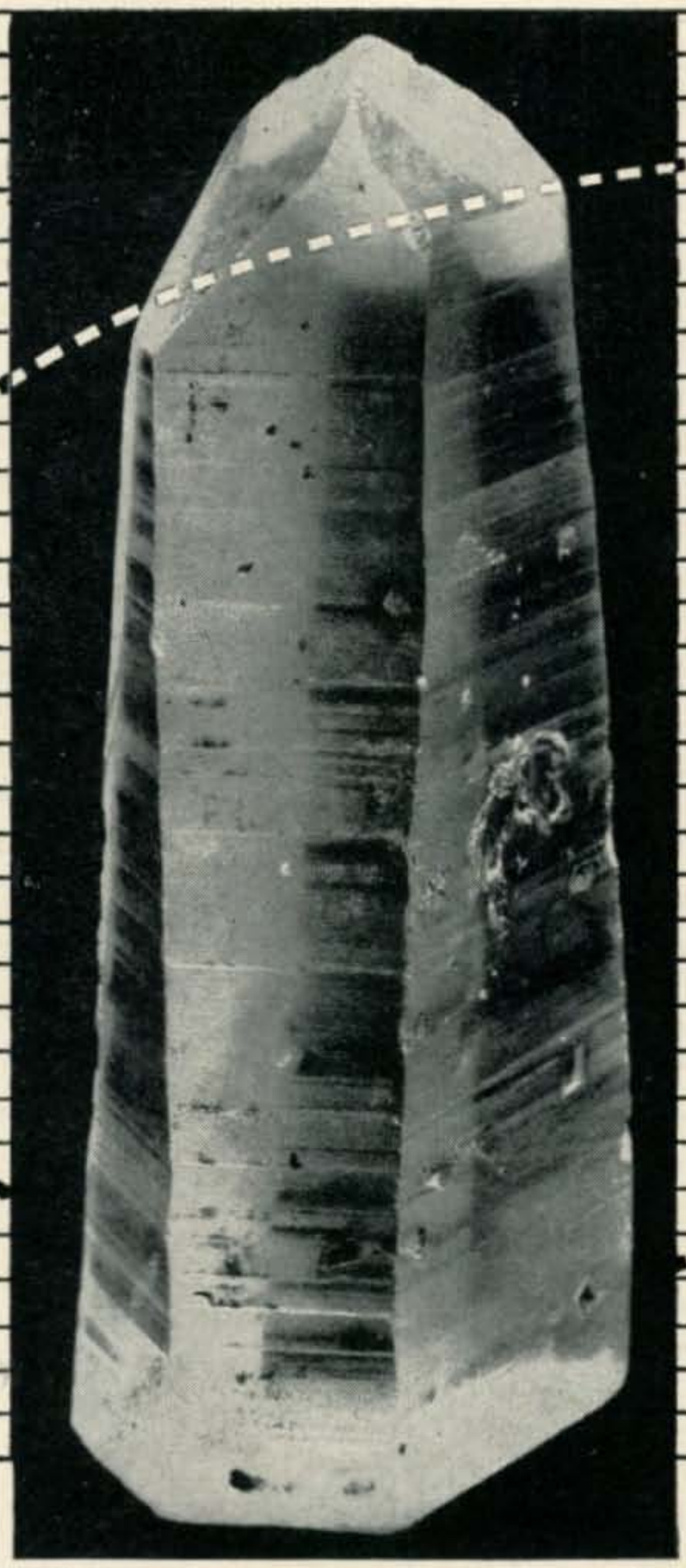
# CQ

JAN., 1951


The Radio Amateurs' Journal

35¢

# SOLID AS A ROCK

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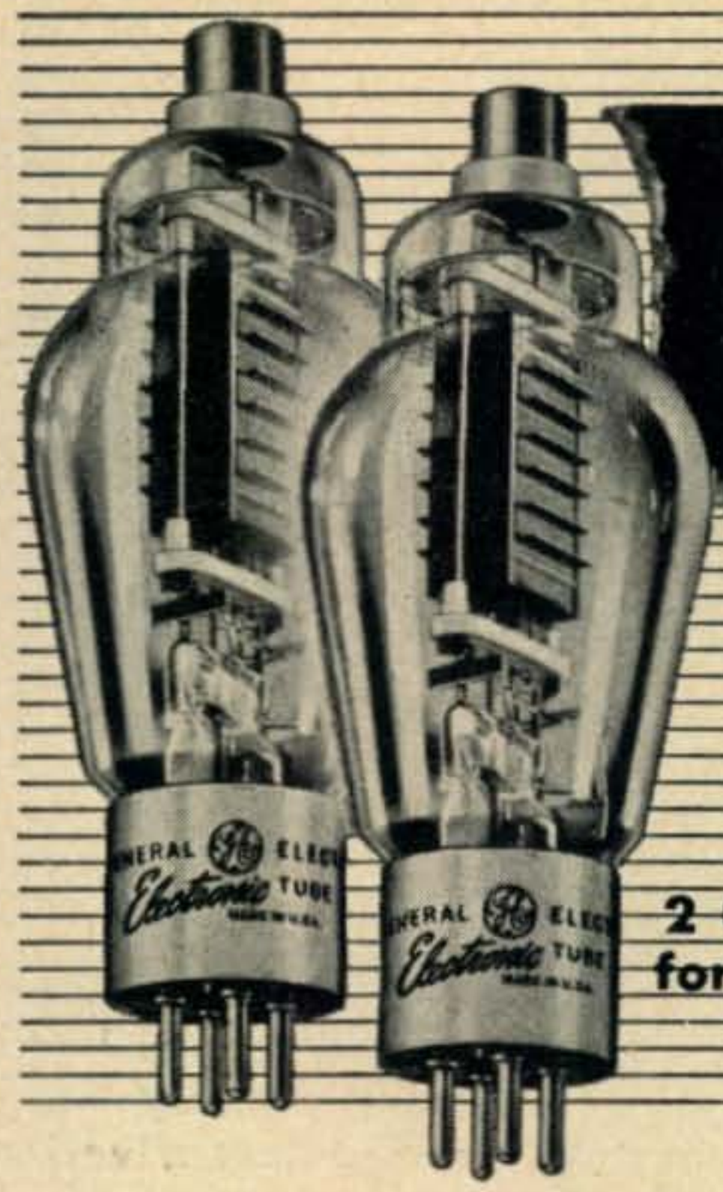
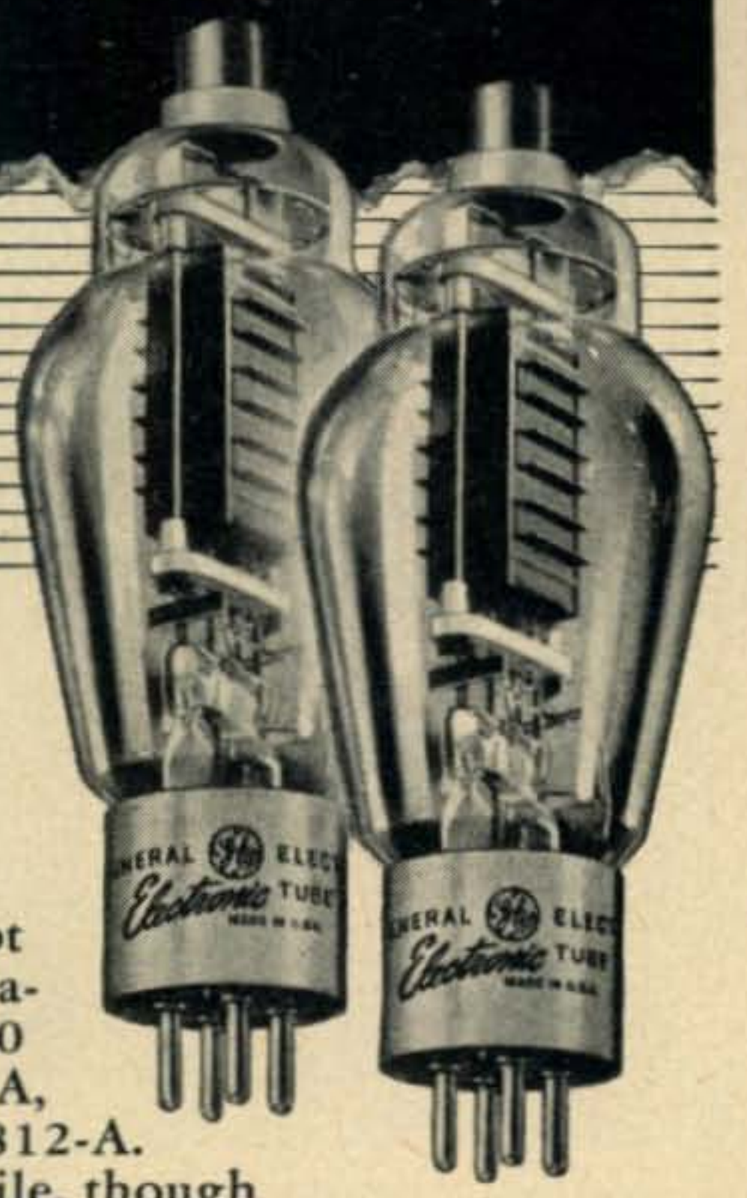



**2 GL-811-A's for modulator**




**2 GL-812-A's for final**

## Cost of all four approximates that of one "50-watter"!

Every dollar does the work of several, when you invest in these up-to-the-minute G-E triodes. They prove by their surpassing value, how much research and constant design improvement mean to your pocketbook's welfare as well as your rig's performance.

Think *first* of the new GL-811-A and GL-812-A for any service in your circuit—modulator, buffer, doubler, or final! Stronger construction than before gives increased toughness, longer life. Other new features—superior high-voltage insulation, improved radiating-fin plate structure—result in better electrical characteristics, such as a plate-dissipation top of 65 w instead of the earlier 55 w. This, in turn, means substantially increased output.

As you know, the two tubes are similar in design except for the amplification factor—160 for the GL-811-A, 29 for the GL-812-A. Both are versatile, though the "11-A" serves primarily as an a-f power amplifier and modulator (zero-bias in most cases), while the "12-A" is a center-of-the-target choice for modulated or unmodulated Class C r-f work.

Check the ratings below to see how much your money will buy when you beef up your output with four of these G-E economy triodes! Your G-E tube distributor will be glad to show you the tubes, quote you their low price. Or write *Electronics Department, General Electric Company, Schenectady 5, New York.*

**TYPICAL OPERATION, ICAS**

| | 2 GL-811-A's, Class B Modulator Service | 2 GL-812-A's, Class C Telegraphy |
|---|---|---|
| Plate voltage | 1,250 v | 1,500 v |
| Plate current | 350 ma | 346 ma |
| Grid bias | 0 v | —120 v |
| Power output | 310 w | 380 w |

**ELECTRONIC TUBES OF ALL TYPES FOR THE RADIO AMATEUR**

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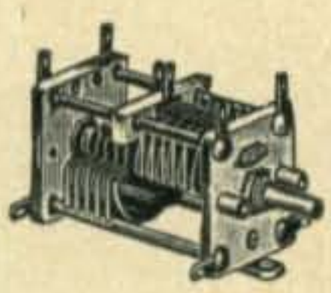
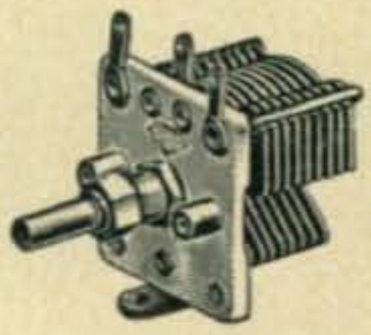
1. Extremely efficient, they embody everything that any other condenser has PLUS a positive rotor wiping contact in the exact electrical and physical contact permitting the design of balanced circuits.
2. Ball bearings are featured on this double bearing condenser for centering and elimination of end-play.
3. Any of three methods of mounting can be used.
4. Alignment is maintained by 4 rigid tie rods.
5. Two solder lugs on each stator permit the placement of other components for efficient, short lead design.



| Catalog Number | Max. Cap. | Min. Cap. | PER SECTION No. of Plates | Air Gap | Distance Behind Panel | Dealer Cost |
|---|---|---|---|---|---|---|
| CE-2032 | 35 | 6 | 7 | .030" | 3 1/32" | $2.97 |
| CE-2033 | 50 | 7 | 9 | .030" | 3 ¼" | 3.27 |
| CE-2034 | 75 | 8 | 14 | .030" | 3 21/32" | 3.63 |
| CE-2035 | 100 | 9 | 18 | .030" | 4 3/32" | 3.14 |
| CE-2036 | 150 | 10 | 27 | .030" | 5 3/16" | 4.80 |
| CE-2039 | 15 | 5 | 5 | .060" | 3 1/32" | 3.45 |
| CE-2040 | 35 | 7 | 11 | .060" | 4 1/32" | 3.96 |
| CE-2041 | 50 | 8 | 15 | .060" | 4 23/32" | 4.35 |

### BUD "CE" MIDGET CONDENSERS-SINGLE BEARING

1. Any of the three methods of mounting can be utilized.
2. Extended rotor shaft allows ganging of two or more condensers.
3. Smooth operating and noiseless bearings permit operation on high frequencies and prevent capacity changes.



| Catalog Number | Max. Cap. MMFD. | Min. Cap. MMFD. | Air Gap | No. of Plates | Overall Length | Dealer Cost |
|---|---|---|---|---|---|---|
| CE-2020 | 15 | 4 | .030" | 3 | 1 11/16" | $1.65 |
| CE-2021 | 35 | 6 | .030" | 7 | 1 29/32" | 1.86 |
| CE-2022 | 50 | 7 | .030" | 9 | 2 1/32" | 2.07 |
| CE-2023 | 75 | 8 | .030" | 14 | 2 ¼" | 2.31 |
| CE-2024 | 100 | 9 | .030" | 18 | 2 15/32" | 2.49 |
| CE-2025 | 150 | 10 | .030" | 27 | 3" | 2.64 |
| CE-2028 | 15 | 5 | .060" | 5 | 1 15/16" | 1.86 |
| CE-2029 | 35 | 7 | .060" | 11 | 2 7/16" | 2.07 |
| CE-2030 | 50 | 8 | .060" | 15 | 2 25/32" | 2.31 |



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VOL. 7, NO. 1 JAN. 1951

# CONTENTS




## OUR COVER

The mecharical layout of a kilowatt amplifier can be a tough problem. A simple right-angle crive made this one a lot easier. (See page 6.)



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Deer Hon. Ed:

The most horrendous thing that are ever happening to Scratchi are just happened. Hon. Ed., there I was, the world at my fingertips, practically a million bux in my pocket, and the publishers of Who's Whom and How Come practically holding the presses to getting out a special edition to including Scratchi, when—WHOOOM! the hole things are blowing up in my face. Honestly, Hon. Ed., at this point I are feeling lower than angle of radiation off underground antenna.

Scratchi the big shot, Scratchi the electronics genius, Scratchi the miracle-maker—all shot to little pieces. You are probably saying how come and who's kidding who, but here is what's happening. Several weeks ago I finding myself in tough spot. I had promised to making antenna coupler for demonstration purposes at a local ham shindig, and hadn't got around to it yet, and the meeting was that evening.

So, madly rushing around and getting a chassis and shield box and various coils and condensers and insulators and binding posts and soldering them all into box. Not following any design on acct. in too big a hurry, but just grabbing parts at random and soldering them from here to there and from there to here. When getting finished are having most complicated looking affair. Upon close examination are finding that a selenium rectifier are finding its way into box. However, are not worrying, as hams at club not knowing difference anyway.

That evening at meeting are gathering together the other equipment, transmitter, receiver and antenna, and fixing it up all reel pretty-like. Later on in program are giving demonstration, which are going over like slicky. For some odd reason the antenna matching network are actually matching the transmitter to the antenna, which are pleasant surprise, to saying the least.

After the meeting a couple of the local bug-happy hams are deciding to having QSO or two on the demonstration set-up, despite the fact that the antenna is a hunk of wire thrown along the floor. They are firing up the rig and tuning across the band, and finally calling a local. They raise him, and he giving them 599X report. Following standard see-w procedure, they signing on second come-back and deciding to call seek-you. They do same, and then it happened. The whole bunch of kilocycles are suddenly eruptting in one huge mess of QRM, all calling us. Hokendoke!! practically every state in the union and all zones are represented. The next cupple of hours are a blur, except that I recalling that no one believing it when it all over. We finally deciding that freak propa-

*(Continued on page 57)*

# "You can't beat Sylvania Tubes for long life and great performance,"

***says Philip J. Crist, W3NNX***

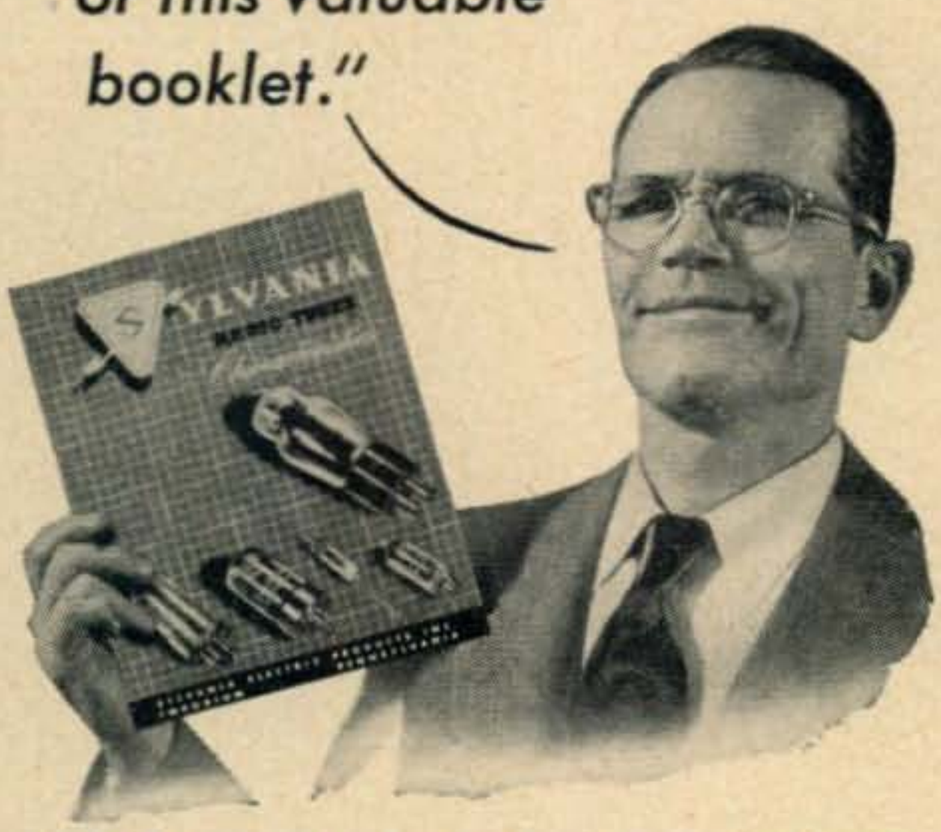
Mr. Crist, one of Baltimore's most active Hams, is also widely known for his regular morning program on Station WFBR during which he salutes the Hams. Naturally you'd expect this expert to be a booster of Sylvania Radio Tubes . . . and he is. Says he:

"Frankly, I'm delighted with both the long life and great performance of Sylvania Tubes. I have been using them in my transmitter as well as my receivers for several years and am completely sold on Sylvania."

This report from Mr. Crist may also be regarded as good news by scores of Hams everywhere. The Sylvania line now consists of highest quality tubes for every rig . . . for every circuit, tuner, receiver, and transmitter. You'll find all these tubes listed, rated and fully described in the catalogs: "Sylvania Radio Tube Characteristics" and "Sylvania Transmitting Tubes."

Get your copies of these catalogs now! They show complete ratings and indicate the best possible Sylvania Tube for any specific job. If your regular Sylvania distributor doesn't have these booklets, mail the coupon for your free copies *today*.

*"Send for your free copy of this valuable booklet."*

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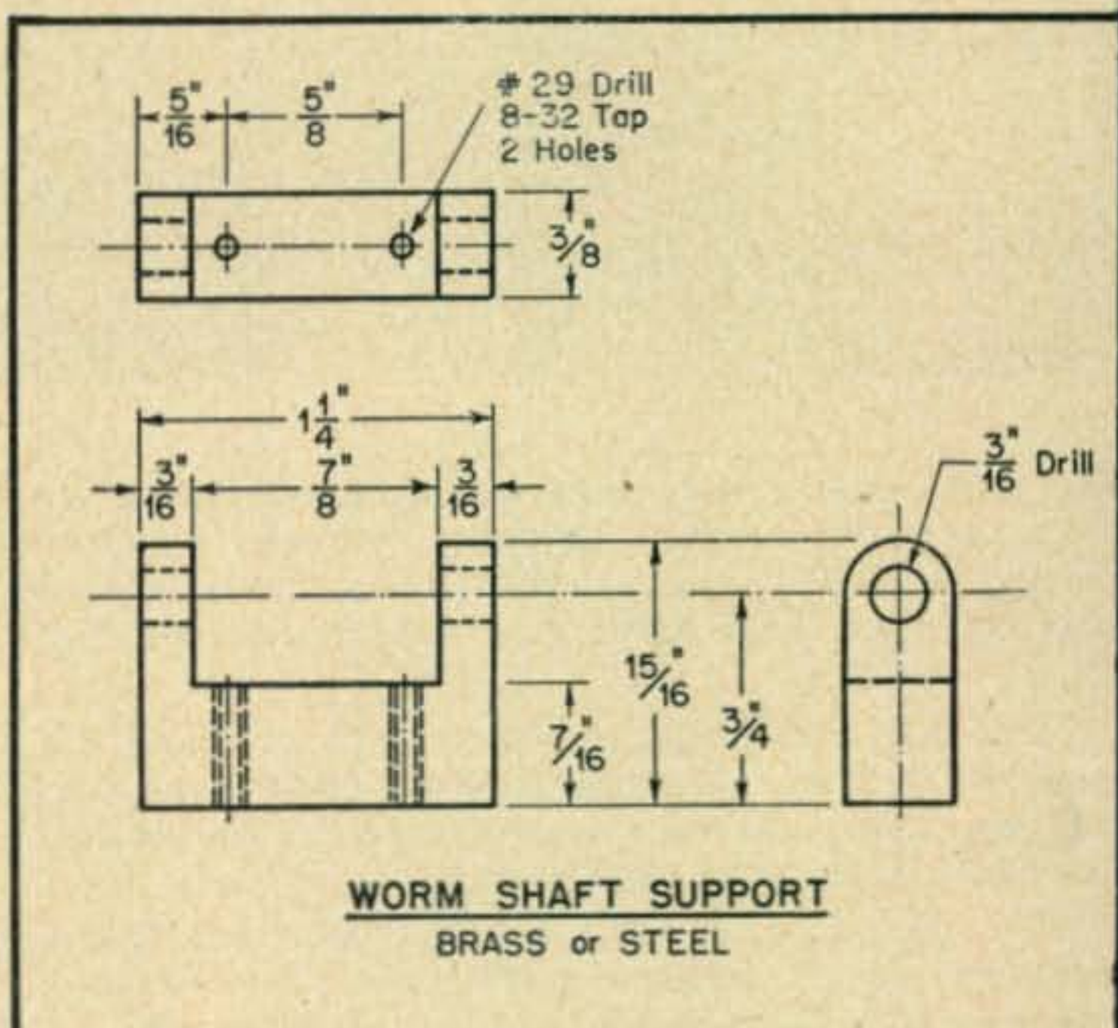
# OUR COVER

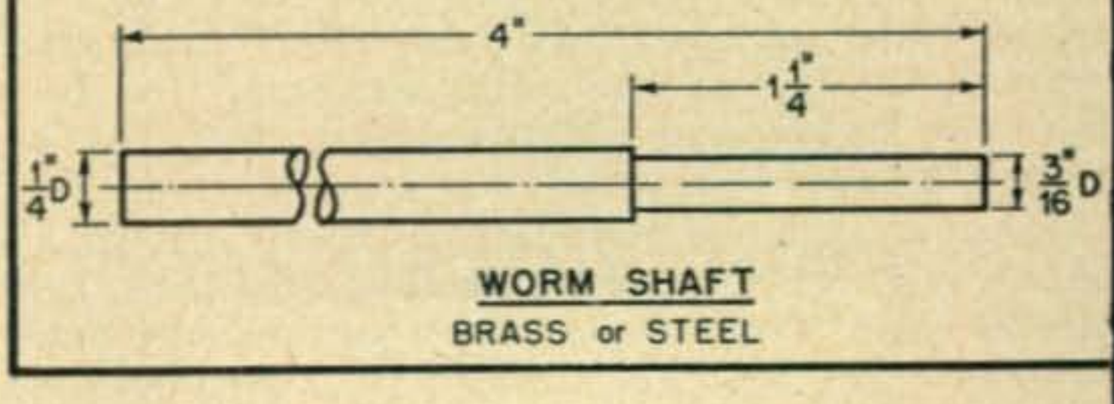
THE PROBLEM OF DRIVING a variable capacitor through a right angle arises from time to time. Commercial right angle drives are available and usually fill the bill. Most of the commercial units, however, occupy a fair amount of space, particularly in depth. Here is a really simple design for a right angle drive which can be assembled from stock gears with a minimum of metal work. It has the virtues of simplicity, vernier action, low cost, and minimum size.

The right angle drive consists of four pieces: two purchased and two fabricated, as indicated in the drawing. The purchased items are stock gears from Boston Gear—Boston worm gear, catalog number QTH (90¢) and worm wheel catalog Q 1332 ($2.75). The worm is altered only by adding a 6-32 tapped hole in the hub for a set screw to fasten to worm shaft.

A 6-32 tapped hole is also required in the hub of the worm wheel. The stock bore of the gear accommodates a standard condenser shaft (¼" diameter).



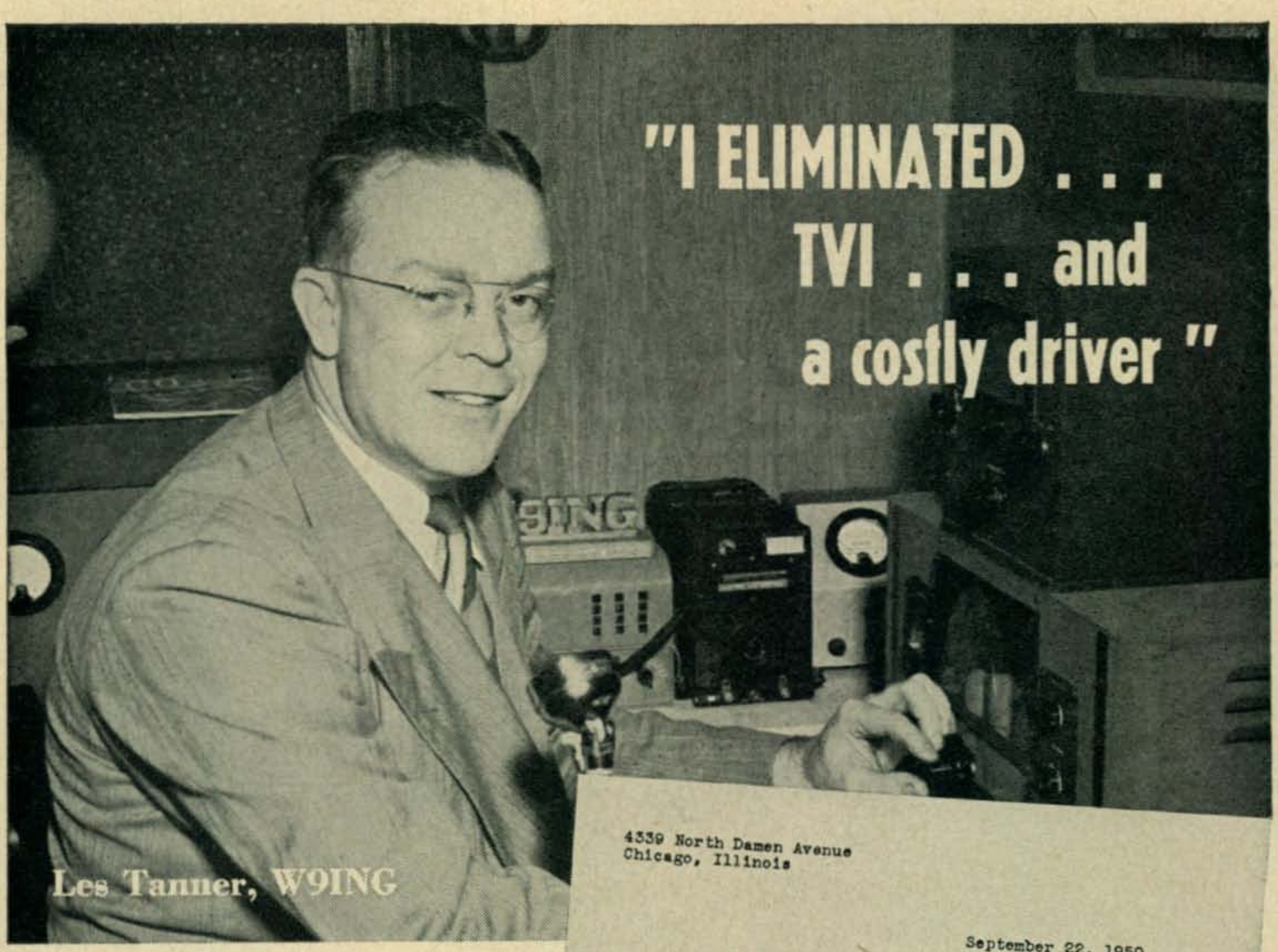

**WORM SHAFT SUPPORT**
BRASS or STEEL




**WORM SHAFT**
BRASS or STEEL

A block of steel ⅜" x 1" x 1¼" is machined as shown in the sketch for the worm shaft support. Cold rolled steel rod ¼" D, approximately 4" long is turned down to 3/16" D for a length of 1¼" at one end, to accept the worm bore. There was not enough stock in the worm to permit enlarging to ¼", and this diameter was desired for the shaft size so that standard couplings might be used.

*(Continued on page 19)*




4339 North Damen Avenue
Chicago, Illinois

September 22, 1950

Eitel-McCullough, Inc.
San Bruno, California

Gentlemen:

For many years I have used triode tubes in the final class C stages of my transmitters.

With the event of television it became apparent that T.V.I. would quickly force me to curtail operating unless something could be done to eliminate this interference at the transmitter.

The answer proved to be a flea power exciter driving a single Eimac #4-250A tetrode in the class C final stage running at a conservative half KW input.

This tube line-up, plus a bit of common sense design, has made it possible for me to operate on the 10 and 20 meter phone bands without fear of disturbing many neighboring television viewers. The low drive requirements and high efficiency of the #4-250A tetrode have eliminated the necessity of using costly driver and doubler stages, thereby reducing the size of my transmitter by approximately fifty percent.

With best wishes for continued success, I remain

Very truly yours,

Les Tanner

Les Tanner
W9ING

LET/ehb

Benefit by the experience of Les Tanner and other outstanding amateurs . . . put Eimac tubes to work for you.

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# ZERO BIAS

## EDITORIAL

As we enter 1951, CQ begins volume 7 with a new Editor, an enlarged staff and a full set of New Year's resolutions. This is part of our publishers's promise to bring you an even better CQ, with improved service to all our readers.

We welcome two new members of our editorial staff, whose names appear on our masthead for the first time this month. Al Gross, W8PAL, is well-known in the engineering field as the designer of one of the very few FCC approved trans-receivers for the Citizens' Radio band. His forthcoming articles will cover this field, which promises to become one of special interest to all alert hams, and we suspect that his explanation of miniaturization techniques will lead to applications in other phases of our hobby. Our other new family member, G. Franklin Montgomery, W3FQB, is another chap who uses a slide rule in his daily pursuit of bread, butter and the necessities of ham radio. Monty is on the staff of the Bureau of Standards and has contributed some pretty esoteric stuff to the Proceedings of the I.R.E. On the other hand, the gang around Washington know him as an all-around good ham, a crackerjack CW man who also works 'phone, runs up whopping contest scores and DX totals, and manages to dream up useful ham gadgets in between.

### FCC

It's apparent FCC is really cracking down on violations these days, judging from their reports. This increased enforcement is obviously required with world conditions as they are. This is certainly no time to condone any funny stuff" in our bands, including such things as operating a Class B 'phone on a Class A frequency. In many ways, the political situation is sadly similar to what it was nine years ago. Our responsibility is something we owe not only to ourselves but to every other licensed Amateur, and let's recognize it.

### and ITV

As reported in Zero Bias last month, ITV (interference from television, primarily radiation of harmonics of the 15.75 KC horizontal sweep frequency) is becoming a very serious problem. Few of the earlier TV sets were guilty of this, but the recent drive to cut prices has resulted in a minimum of shielding and filtering in many of the current models. It is very delicate and difficult situation for the FCC to attempt to intervene in the design of a commercial product, and consequently this interference becomes an industry problem and is being handled as such.

Fortunately, not all of the current sets are of--fenders, and at least one producer of an acknowledged bad radiator has reportedly taken steps to correct this condition in present production, plus instituting a policy of curing" sets already in the field.

FCC is cooperating with hams and BCL's in ITV cases, but naturally the facilities of regional offices are not sufficient to cover large scale operations. Present policy is to explain the nature of the problem to the owner of the offending set, and suggest that his dealer service organization, or the manufacturer, be advised of the conditions and asked to correct it.

To assist in such cases, the CQ staff is now compiling an analysis of the technical problem with suggested corrective procedures. The full story will appear in an early issue, and will be presented to serve as an explanation to the set owner and a guide to *his* serviceman.

### Transformerless Gear and Hot Chassis

Although we know we are revealing a bad mistake which went unnoticed by many of our readers, we must point out a lethal condition which lies in the circuit of the transformerless regenerative receiver described in our November issue.

With the line plug inserted the "wrong" way, the exposed metal chassis is above ground by the full line voltage! If you are copying this receiver or have already done so, you should modify the circuit so that only one prong of the line plug is used, and connect the chassis solidly to a good ground. If you are not familiar with this fairly-safe method, please write for a fuller explanation. We promise that this type of thing won't get past us again.

Personally, we don't like transformerless power supply circuits. Of course, they're economical and save space, but we think safety is more important. We'd like to see some of the transformer manufacturers bring out a compact inexpensive transformer with perhaps a light 6.3 volt winding and a light half-wave secondary capable of say, 125 volts DC at 25 or 30 ma, or even less. This would do the job that most transformerless supplies do in the average ham application. We dearly love our readers, and we'd like to see them happy and intact for a long time to come. Hope some of our advertisers are listening. —*Gene, W2ESO*

# SERIAL NO. 1 OF THE 75A-2 GOES TO WØHBG

Dick Bellew, WØBFY, Clyde Hendrix, WØHBG, and Art Collins, WØCXX, watch Leo Wilkins, WØAUQ, finish assembling the first Collins 75A-2 receiver to leave the assembly line. Hendrix, perennial purchaser of Serial No. 1 models of Collins ham equipment, again demonstrated his complete confidence by ordering sight-unseen, many months ago. He drove from Clinton, Iowa, to the Collins factory to take delivery.

**For the best in amateur radio, it's . . .**

COLLINS

**COLLINS RADIO COMPANY, Cedar Rapids, Iowa**

**11 West 42nd Street, NEW YORK 18** **2700 West Olive Avenue, BURBANK**

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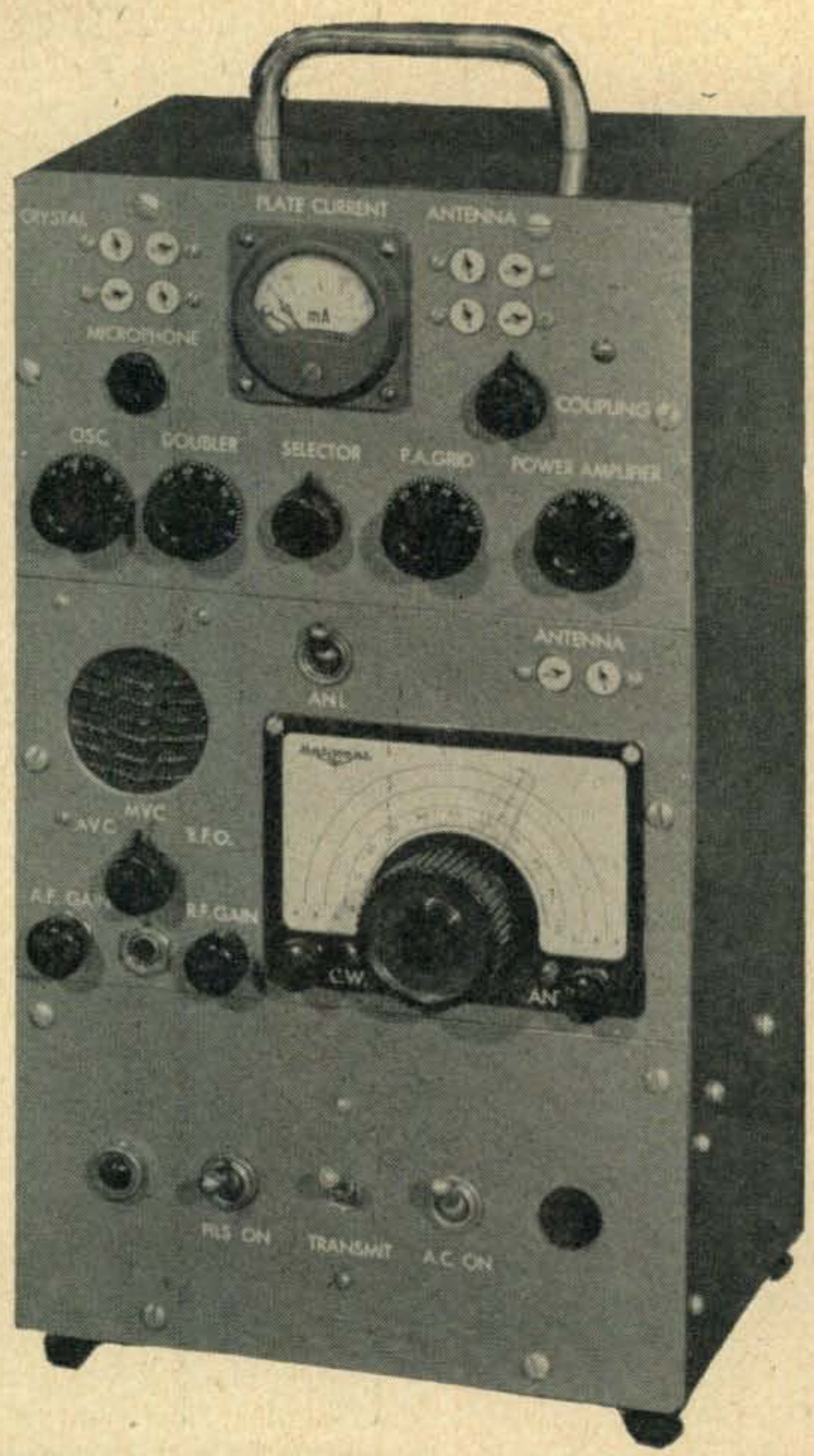
# POWERFUL PORTABLE INT




THOMAS M. LOTT, VE2AGF*

*First Place Winner in CQ's Prize Contest, By Unanimous Decision Of The Judges.*

# Combination Transmitter & Receiver

HAVING IN THE PAST READ SEVERAL DESCRIPTIONS of pint size rigs in *CQ* and come to the conclusion that none of them would quite fulfil my requirements, I decided to try and construct a half-pint station and the following is the result.

The rig was really designed and built as one small stone to kill three large birds. First, for portable and emergency uses such as F.D., secondly as a mobile rig in a car, and, lastly, as the rig about the shack that can be put on the band quickly, and will not always be in the process of rebuilding just when the rare DX is coming through. So far, it has been in use at the home QTH while the QRO rig is being rebuilt; and many successful DX contacts have been made on 10- and 20-meter phone with folded doublet antennas.

The entire station, consisting of an eight-tube 25-watt AM transmitter, an 11-tube double-conversion superhet, and the a.c. power supply, is housed in a standard 6" x 7" x 12" metal carrying case.

A glance at the transmitter circuit will show that it is perfectly straightforward; a 6C4 crystal oscillator followed by a capacity coupled 6C4 doubler, link coupled to the grid circuit of the p.p. 6AQ5 PA stage, which is modulated by another pair of 6AQ5s. These are driven by a transformer-coupled 6C4, with a 9001 as the microphone amplifier. The receiver utilizes a 6BH6 r.f. amplifier; the new nine-pin 6BA7 high efficiency mixer tube, with a 6C4 as a separate electron coupled oscillator, one stage of 1600-kc. i.f. amplification using a 6BJ6; a 6BE6 second mixer; two 6BJ6 262-kc i.f. amplifiers; a 6AL5 second detector, AVC, and automatic noise limiter; a 6AQ6 first audio, and a 6AK6 output. A 6C4 is used as the beat oscillator.

The power supply, which is built into the bottom of the case, utilizes twelve 100-ma. selenium rec-

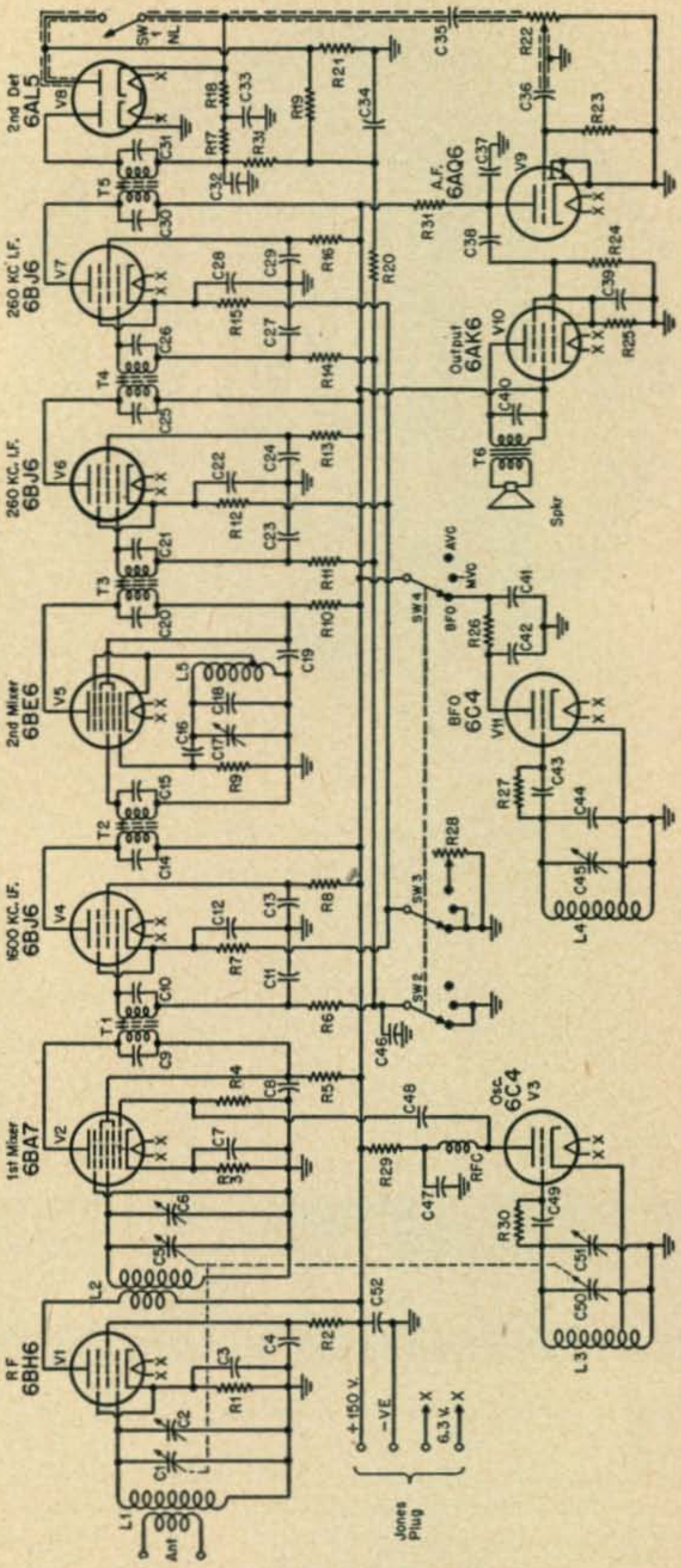
* *1730 Dorchester St. West, Montreal, Canada*

tifiers in a bridge circuit giving 300 volts at 200 ma for the transmitter, and 150 volts for the receiver. Although the cost of the selenium rectifiers is considerable, the use of the bridge circuit, besides doing away with a large heat generating tube, enables a much smaller power transformer to be used as no rectifier filament winding is necessary. The output is fed to the tx and rx by means of *Amphenol* flat multi-conductor cable, terminated with Jones plugs. The change from receive to transmit is made by means of two *Advance* miniature 300-ohm antenna relays.

The entire rig was constructed using an electric drill, several *Greenlee* chassis punches, and an assortment of round and flat files; two other major requisites for a rig of this description are a fine pointed soldering iron and a large supply of patience. The chassis were made from 20-ga. sheet aluminum by a local sheet metal worker, who also sheared the front panel into three 4" sections. All the holes were marked off and drilled before the chassis were painted and scotch tape was used to protect the panel surfaces during drilling operations. The panel lettering was done by means of *Tekni-Cal* decals.

The transmitter was constructed as two complete units, the modulator on the rear chassis 2" x 1-5/8" x 6-1/2", the RF portion on a chassis 3-7/8" x 1-5/8" x 6-1/2", the two being interconnected by means of a six-pin Jones plug and socket. Should c.w. operation be desired, the entire modulator unit may thus be removed and replaced with a six-pin plug having a shorting link to supply plate voltage to the final. A closed circuit jack inserted in the cathode circuit of either the crystal oscillator or the doubler and mounted on the panel alongside the microphone jack completes the requirements for c.w. operation. The layout of the various components may be seen from the photographs. The sleeving-covered wires which terminate in mid air, (to the rear of the grid tuning condenser) form the neutralizing condensers and may be adjusted by cutting to length until neutralization is obtained.

Whilst the transmitter was designed for 10 meter operation, as plug in coils are used throughout, it may be operated on other bands. The PA grid coils are made from *B & W. Miniductors* mounted on *National* PB16 plugs. The plate coils are *National* type AR16S with the swinging link removed and mounted on two small plugs which fit into two banana sockets, mounted on a 3/8" polystyrene rod, which is drilled to take a standard quarter inch diameter panel bushing shaft. This permits front panel control of antenna loading. The PA tuning condenser is a *Cardwell* 6080 butterfly condenser. A six-way switch is used to switch the meter into the various cathode circuits, a two-pole switch being used, as the meter polarity must be reversed to enable the PA grid current to be read. The meter shown in the photograph is actually one taken from captured German equipment, but any 1½" dia. meter of 10 MA or less may be used. i.e. *Roller Smith* Model 1526010-1 ma or 1½" *Simpson*. Two crystal sockets are




**See Parts List In Next Column**

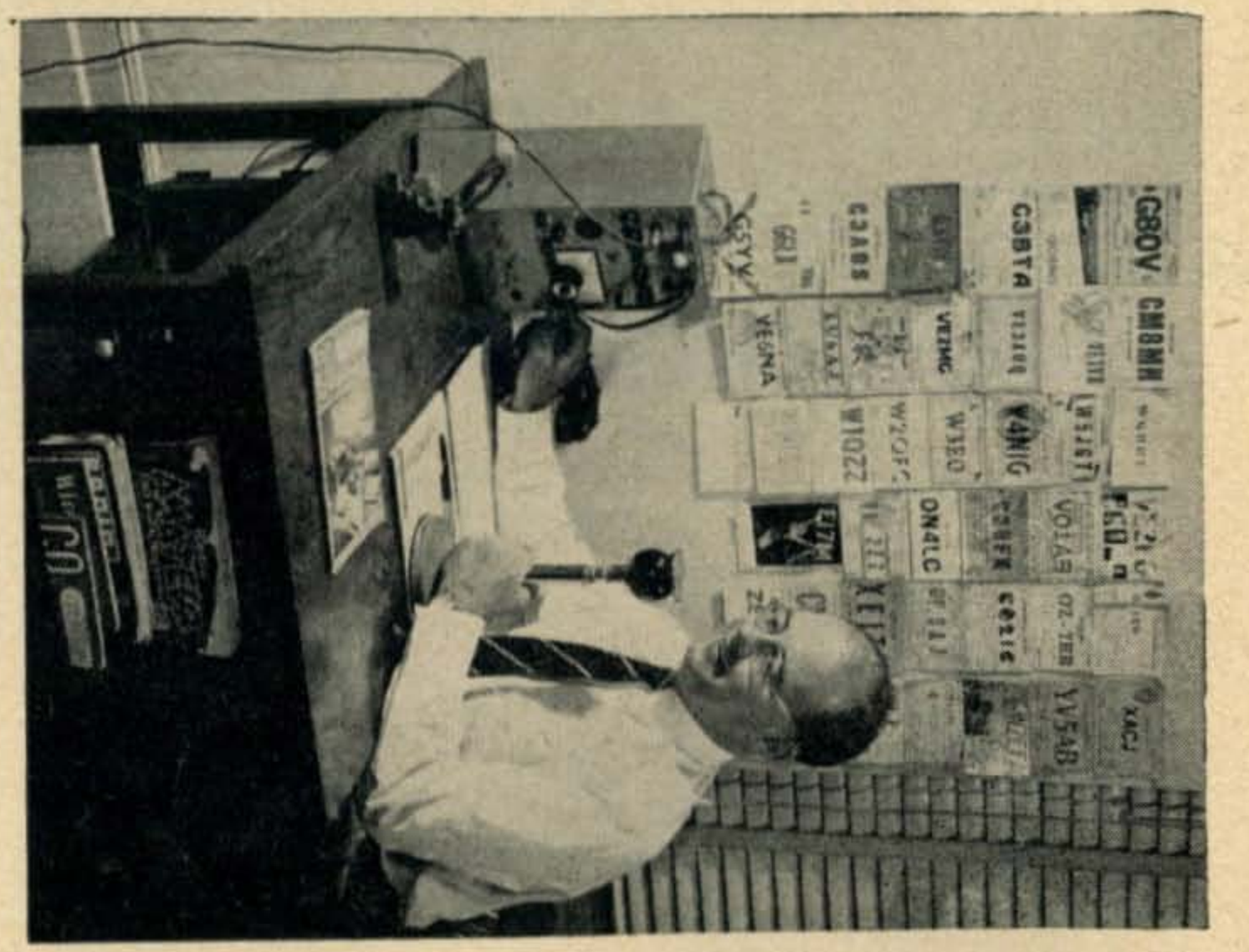
mounted on the front panel to enable rapid QSY to be effected by means of a relay, to be fitted at a later date, when mobile operation is contemplated. To provide maximum utilization of chassis space, both the modulation and driver transformers have one mounting lug bent vertically and passed through a slot filed in the chassis.

Three aluminum shields (4-7/8" x 2-3/8"; 3-7/8" x 2-3/8"; 3-3/4" x 5/8") are used to screen the PA stage from the driver section and the modulator. After all the components are assembled, the modulator section should first be wired, and then tested by means of a 4000-ohm dummy load. Next, the r.f. section may be wired and power applied, with

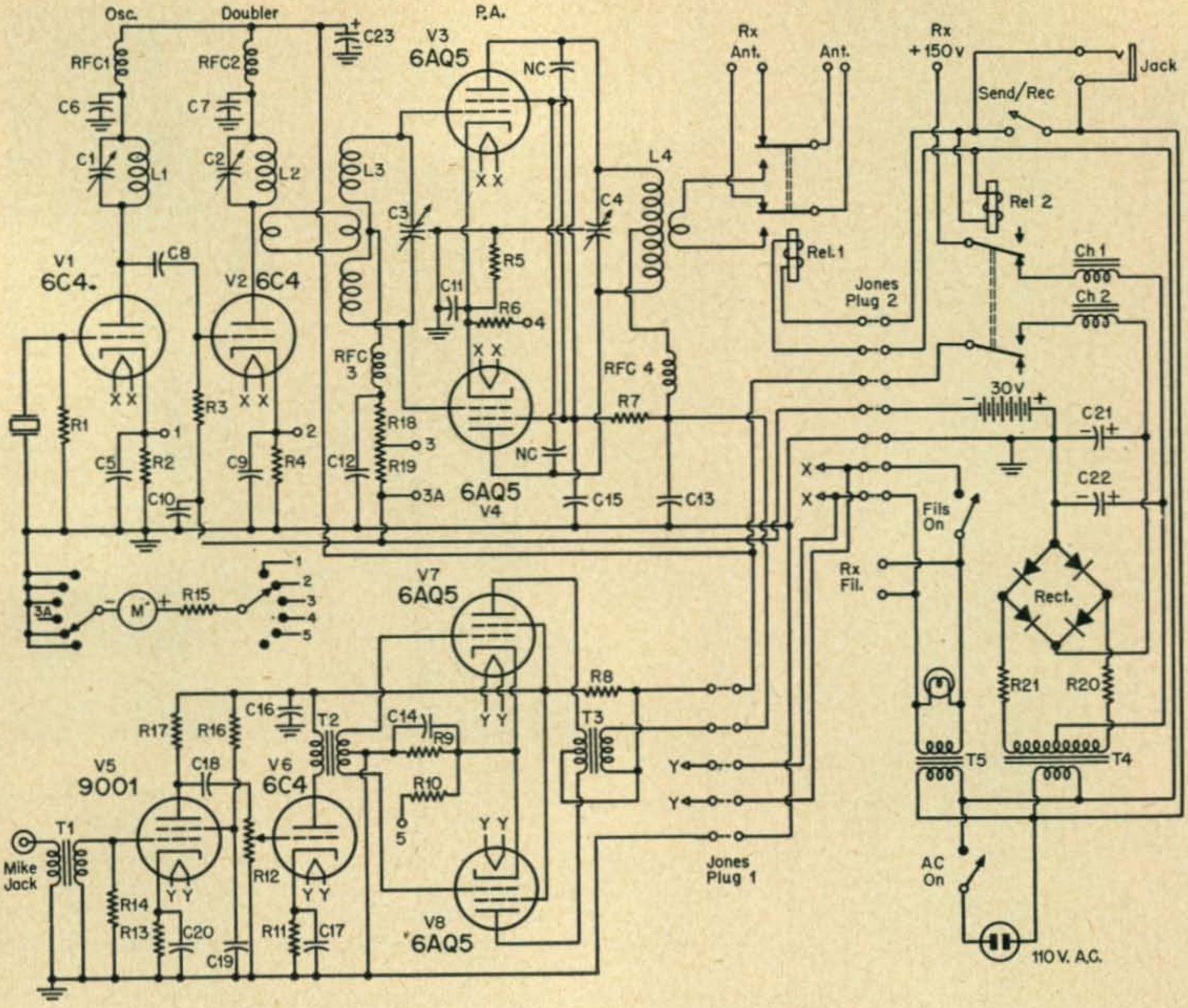
the modulator section removed; with the meter switch in position one, the crystal oscillator should give the normal crystal dip when condenser $C_1$ is rotated through resonance. The meter switch should then be turned to position two and the doubler tuning condenser $C_2$ rotated for dip; then with the switch in position three, the PA grid tuning condenser should be adjusted to give approximately 5 ma of grid current. A strap should then be placed across the two high-voltage terminals on the six-pin *Jones* plug to enable high voltage to reach the final, which may then be neutralized by moving B+ from the two earlier stages (by removing their plate coils) and reducing the bias to 30 volts, giving a standing plate current of about 30 ma. The small neutralizing condensers, described earlier, are then adjusted until no sign of oscillation can be detected (either by movement of the cathode current meter or by means of a small neon bulb near the PA coil) when the plate and grid tuning condensers are rotated. When this has been done, a small drop of glyptal or similar cement may be used to make the adjustment permanent. This method of neutralizing a final (by reducing bias) may be applied to any transmitter and is probably the most positive method of insuring stability and neutralization. The final step before putting the rig on the air is to plug in the modulator unit and adjust the modulation level control on the rear of the chassis to give 100% modulation.

The receiver is built on a 5-7/8" x 6-1/2" x 2" chassis with a single aluminum partition dividing the r.f. portion from the remainder and acting as a mount for the three-gang tuning condenser. The receiver coil block is made from the coil pack used in the 274N type receiver, the entire unit being dismantled and the coils and their mica socket mountings removed. Then 1-1/4" square blocks of 1/4" polystyrene are cut to fit inside the three small aluminum can bases. These blocks are then drilled to take five small banana plugs, a five pin tube socket being used as a template. *Amphenol* No. 24 coil forms, with 1/2" sawed off the top to enable them to fit into the cans, are then mounted on the blocks. The entire coil block assembly plugs into three ceramic five pin tube sockets mounted on the main chassis by means of a small sub-chassis 1-3/4" x 4-1/2" x 1/4". Should a 274N type coil block not be available three *National* type RZ coil shields, cut down to a height of 1-5/8" and

C1, C5, C50—Three-gang condenser, J. B., miniature, 15 $\mu\mu$f per section or General Instrument type 2801 modified to have two rotor and two stator plates.
C2, C45—Johnson miniature variable, M11.
C3, C4, C7, C8, C41, C42—500 $\mu\mu$f Centralab Hi-Kap.
C6, C17, C51—3-30 $\mu\mu$f trimmers
C9, C10, C14, C15—Part of i.f. transformers.
C11-13, C19, C22-24, C27-29 C33, C35, C36, C38, C40, C46, C47—.01 $\mu$f Centralab Hi-Kap.
C16, C32, C34, C37, C43, C49—100 $\mu\mu$f silver mica EL Menco CM20-101.
C18—50 $\mu\mu$f silver mica, El Menco CM20-500.
C20, C21, C25, C26, C30, C31—500 $\mu\mu$f Erie button-type silver micas, employed only if 455-kc i.f. transformers are used.
C39—10 $\mu$f, 25-volts, Aerovox type PRS 25.
C44—100 $\mu\mu$f Erie Ceramicon.
C48—10 $\mu\mu$f Erie Ceramicon.
C52—10 $\mu$f, 450 w.v., Solar.
R1, R3, R7, R12, R15—100 ohms.
R2, R8, R13, R16—47,000 ohms.
R4, R9, R26, R27, R29, R30—22,000 ohms.
R5—1500 ohms.
R6, R11, R14, R17—1 megohm.
R10—5000 ohms.
R18—820,000 ohms.
R19, R21, R31—270,000 ohms.
R20—2.2 megohms.
R22—1/2-megohm miniature control.
R23—10 megohms.
R24—470,000 ohms.
R25—560 ohms.
R28—5,000-ohm 2-watt potentiometer.
All resistors 1/2-watt Ohmite unless otherwise specified.
L1—10 meters: Primary 2 turns, secondary 5 turns.
20 meters: Primary 3 turns, secondary 11 turns.
L2—10 meters: Primary 3 turns, secondary 5 turns.
20 meters: Primary 4 turns, secondary 11 turns.
L3—10 meters: 5 turns, tapped 1 turn from cold end.
20 meters: 10 turns, tapped 2 turns from cold end.
All above coils wound with #18 enamelled wire, close-wound, on Amphenol No. 24 form. (See text)
L4—One section of Meissner replacement i.f. winding type 16-6602, center-tapped, with turns removed for resonance at 262 kc.
L5—Meissner 14-1033 Oscillator coil.
T1, T2—1600-kc miniature i.f. Stanwyck SM129.
T3, T4—Miller 12H1, 262 kc, or Miller 12C1, 455 kc, padded with 500 $\mu\mu$f Erie
T5—Miller 12H2, 262 kc, or Miller 12C2, padded with 500 $\mu\mu$f Erie button-type silver micas.
T6—10,000 ohm to 3.2 ohm voice coil, output transformer.



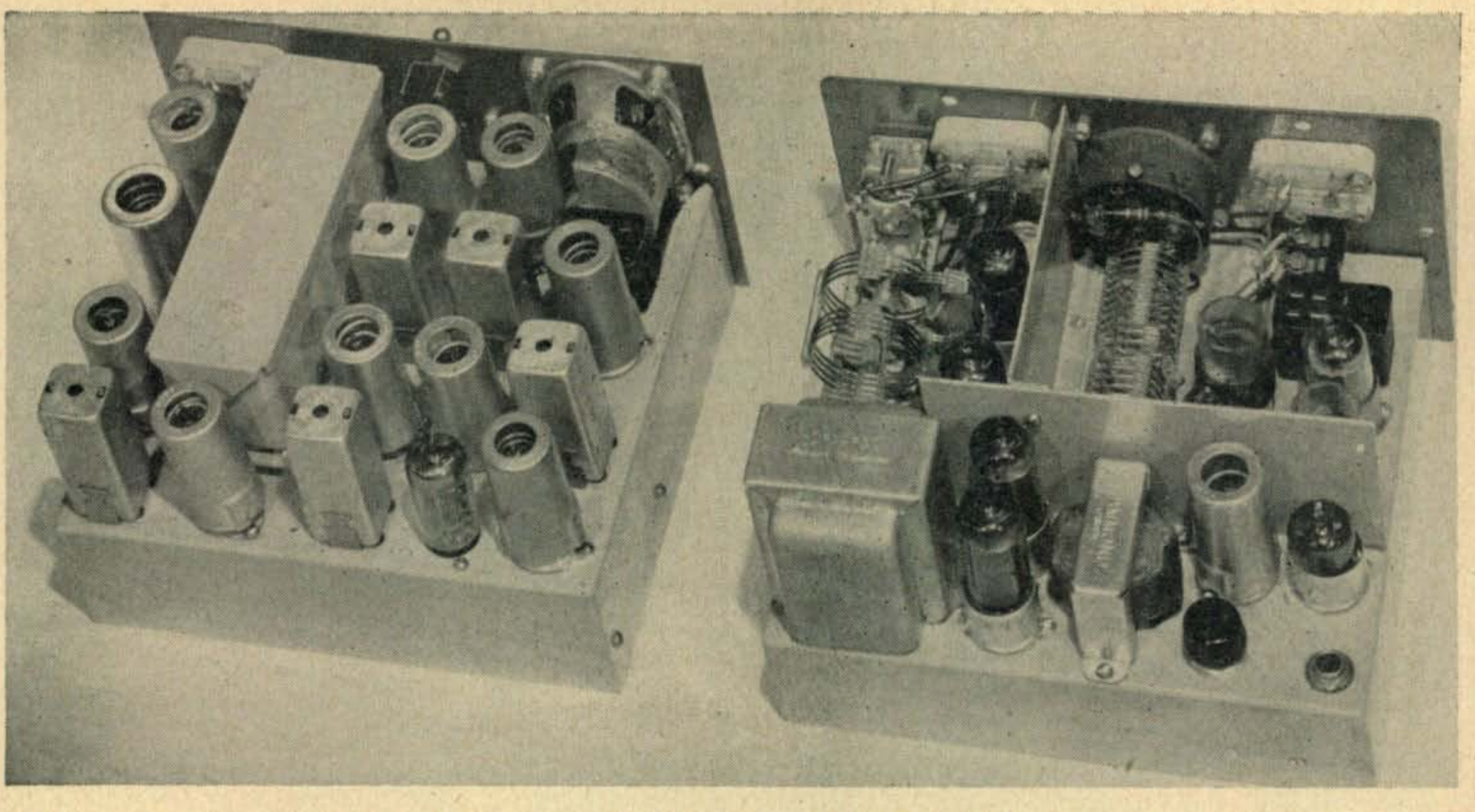

**VE2AGF, with his prize winner in actual operation. Plenty of room, with everything in place.**




C1—75 μμf Johnson 75J12.
C2—50 μμf Johnson 50J12.
C3, C4—Cardwell 6080 butterfly - type condenser
C5-7. C9-12, C15—1000 μμf, 500 v. mica, Aerovox 1467 or 1468.
C8—100 μμf silver mica, El Menco CM20-101.
C13—.002 μf Aerovox 500 v. mica, type 1467.
C14—50 μf, 25 volts, Aerovox PR 525.
C16, C23—10 μf, 450 v. Solar Minicap.
C17, C20—25 μf, 25 v. Aerovox PRS 25
C18, C19—.01 μf Centralab Hi-Cap.
C21—16 μf, 450 v., Solar.
C22—10 μf, 450 v.,

R1—100 K, ½ w.
R3—22K, ½w.
R2, R4—100 ohms, ½ w.
R5—50 ohms, ½ w.
R6—Shunt for 100-ma full scale meter deflection.
R7—5K, 5 w.
R8—10K, 5 w.
R9—300 ohms, 1 w.
R10, R15—Multiplier to give full scale deflection at 10 volts.
R11—1500 ohms, ½ w.
R12—500K Midgetrol pot.
R13—2700 ohms, ½ w.
R14, R16—2.2 meg., ½ w.
R17—1 meg., ½ w.
R18—5K, 1 w.
R19—250 ohms, 1 w.
R20, R21—27 ohms, 2 w.
RFC1, RFC2—2.5 mHy choke, National R50.
RFC3—1 mHy choke, National R50.

RFC4—2.5 mHy choke, National R100.
L1—10 meters 14 turns #18 enam., closewound on Amphenol 24-6P form.
20 meters: 30 turns #24 enam., closewound on Amphenol 24-6P form.
L2—10 meters: 6 turns #16 enam., 2 turn link, closewound on Amphenol 24-6P coil form.
20 meters: 14 turns #18 enam., 2 turn link, closewound on Amphenol 24-6P coil form.
L3—10 meters: 6 turns each side of center tap (B&W 3011 coil), with 2-turn link.
20 meters: 9 turns each side of center tap (B&W 3012 coil), with 2-turn link.
L4—10 meters: National AR16S-10.
20 meters: National AR16S-20.
M—Meter, see text.
NC—Neutralizing condenser, see text.
T1—Mike transformer, UTC 0-1.
T2—Hammond 134 or Stancor A52C.
T3—Thordarson T21M52.
T4—Power transformer, 300 v., c.t., 200 ma., see text.
T5—6.3 v. @ 6 amp fil. trans. Thordarson T21F11.
CH1—Thordarson T20C59.
CH2—Freed F627.
REL1, REL2 — Advance miniature relay K1504.
RECT—12 100-ma Federal selenium rectifiers, type 403D-2625, 3 per branch, series connected.
Meter Switch—Mallory 3226J



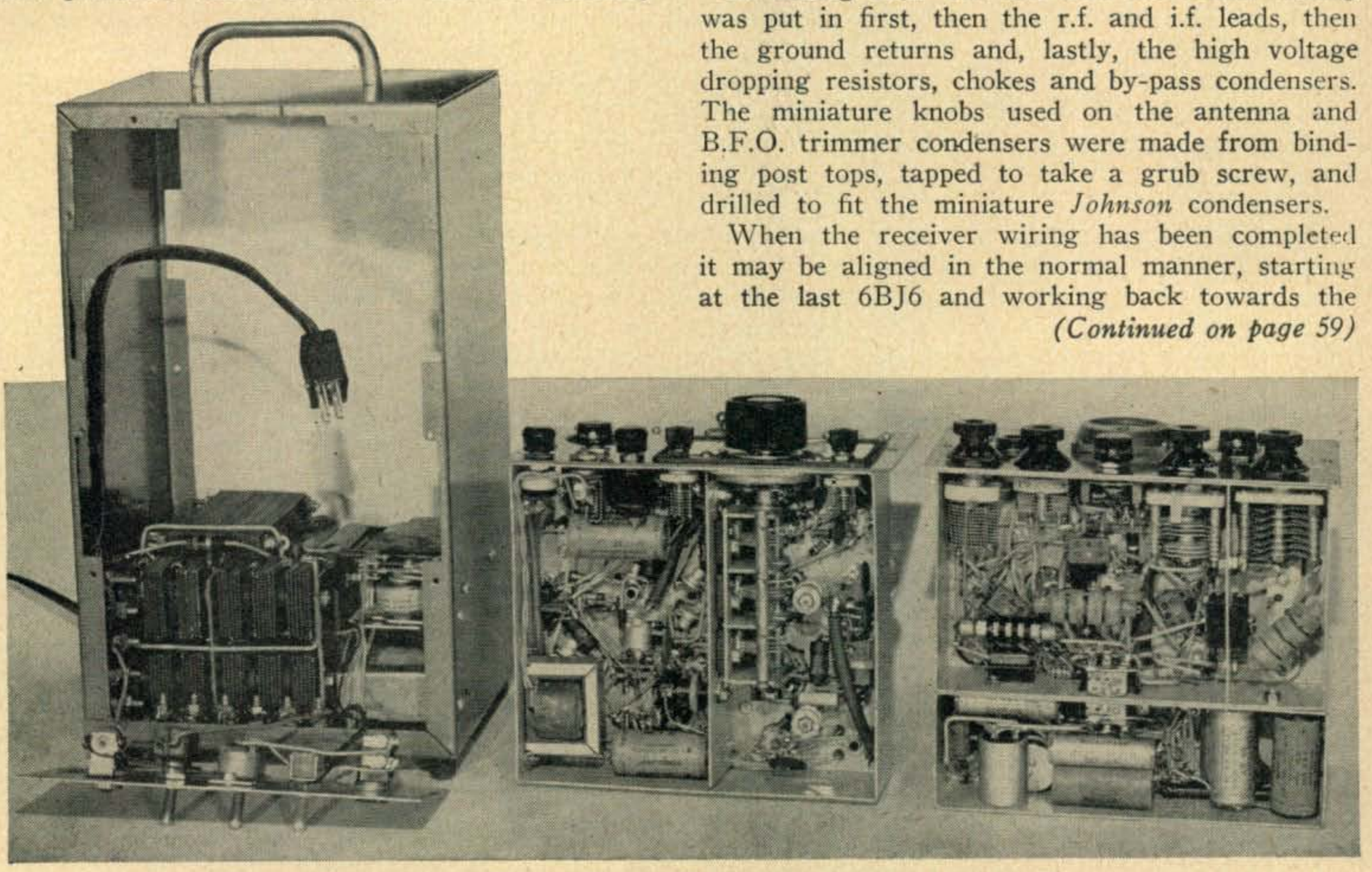
Receiver on the left, transmitter on the right

riveted or bolted to a 4" x 1-1/2" x 1/16" aluminum plate, make a good substitute although, as there is no base plate on these shields, the polystyrene blocks must be cut 1-3/8" square and drilled and tapped to enable them to be held in place in the shields. In wiring the r.f. and i.f. sections all leads are kept as short and direct as possible, the use of *Hy-Cap* miniature condensers facilitating very short leads for r.f. by-pass. In two positions where r.f. leads have of necessity to be longer than advisable, short lengths of 1/4" diameter coaxial cable are used to screen them. The miniature i.f. transformers are mounted by slightly enlarging the center hole on the spring mounting clip supplied, and mounting the clip above the chassis by means of a banana socket, this allows access to the lower tuning slug without necessitating the awkward slot cutting usually employed.

In wiring both TX and RX the heater wiring was put in first, then the r.f. and i.f. leads, then the ground returns and, lastly, the high voltage dropping resistors, chokes and by-pass condensers. The miniature knobs used on the antenna and B.F.O. trimmer condensers were made from binding post tops, tapped to take a grub screw, and drilled to fit the miniature *Johnson* condensers.

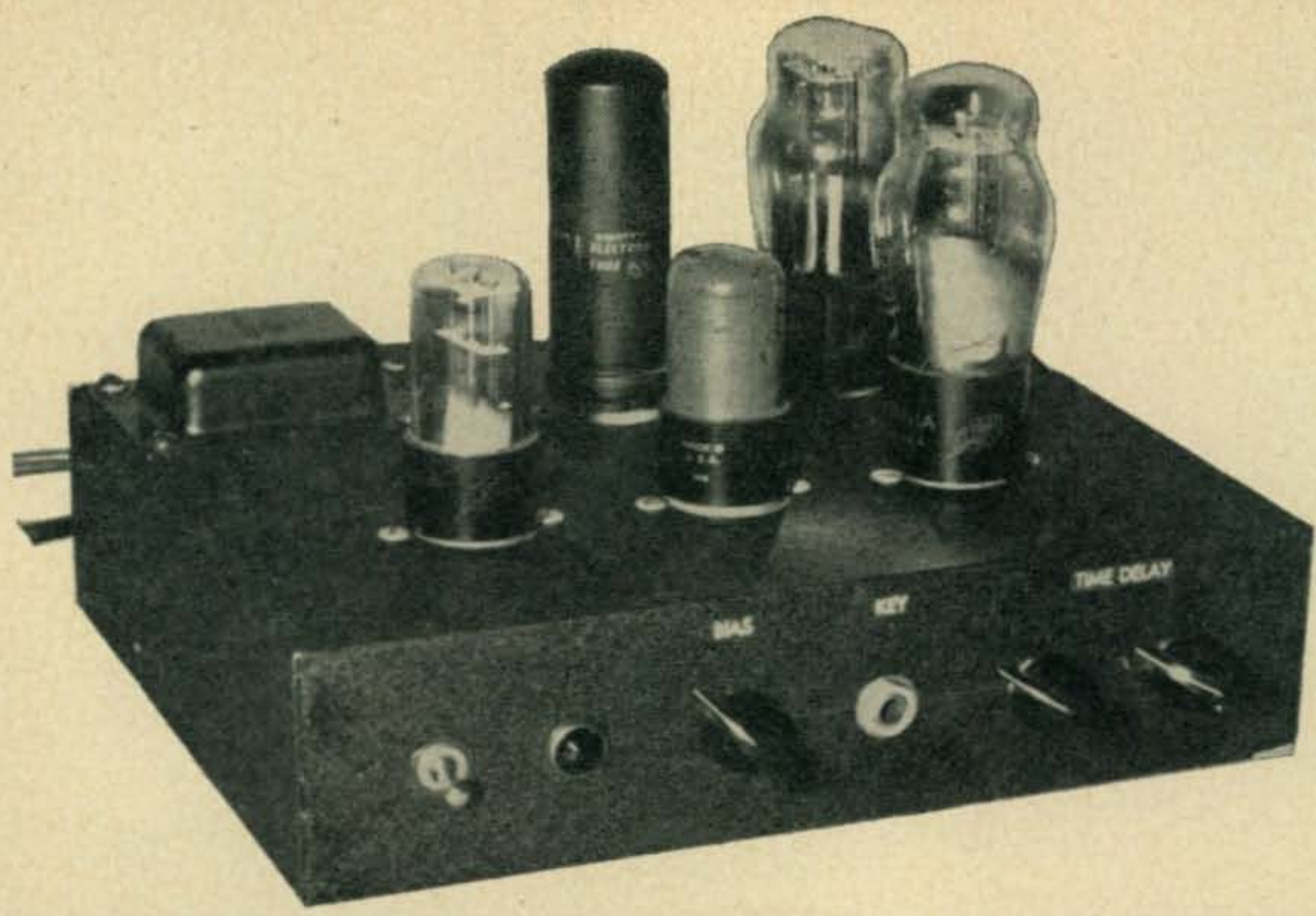
When the receiver wiring has been completed it may be aligned in the normal manner, starting at the last 6BJ6 and working back towards the

*(Continued on page 59)*



Selenium rectifiers help where space is limited!

*This is "must" reading for every traffic man and contest operator.*




# A NEW SYSTEM FOR

STEPHEN LEIBHOLZ, W2ZDE*

DIFFERENTIAL KEYING OF A *C.W.* TRANSMITTER is a case of having and eating your cake at the same time: amplifier keying plus full break-in.

In general there are two methods of operating a c.w. transmitter: keying of the oscillator to get full breakin operation, and keying of a later stage in order to produce a better waveform. You cannot effectively do both. It is practically certain that an oscillator cannot be keyed to produce an ideal waveshape. As the key is pressed there is one instant at which the oscillator breaks into operation. This causes a transient which is noticed as the familiar thump, or click—even in crystal oscillators. If we attempt to turn on the oscillator gradually, to minimize the transient (by using *RC* or *RLC* filters in the key circuit) the changing input admittance and feedback may cause a change of frequency, or chirp. Any compromise keying is really a choice between two "evils," and as a rule there is no amount of filtering of a keyed oscillator that will produce an ideal waveform.

The most obvious answer to the keying problem is not to key the oscillator at all. Why not simply key a later amplifier stage? This is the system most used at present to get a good c.w. note—but full break-in operation goes out the window. Even if the station is controlled by one switch, (so-called "one switch break-in"), the operator cannot be interrupted by the other station for a question, to ask for fills, etc. The backwave from the continuously-running oscillator will prevent reception until the whole transmission is over [1].

Full break-in is essential to fast, snappy c.w. operation. Listen to 80 meters almost any night and you will be able to tell the difference between the operators using break-in and those who are not using it. It is the c.w. equivalent of duplex phone. However, a good c.w. station must have a good c.w. note—and this can often only be achieved by using amplifier keying.

The old question comes up: how to have and to eat our cake at the same time? It is impossible to do both directly: the keying of an oscillator *and* amplifier is the same, effectively, as oscillator keying. However, it can be done, by using a system which turns on the oscillator just before each letter, and turns it off after the letter or character is completed—doing the actual keying in an amplifier stage. One way is to use a mind-reader to switch the oscillator on just before you touch the key. However there are a number of problems connected with mind-reading machines, which we haven't solved as yet. Another way is to delay the amplifier keying slightly on "make," and delay the oscillator keying on "break." Thus we would produce essentially a crude form of differential keying. Unfortunately this cannot be done with a simple

* *54-55 69th Lane, Maspeth, N. Y.*

1 "Rx For Painless Breakin." **CQ**, Oct. 1950.

lag filter. We have to use some electronic means to produce the necessary delays. In other words, the system would operate something like this:

1. Oscillator turns on.
2. Amplifier begins keyed character.
3. Amplifier finishes keying.
4. Oscillator turns off.

What this boils down to is to have one RC circuit with four different time constants—a pretty good trick. This is exactly what was done in the "Goodman", or Deluxe Keyer[2]. A standard vacuum-tube keyer was used to key the amplifier stage, while a relay operated the oscillator. However, this device had several disadvantages; the relay followed too closely with the keying, and tended occasionally to stick. More important, the differential keying was not adjustable, that is, the recovery time of the oscillator could not be adjusted to suit the code speed. Then, too, relays cost money!

It was with these points in mind that the all-electronic differential keyer shown on these pages was designed. It had to switch an oscillator on and off, and key an amplifier, both separately and with independent controls. It had to be reasonably simple and adaptable to existing keyer circuits, and it should plug in to an average transmitter without major circuit changes.

The circuit of the keyer is shown in *Figure 1.* The upper half is essentially a standard vacuum-tube keyer which keys the amplifier circuits. ($T_1$, $V_1$, $C_1$ comprising the power supply and $R_1$, $R_2$, $R_3$, $C_2$, and the '45 tubes in the keyer.) The 6SN7 is a two-stage d.c. amplifier operating under critical near-cutoff conditions. $V_5$, the 6Y6, is the oscillator-keyer tube. The original circuit was designed to key the cathodes of a v.f.o. and a low-power driver. It is easily adaptable to grid-block keying of the amplifier, as well as convertible from present keyers.

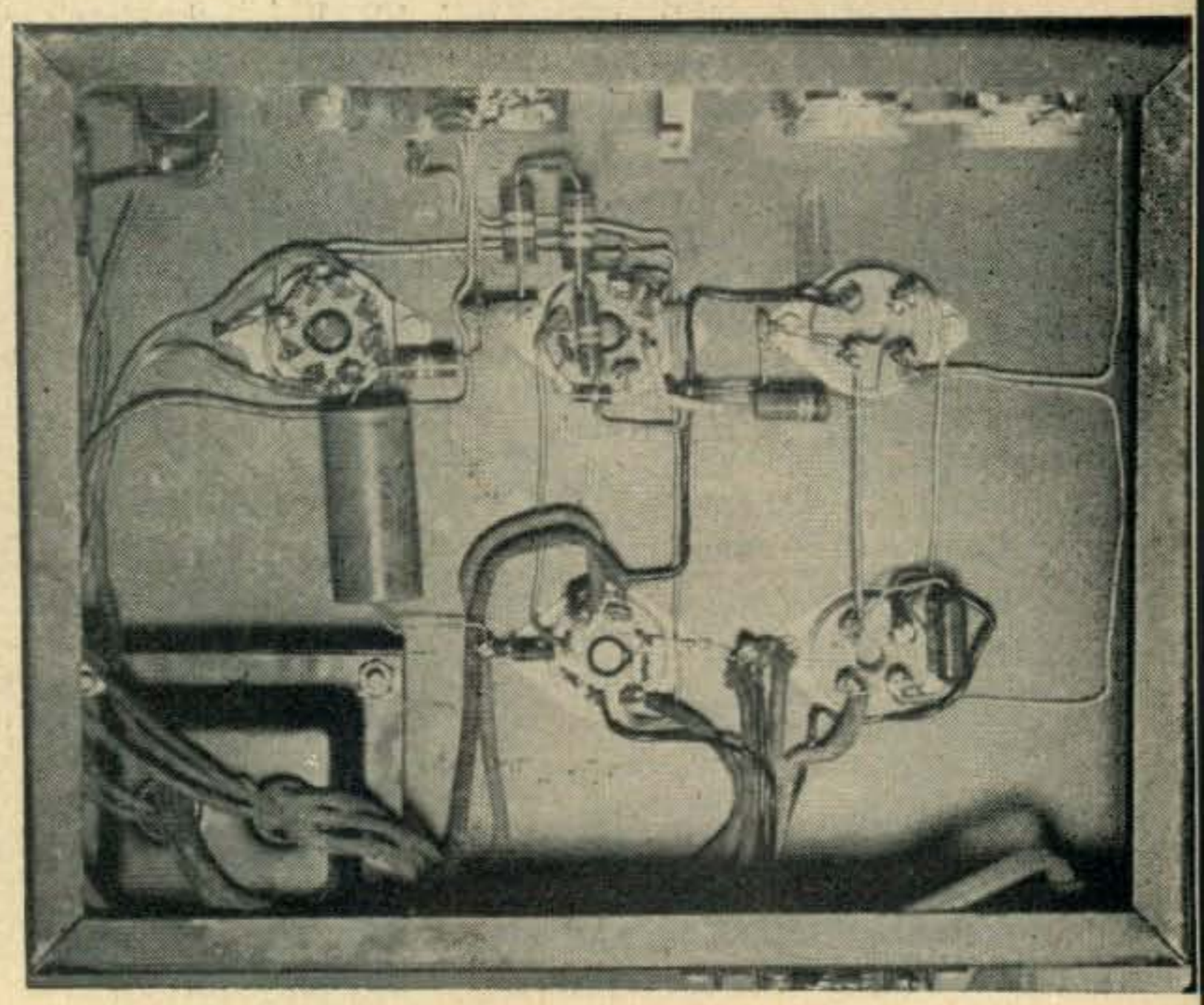
The operation of the keyer is roughly as follows: $C_2$ is normally charged by the negative-high voltage, cutting off $V_2$ and $V_3$. Thus the amplifier stages are normally cut off. When the key is pressed, the bias is shorted out and $C_2$ discharges to ground through $R_3$. When the voltage across $C_2$ drops to around 100 volts the '45 tubes begin to conduct, and the amplifier begins to operate. Thus the time constant ($R_3$-$C_2$) determines the waveshape and lag on "make." Releasing the key restores bias, and $C_2$ is allowed to charge through the resistors $R_1$, $R_2$, $R_3$. Again, as the voltage across $C_2$ goes past 100 volts the amplifier is turned off.

Up until now we have been describing the operation of a typical vacuum-tube keyer. Let's take a look at the oscillator control circuit. $V_4$a, the first section of 6SN7, is biased just a few volts beyond cutoff by the voltage drop in $R_4$, which is adjustable. As long as $V_4$a is cut off, the grid of the second section is grounded and this tube conducts, applying bias to the grid of the 6Y6. Now, as soon as the key is pressed there is a small voltage drop in $R_3$, and $V_4$a conducts immediately. This happens long before the amplifier begins to key, because the condenser has only to discharge from, say 400 volts to 395 volts for the 6SN7 to operate, while it has to discharge all the way to 100 volts or so to start the amplifier. As soon as $V_4$a conducts, the d.c. amplifier changes over, $V_4$b is cut off now, and the bias on the 6Y6 disappears, allowing it to conduct and turn on the oscillator. *Figure 2,* which shows what happens, plotting voltage across $C_2$ versus time, may help to indicate this sequence.

# PERFECT KEYING

Now on "break," the exact opposite occurs. Again looking at *Fig. 2* we see that as the voltage at $C_2$ increases (or drops to a negative value) the amplifier is first cut off, and the oscillator does not shut down until $C_2$ is again charged to 99% of its full value. If this charging is not completed between two pulses, the oscillator will "hold on" for the next pulse. Adjustment of $R_4$ will control this recovery time. Thus we have differential operation. The oscillator is turned on before the amplifier, (the clicks are not transmited,) and stays on until the amplifier finishes keying a whole character—after which the oscillator turns off, allowing break-in reception.

To show just how the keyer will operate, let



Underside view shows wiring is simple.

2 Radio Amateur's Handbook. p. 255 of 1949 ed.

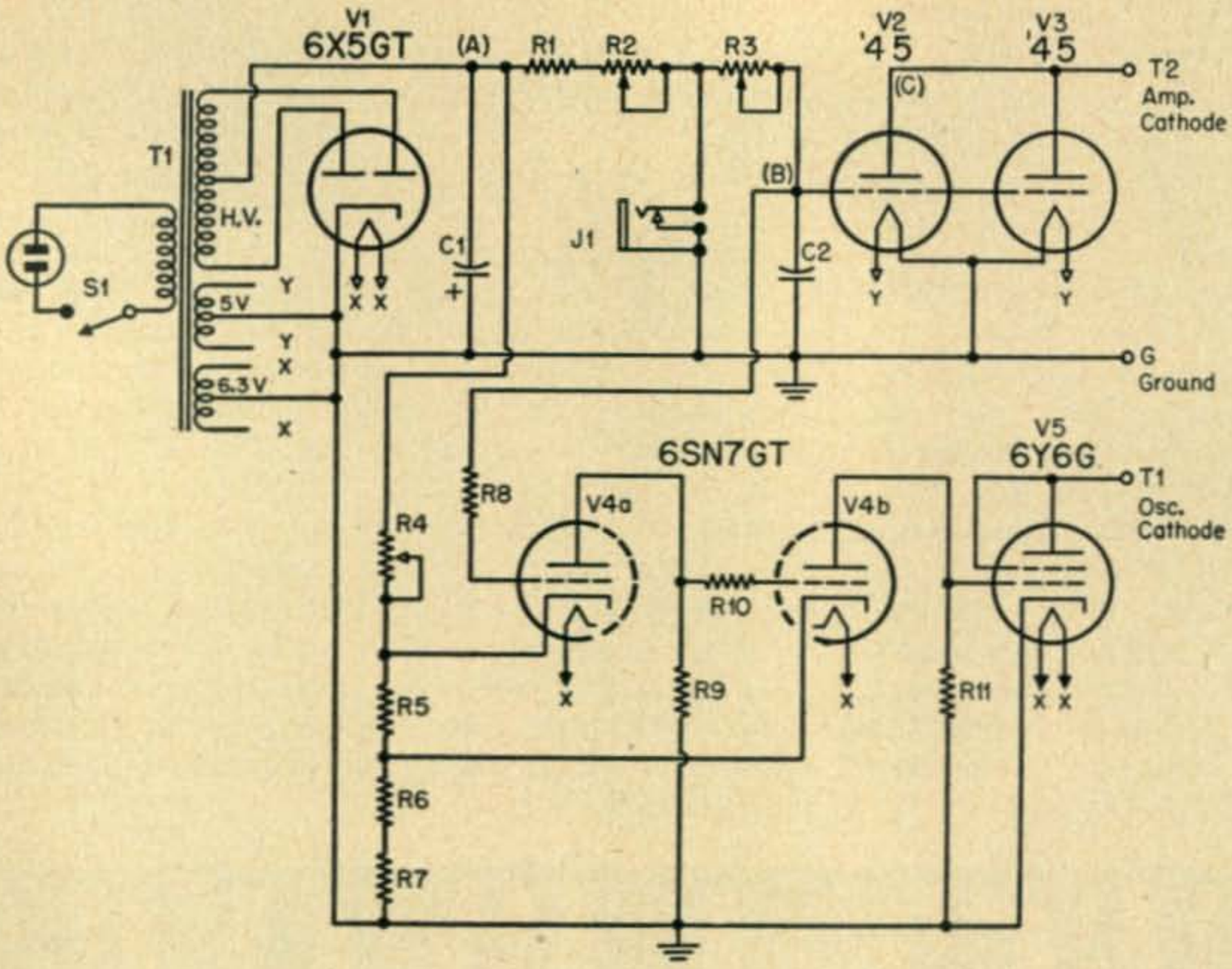



Figure 1. Circuit set up for cathode keying.

us take the following typical situation:

Voltage of bias supply- 400 volts.

Plate voltages of keyed stages- 400 volts.

$R_4$ set to five volts beyond cutoff.

$R_2$ at full resistance (5 meg.); $R_3$ at ½ resistance (½ meg.)

We can then set up a "timetable of operation," using the well-known formulas for RC curcuits:

1. Keys goes down. Time 0 seconds.
2. Oscillator turns on. Time less than 0.1 millisecond.
3. Amplifier begins keying. Time 2.3 milliseconds.

1. Key goes up. Time 0 second.
2. Amplifier cuts off. Time 12.8 milliseconds.
3. Oscillator shuts down. Time 110 milliseconds (1/9 sec.)

Thus our timetable fits in with the desired schedule of events. Of course if the key is pressed during the 1/9 second required to shut down the oscillator, it will just stay on until a space is reached. The exact recovery time can be adjusted with $R_4$, up to a full 3 seconds: the *greater* the bias, the *smaller* the recovery time. The controls $R_2$ and $R_3$ will control the amplifier lag, and hence the waveshape. *Figure 3* shows, diagrammatically, how the entire system operates for the letter "r."

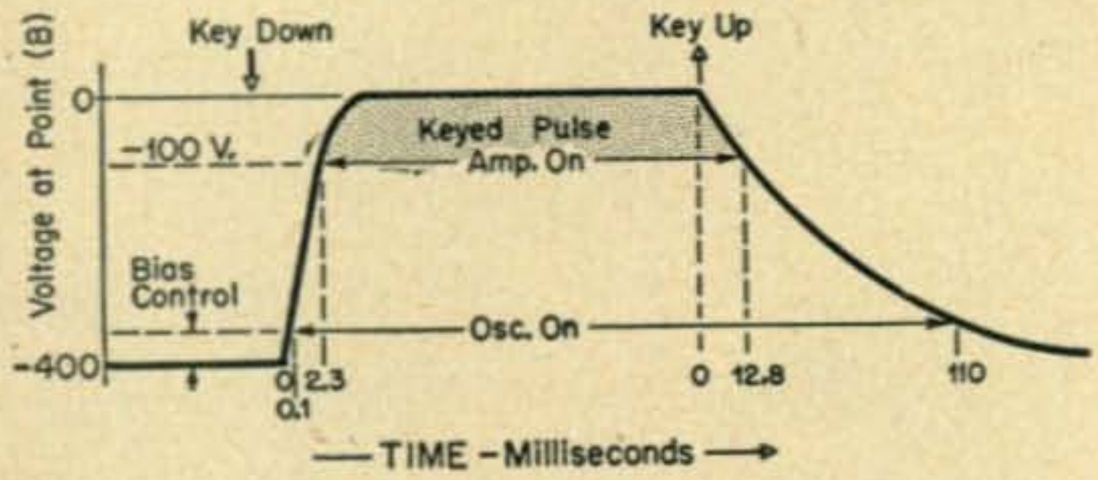



Figure 2. The Keying Sequence

It may be desired to employ block-grid keying of the amplifier stage. Referring to *Fig. 4,* we see that $R_1$, $R_2$, $R_3$, and $C_2$ must be replaced, and the amplifier-keyers (the '45s) can be eliminated. The C- terminal of the keyed stage is then connected to point (B) on *Fig. 2.* New component values:

$R_1$a. . .50K, 5w.

$R_2$a. . .proper grid-leak resistance for keyed stage.

$C_2$a. . .new value given by rough formula:

$$C = \frac{5000}{R_2 a} \text{ N.F.}$$

With respect to receiver-disabling, none was provided for. The reason is that receiver protection can be accomplished in other ways. The link input can be protected by an ordinary No. 47 bulb wired in series with the coil, and the grid of the first r.f. stage by a small unbased neon bulb (type NE-2) wired from grid to ground. However, no precaution is necessary unless the receiving antenna is very close to the transmitting antenna, or high power is used.

Construction of the keyer is fairly simple. A present vacuum tube keyer can be easily adapted to differential keying. There is only one very important thing to observe. Because of the nature of the d.c. amplifier the oscillator section will operate on a very small leakage current in the circuit comprising $R_1$, $R_2$, $R_3$, $R_8$ and $C_2$. This calls for a good mica condenser and clean wiring. Depending upon the setting of the bias control, as little as 1000 megohms' leakage can trigger the circuit. This high sensitivity has found other applications.

Partly as a result of the leakage sensitivity, and the low key current (around 1 ma.), no ex-

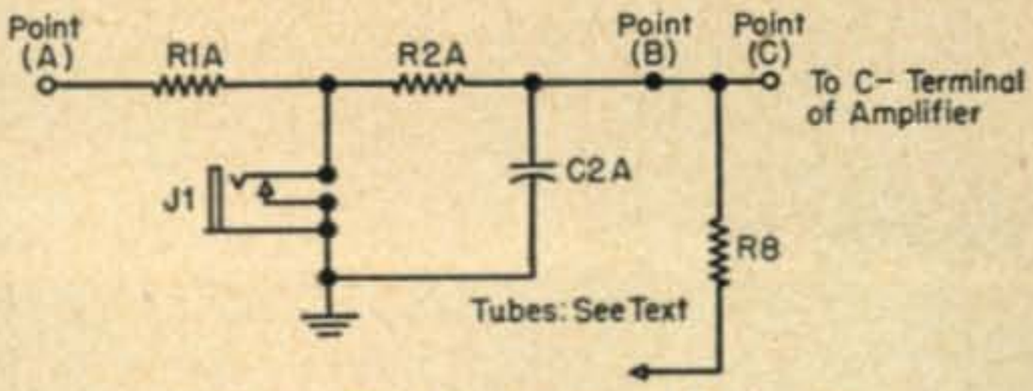



Fig. 4. Changes for grid keying.

ternal key filters are needed, and may in fact hamper operation.

The unit was built on an 8x10x2½-inch chassis, Controls are *A.C. Power, Dial Light, Bias, Key Jack,* $R_2$, $R_3$, in that order. The oscillator section will key up to 400 volts at 30 ma., and the amplifier section up to 450 volts at 100 ma. It is desirable to minimize all shunt capacitance and series resistance in the oscillator circuit, to speed up the keying there. It is also good idea to connect the d.c. grid-leak or bias returns of all keyed stages to their cathodes, instead of to ground.

After the circuit has been checked, the key is plugged into $J_1$, and connections made to the transmitter. Rotate the bias controls $R_4$ with the key up. You will notice that the oscillator is on when $R_4$ is set at zero, but cuts off at about 1/3 setting. This is best checked with the receiver. All operation is done with $R_4$ advanced past the cutoff point. The *closer* that it is to this point, the *longer* the recovery time of the oscillator, and vice versa. If $R_4$ is set to full resistance, the bias across $V_4$a is the greatest, and the recovery time the least. Test the transmitter with $R_4$ in various positions to note the difference. The most convenient setting will most probably occur when the oscillator is on for just one letter at a time, and is a function of code speed. This is strictly a convenience feature and does not affect output waveshape.

$R_2$ and $R_3$ control respectively the "break" and "make" waveshape of the keyed signal. These controls do not interact with the oscillator. A good first try is to set the controls as was used in the illustration, $R_2$ at full 5 megohms, $R_3$ at ½ megohm. Increasing the resistances, (or increasing the value of $C_2$) will soften the keying.

On-the-air tests of the keyer have confirmed our predictions. It has eliminated a click that we had as a "trademark," and has not affected break-in operation. The keying is smooth (they tell me). In other words, we like it.

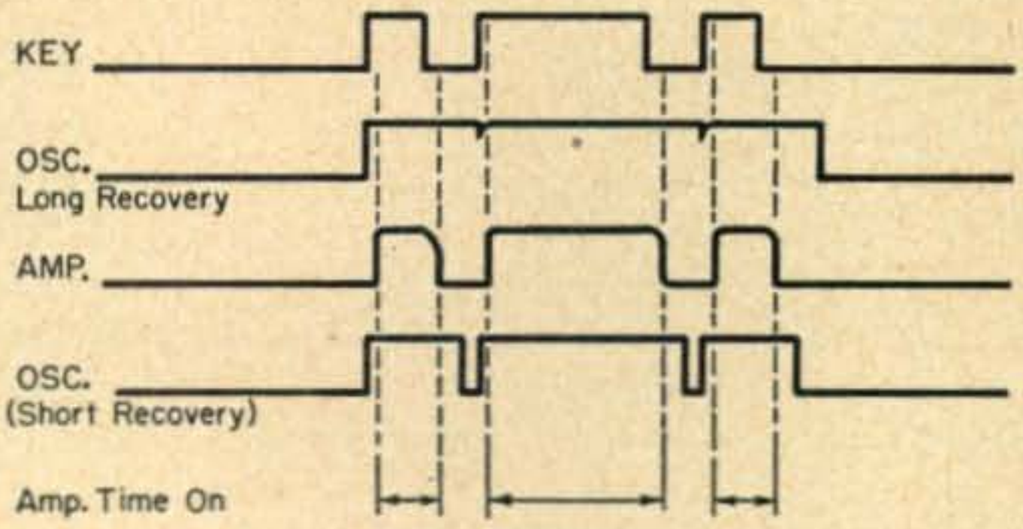



**Figure 3**

# MILITARY AMATEUR RADIO SYSTEM WILL ACCEPT CIVILIAN MEMBERS

The Department of the Army has announced that it will accept civilian members in its Military Amateur Radio System (MARS) program. Previously membership in MARS-Army was restricted to personnel on active duty and members of the Army's civilian components. Civilians interested in joining the system are invited to seek further information from the Signal Officer of the nearest Army installation, since MARS-Army is operated by the Signal Corps.

Authorization for civilian membership in MARS-Army insures the continued use of the net as a back-up communication system if activities and Reserves of the Army are mobilized. MARS membership does not, however, effect draft status.

Civilian members must be 21 years of age or older and must hold a valid Federal Communications Commission amateur radio station license. They must also agree to operate their stations in accordance with rules and regulations prescribed for the MARS by the Army. Only amateurs who own stations, in operation at time of application for MARS membership, can be considered. No radio equipment can be furnished civilian amateurs under existing law.

MARS stations are assigned military call signs and operate on military frequencies allocated to the system. A MARS Bulletin and manual of operating procedures are issued to all members. The MARS-Army is organized with a Department of the Army net, the control station for which recently was dedicated in the Pentagon; six Army Area nets; a net for each state; district nets, and such local nets as may be required within each district.

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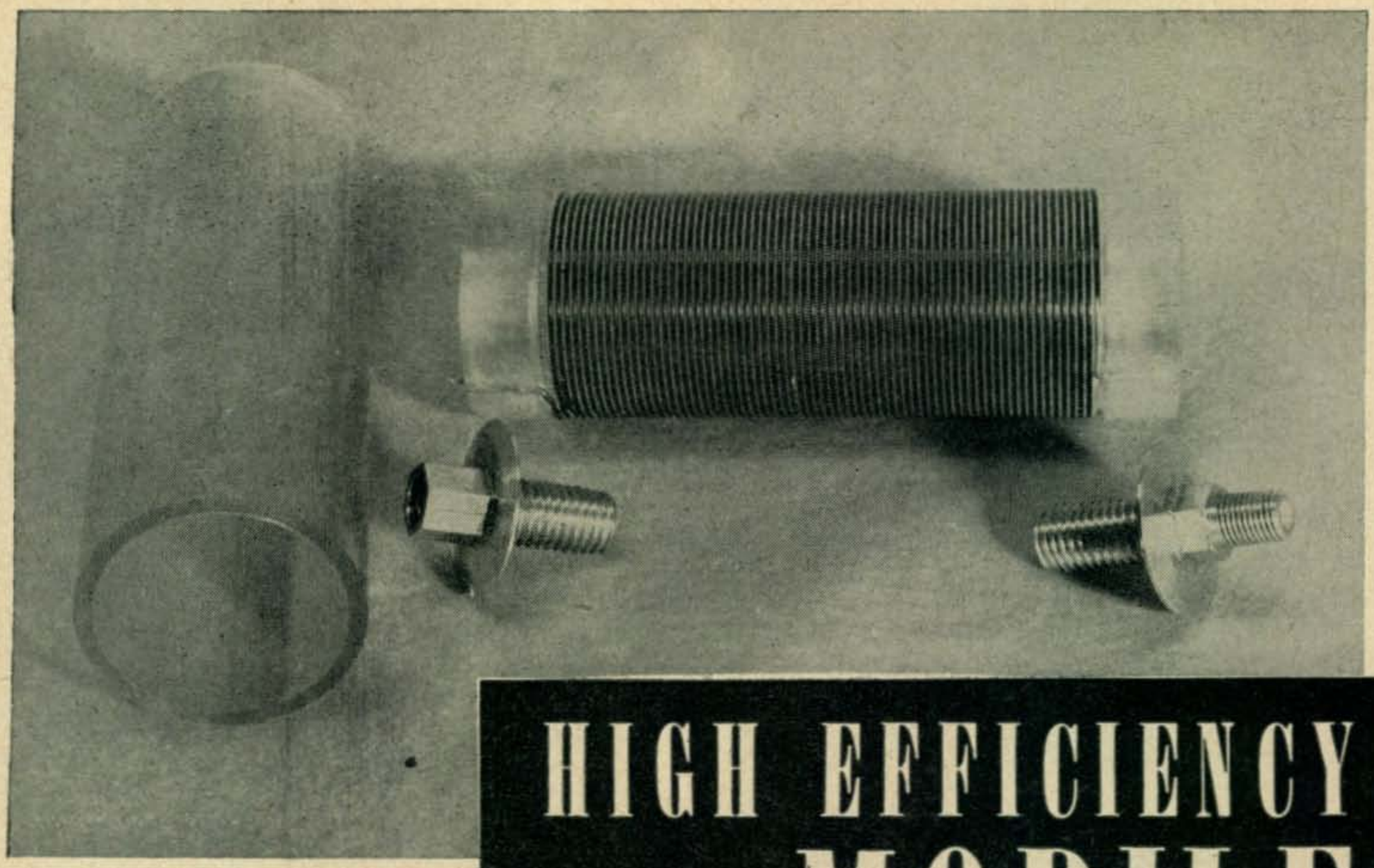
# OUR COVER

*(from page 6)*

Assembly procedure is as follows: The worm wheel is fastened to the condenser shaft so that the center line of the worm wheel face is ¾" from the outside face of the condenser end plate or bracket. With the worm fastened to the worm shaft and shaft support, the approximate location of the support is outlined on the end bracket, and two oversize holes are drilled in the bracket for receiving two 8-32 screws. These holes are drilled oversize to allow for alignment of the worm with the worm wheel. The fit should be comparatively tight to eliminate backlash between the worm shaft and condenser.

The ⅞" dimension in the worm shaft support should be maintained because this is also the overall length of the worm; by keeping a close tolerance, end play in the worm shaft will be minimized.

The worm wheel has 60 teeth, and since the worm has a quadruple thread, the overall reduction is 15:1. However, since the B&W Butterfly condenser goes through a complete cycle in 90°, the effective reduction is 3.75 to 1. That is, the worm shaft turns 3¾ times in turning the condenser from minimum to maximum capacity, and so provides a smooth vernier action.



# HIGH EFFICIENCY FOR MOBILE

SINCE THE LOWER-FREQUENCY AMATEUR BANDS were opened for mobile operation in 1948, such operation has been becoming increasingly popular, and within the limitations imposed by restricted antenna size, 75 meters particularly has given an excellent account of itself. The relative freedom from ignition noise, and consistent daytime range extending out to two or three hundred miles with no dead spots and little shadow effect or fading is indeed a revelation to the ten-meter mobile operator.

Unfortunately, such results are not achieved without solving a number of problems, particularly those involved in obtaining an electrically satisfactory antenna installation that does not require an advance crew to remove overhead wires, tree limbs and such.

Many 75-mobile antennas of radical design, some wondrous to behold, have been constructed, but after the novelty wears off, the old standby, a seven or eight-foot whip, usually wins out from pure mechanical simplicity. If it is properly loaded, about the only thing that can beat it is a longer whip (perish the thought) or the big antenna on the home station. It is that little phrase "properly loaded", however, that trips the unwary. Although center loading and top loading have some theoretical advantage over base loading, the increase in efficiency is small compared to the difficulty of moving the coil very far up the antenna. A short extension below the loading coil may be justified for special installations, such as on a panel truck or a station wagon where it is desirable to raise the coil to get it clear of the body, but on the usual passenger car, it has little advantage.

But to start with fundamentals: An eight-foot whip, at 4 mc, mounted well up on an automobile, has very troublesome electrical characteristics. What it actually looks like to the transmitter and loading system is a resistor of approximately 1.5 ohms, with a capacitor of approximately 25 μμf connected in series with it. The 1.5 ohms represents the radiation resistance, the thing we want to put our power into, and the capacitance is just in the way. All of the current into the 1.5-ohm resistance must flow through the 25 μμf capacitance. That is unfortunate, for the reactance of that capacitance is some 1590 ohms. If we don't let phases trip us up, we can apply Ohm's law to current through reactance as well as through resistance, so let's see what it takes to push a few watts into the radiation resistance of our antenna. Suppose we start at the receiving end, and assume a current of 2 amperes in the antenna. $I^2R$ tells us that this represents 6 watts in the 1.5 ohm radiation resistance of the antenna. These are good watts, the ones that do the work. But to put that 2 amperes through the 1590 ohms of capacitive reactance take a radio-frequency voltage of $2 \times 1590$, or 3180 volts! And that voltage appears on the entire length of the

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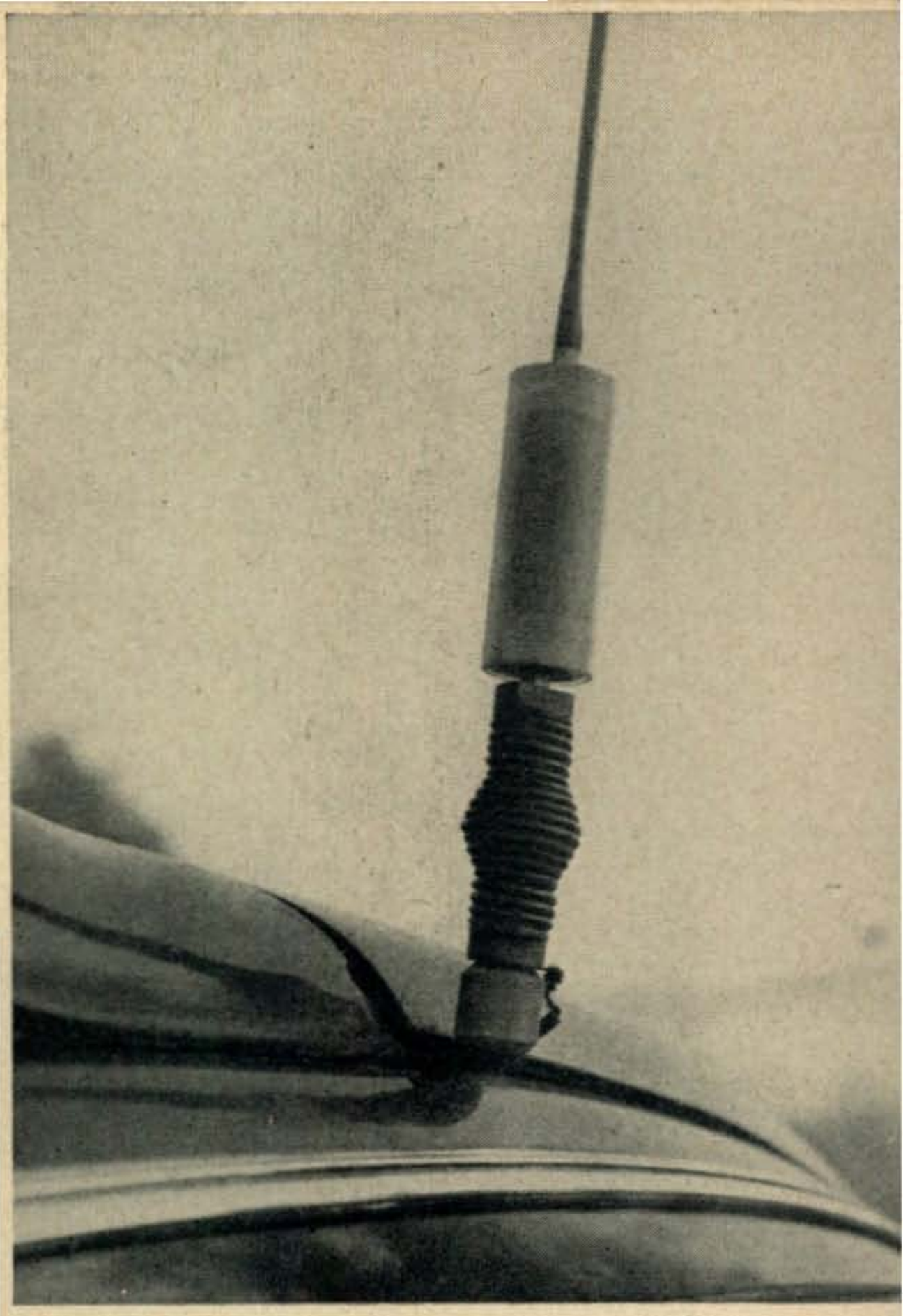
* *14 Kingsland Rd. No. Tarrytown, N. Y.*

*Here's some sound data on mobile antennas by one of the pioneer mobileers*

GEORGE M. BROWN, W2CVV*

# LOADING COIL ANTENNAS



The complete assembly

whip, above the loading coil. Now you see why good insulation is imperative. Although there is nothing dangerous about that voltage, since it is radio-frequency and the regulation is extremely poor, getting it to put on the antenna takes some doing.

Of course the first thing we think about when we have some reactance we don't like is to tune it out, and that is exactly what we do in this case. We wind a coil having 1590 ohms of *inductive* reactance, and connect it in series with the antenna. Properly adjusted, this very effectively tunes out the 1590 ohms of *capacitive* reactance of the antenna, and if it were a perfect coil, all that would be left for the happy transmitter to look at would be the 1.5 ohms of antenna resistance. This doesn't mean that the 3180 volts are no longer required—they are just produced by the series resonance of the loading coil and the antenna capacitance. They appear not only on the antenna, but across the loading coil as well. Even the Iron Curtain boys don't claim to have invented a perfect coil, however, and all physically realizable ones have resistance as well as reactance—altogether too much of it to make us really happy. The ratio of reactance to resistance of a coil is given the symbol *Q;* a coil having a reactance of 200 ohms and a resistance of 2 ohms is said to have a Q of 100. The first loading coil wound at W2CVV had a *Q* of 160, which meant that with a reactance of 1590 ohms the resistance was 1590/160, or approximately ten ohms. Since we have tuned out all the reactance, what we have left is actually the 1.5-ohm radiation resistance of the antenna, fed through the ten-ohm resistance of the loading coil.

Going back to the two amperes of antenna current we assumed to start with, pushing it through that ten ohms will soak up 40 watts, all dissipated as heat in the loading coil, and doing no one any good.

Thus with a base loading coil having a *Q* of 160, and that is about what the usual ones run, to put 6 watts into the antenna we have to have a total *output* of 46 watts from our transmitter, well beyond the capability of the usual mobile installation. Our coupling efficiency, neglecting such variables as ground resistance and miscellaneous losses, is only about 13%. To improve this efficiency requires either increasing the radiation resistance of the antenna or decreasing the resistance of the loading coil. The antenna resistance is pretty well determined by its length, however, and nothing much can be done about it, within practical limitation, so the problem nicely resolves itself into that of building a better loading coil. *Figure 1* curve (*a*) is plotted to show the variation of coupling efficiency with various values of loading coil *Q*.

A study of the rather meagre literature on the design of high-*Q* coils disclosed some interesting facts, not all of them favorable to our project:

1. In general, the larger the coil, assuming a good form factor, the higher the *Q*.

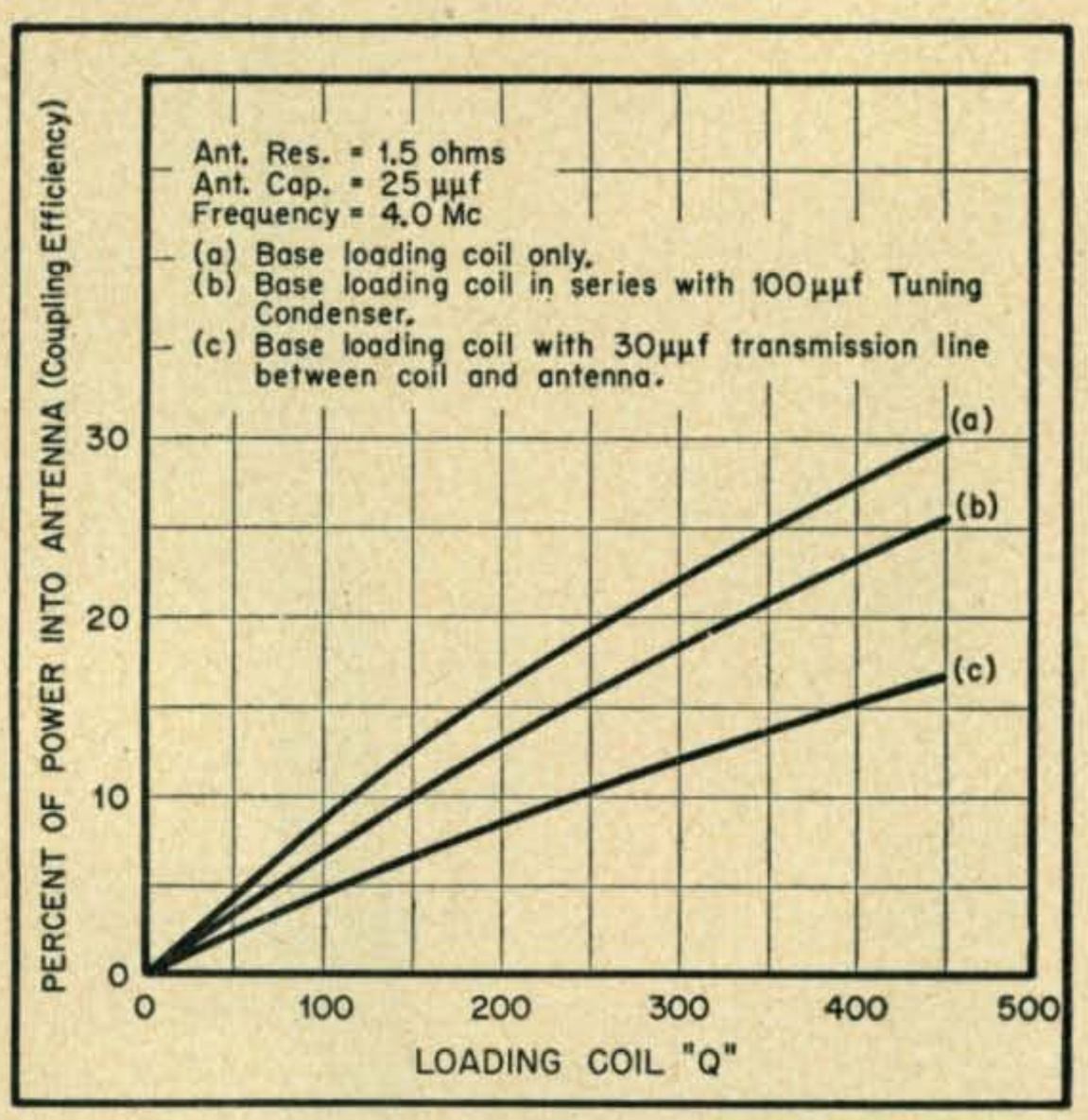



**Figure 1.**

2. Once the size of the form is established, the optimum wire size is somewhat smaller than the largest that will give the necessary number of turns in the space available. In other words, use smaller wire and space the turns.
3. Reasonable liberties can be taken with form factor, and since a long slim coil can be more easily mounted on a car than a squat fat one, some departure from the optimum dimensions can be tolerated, although of course very long slim designs should be avoided.

With these rather nebulous design criteria in mind, a number of dry maple forms were turned out, and quite a few experimental coils wound. The results were disappointing—it seemed that the best ones had a *Q* of 180. Although dry wood is supposed to have reasonably low loss, it was eventually found that "reasonably low" just wasn't good enough. Transferring one of the windings having a *Q* of 180 from the wood form to one of polystyrene immediately increased the *Q* to over 300.

The final coil design, is shown in the photograph, and *Fig. 2* shows its construction in more detail. The core is a piece of 1-¾″ diameter polystyrene rod, undercut and threaded to take the winding of #18 wire spaced 16 turns per inch. The end fittings are made from brass, and securely anchored to the core by threading into it and then staking with a #8 screw tapped through the brass washer and on into the polystyrene. The fittings are threaded to accommodate the antenna and mounting spring that will be used. After final adjustment, the entire coil is covered by a poly sleeve, 1¾″ inside diameter, slipped on and cemented in place. Be sure to do a careful job of cementing, since otherwise the coil will "breathe" and water will condense inside.

This final coil has a *Q* of well over 300—compared to the original coil, with a *Q* of 160, it has a coupling efficiency of over 22% instead of 13%. With the same transmitter input, it will deliver almost twice the power into the radiation resistance of the antenna that the old one would, a substantial improvement and much easier than doubling the power of the mobile transmitter.

One of the penalties that must be paid for high *Q* and high efficiency in the loading coil is that the tuning becomes extremely sharp. It is thus necessary to adjust the loading accurately, and to readjust it for each significant change in operating frequency. To put this in practical terms, if the frequency is shifted plus or minus 5 kc without reloading, no appreciable loss will result; 10 kc, and the output and plate current will start to drop off; 15 or 20 kc, and performance will seriously suffer. Obviously some convenient means must be provided for adjusting the loading coil or some other portion of the circuit to tune out exactly the antenna reactance at each frequency setting. A very slight adjustment of the loading coil inductance would take care of this, but with a high-*Q* sealed loading coil, such adjustment is hardly practical.

A tuning capacitor in series with the loading coil is frequently used, but at considerable loss in efficiency. The way it works, an oversize loading coil is used, and the excess inductance in it is tuned out by the variable capacitor. Increasing the loading coil inductance to provide something for the capacitor to tune out increases its resistance also, however, and the antenna current must flow through the total resistance. Curve (*b*) in *Fig. 1* shows the resulting loss in efficiency, plotted against coil *Q*. It assumes a 100 μμf setting of the variable capacitor. Note how much lower it is than curve (*a*). A much larger capacitor than 100 μμf would, of course, reduce the loss, since it would require less excess inductance in the coil, but a series variable capacitor does not seem to be the easiest way to do the job.

*(Continued on page 56)*

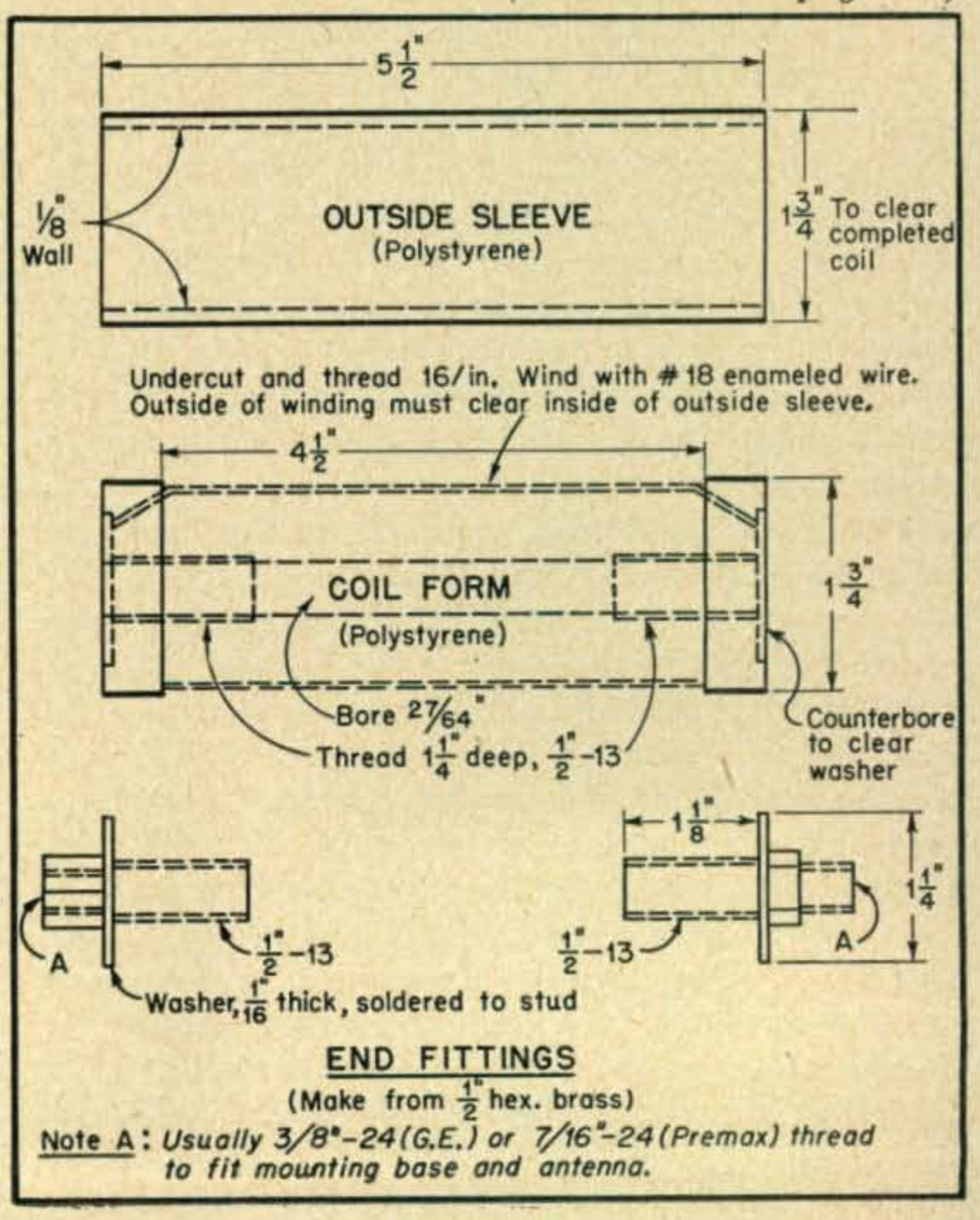



**Figure 2.**

# The Care & Feeding of CONTEST OPERATORS

J. W. PADDON, VE1OU

IT IS A STRANGE THING that the average contest operator will lavish thought, care, and work on his station equipment and aerials while he completely ignores the most vital and important bit of "equipment"—himself!

In the final analysis the receiver and transmitter are only man-made extensions of the brain, nerve, and muscular systems. The sharpest umpteen tube, triple-conversion receiver is no more use than a crystal set if it is not accurately tuned and if the signals it receives are not passed to and accepted by an alert and comprehending brain. Equally: the hottest kilowatt boosting a twenty db beam might just as well be a Ford spark coil if the complex network of brain, nerve, and muscle don't combine to slap the bug sharp and fast.

Worry and anxiety are fatal enemies of mental speed, alertness, and clarity. Setting aside all other considerations save ham radio it can be assumed that the major cause of anxiety would lie in a lack of confidence in the equipment. Last minute crash programs of rebuilding or adjustment are fertile sources of a lack of comp'ete confidence. They can generate a fear that there may be a breakdown just when the VKs begin to come through. A nagging thought that the i.f.s are a little out of line or that the VFO calibration is a few kc sour kills the mental serenity that fosters the best operating. The way to beat all this is to start getting the station set up and in peak condition weeks before the contest. The most ardent perfectionist must eventually run down every probable or possible fault and have to admit that the rig is as perfect as his time, purse, and ability will permit. If this state of affairs can be achieved a week or so before contest time then the shack should be securely locked and left locked until an hour or so before the kick off. This not only permits the operator to simmer down a bit but also to think about other things so that when contest time rolls around he's really full of eagerness and ambition.

To look at some ham shacks you would never believe it, but it is true that mess and untidiness are subconsciously irritating and hence tiring. Any minor hitch that interferes with a smooth operating routine not only breaks concentration but also sets up a minor conscious or sub-conscious frustration, presenting another small block to the effort of rolling up points. Messiness can be cleared simply by planning the layout of the operating table and doing a little study of the best placement of log, call book, etc. Once the best position-pattern for the operating aids has been established, it should be adopted and adhered to as a permanent arrangement. Minor hitches can be avoided by having at hand, and in quantity, supplies of sharpened lead pencils, scratch paper, erasers, and all the other little oddments that individual habit may dictate. Once an operator has dug in and begun his contest drive it should never be necessary for him to get up at an awkward moment in search of anything as trivial as a fill for his fountain pen or a fresh log book. Everything should be at hand, neatly stowed but immediately available.

The eyes can be a major source of fatigue. On a long contest grind lasting for hours on end, eyestrain can and does mount up. When we look from a brightly lighted area in a darker one, or vice versa, the muscles of the eye have to expand or contract the pupils of the eyes. It is true that this is a minor muscular effort but repeated thousands of times builds up fatigue. The operating table

should be uniformly lighted. Any meters on which we have to keep an eye should be visible without peering or squinting. There should never be any bright light source shining in the normal field of vision, and above all the light by which the log is kept and notes taken should fall over the operator's left shoulder. On no account should he have a bright desk light in front of him. Even the reassuring beady glare of pilot lamps is better out of the field of vision from the operating table. It is also possible to have the scales of communication receivers too brightly illuminated. Most hams will recollect that much service receiving equipment was fitted with a variable resistance in series with the pilot lamps enabling the operator to dim them to a level of luminosity most suitable to his needs. To summarize: let us have uniform lighting, not too bright, but adequate, and no glaring sources in the field of vision from the operating position. As a final refinement the author has always preferred to use dull colored paper for his notes as opposed to white. A dull restful green such as is used in offices for second sheets is especially acceptable.

The chair of the operating position is another important aid to good contest work. Probably the worst piece of furniture of this nature is the traditional broken-down arm chair whose contours have been battered by years of occupancy to a shape whereby the operator is lolling all over the place. A chair holding the human frame in what the Victorians used to call "an abandoned posture" may seem all too cosy. It is undoubtedly a good scene for the after-dinner nap but no place for a ham who is competing with the best. What we


need is a chair that gives ample support, is comfortable but at the same time prevents our slumping into a rounded position which will add to the load on the heart and encourage dopiness and lethargy. An inspection of the show rooms displaying good office furniture will provide examples of chair shapes which have been worked out to combine comfort and efficiency of the occupant. This is not to suggest that the contest operator should rush out and buy a vice-president's leather upholstered number, but a good look at one will give him sufficient guidance to select the most suitable type among those available to him.

We have to breathe. The air we consume is one of the basic fuels by which we live. It is quite obvious that a smoke-filled, hermetically-sealed operating room is the worst atmosphere we can breathe, especially at a time when clear headedness and alertness mean more QSOs in the log. The operating room should be full of clean fresh air at all times. The air should be slowly changing. At the same time, the operator will not be happy sitting in a direct draught. Each operating position needs to be studied on its own merits and methods worked out to ensure ample fresh air. There is no more certain cause of dopiness and sluggishness than rebreathing air already stiff with $CO_2$, tobacco smoke and the smell of hot transformers. Anyone who has spent a few hours in some basement night club and then emerged into the cool fresh air of the early morning will have experienced the immediate surge of feeling better and brighter that followed the first lungful.

Someone said that summer is the time when we complain about the temperature to which we heat our houses in the winter. It is better to wear a few more or heavier clothes and operate in a comparatively cool room than it is to strip down to an undershirt in an overheated one. Too high a room temperature is an invitation to drowsiness and lethargy. The ideal temperature will vary with the body condition of the individual. It is probably safe to say that a figure of the order of 68° or less is about right for the average.

Clothes should be loose and easy. Here, again, we seek to avoid a subconscious irritation such as might be caused by an uncomfortable collar or a tight shoe. Unless the operator is blessed with a Falstaffian figure the stomach should rest on its own merits and not be confined by a tight belt. The author has found that a pair of loose wool socks over feet in comfortable carpet slippers takes care of the pedal extremities. An old pair of beltless trousers, topped by a soft shirt (less tie) and loose coat-type sweater takes care of the rest. Every man to his own taste, and the comfortable familiar duds he likes the best will be the best as long as they are not tight anywhere.

The question of feeding is one into which the laymen should not intrude very far. No enthusiastic ham would think twice about paying a few dollars to a competent professional engineer in return for a pre-contest check on his equipment and constructive suggestions. It seems only the path of logic to suggest that the contest operator drop in on his family physician and have a chat with him about what to choose as diet during the gruelling contest period. Said doctor will know about the individual ham's physical machinery. His suggestions will not only include a list of what it is well to eat and drink but also, in all probability, a list of what to avoid—both lists being predicated on his knowledge of the individual. One thing is certain to be stressed—avoid heavy meals! When the stomach has been loaded up with

*(Continued on page 59)*


**Conducted by HERB BECKER, W6QD***

OUR HEARTIEST CONGRATULATIONS to the following seven DX men. These boys, who need no introduction to you, have made WAZ and have been awarded the certificates as follows:

| | | | |
|---|---|---|---|
| 233 | **OK2SO** | C. Oldrich Stourac | 40-145 |
| 234 | **DL7AA** | Rudi Hammer | 40-173 |
| 235 | **DL1FF** | Armin Drasdo | 40-197 |
| 236 | **W6NTR** | Jack D. Clement | 40-138 |
| 237 | **ZL1BY** | William A. Wilson | 40-193 |
| 238 | **W7OY** | Eddie Niespo | 40-163 |
| 239 | **W6ATO** | Richard F. Cziekowitz | 40-149 |

Here we go again. The DX Contest is over and some of the returns are just coming in. You know as well as I do, that conditions for both the phone and c.w. weekends were foul, and judging from the comments of some of you, it is surprising that anything was worked. A lot of the boys got a little discouraged and gave up after the first day. On the other hand, there was plenty of the gang on the air that could remember conditions during the early 30's and the present conditions were not too unlike that period.

In those days, the ARRL had their nine day melee. Many was the time we would stick around all day logging only three or four multipliers. Of course, had we known then what we think we know now about antennas, etc., things would have been somewhat improved. Anyway, the way DX was running wild right after World War II spoiled a lot of us, but we are just going to have to get used to punk conditions.

A few of you may wonder why we can't pick different dates for better weekends, but that is a little easier than it sounds. As I pointed out in the column a couple of months ago, the yearly calendar is pretty well filled up with the World Wide Ham activities, and it became necessary to pick the best weekends which were left open.

I will admit that we could pick weekends that would be better year in and year out, but as it stacks up now, we would be piling on someone else 's activities. Remember this, if any of you have any good suggestions for bettering the Contest, they are always welcome. If you have a suggestion for better weekends, let's hear about it, but remember, if you pick any dates be sure that they don't land on someone else's activities somewhere in the world. I think we will all have a lot of fun if we just stick together on this Contest. It is very gratifying to hear that most of you like this style of contest. Outside of the fact that a few of you would like 80 meters put in, our contest was designed from the general ideas of a whole flock of you. We don't want to take any particular credit for the contest outside of sponsoring it.

I got a big bang out of sitting there and listening to the flock of DX that was on the air as the band would open. Of course it wouldn't stay open for long, but nevertheless the boys were in there itching for something to work. There were a lot of good stations in there doing a real job such as CR5AC, VR1C, EAØAB, CT3AA, and several VP8's. It was too bad the Far East Command clamped down on 40 meter activity for all those in that area. This occured not to long before the contest, and obviously left some of them high and dry. But of course there was a reason for it, and we are likely to have more handicaps in our DX, although right now, let's not think about it.

Now let's see what we can get out of the mail. VE4RO made up for lost time the last day of the c.w. Contest when Europe burst wide open for about three hours. George said 10 meters was a wash-out, and for that matter, I believe that's the general feeling everywhere. . . . G3BPP is a new one to the Honor Roll with 36 Zones, but wants to know if he can get credit for half a zone, as he has a 'heard' card from Zone 18. I tried that two or three years ago with Zone 2, but couldn't put it over.

KH6VP sends in a flock of new countries, bringing his totals up to date. During the phone weekend of the contest Bill received orders from Washington transferring him back to his old home town of Los Angeles. Col. Shuler is, as many of you know, in the Engineer Corp and this new setup makes him District Engineer, which is a swell jump upwards for him. It will be good to see Bill again, and I am wondering if he is going to go after a WAZ from W6. As you know, he made it from W7BE and KH6VP.

A lot of the boys worked 3A2AB in Monaco. As far as we know, this is the only good one that has ever been on the air from there. . . . KS4AC sent me a QSL card he had just received from. of all people, FA8IH. Something was once said about the rarity of seeing a card from him, and so Grif, ever eager to oblige, sent his along for a 'look-see'. Now we are convinced. He says maybe most of the boys put too much heat on him, and this may account for not getting a card. He suggests you act disinterested, unconcerned, and nonchalant, even telling him that you will be glad to answer his card when received. At the same time you can stand by and chew your finger nails until you get the card. To this I say, "Oh Yeah!" Grif

*(Continued on page 32)*

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

# RADIO WAVE PROPAGATION

CHESTER R. UNDERHILL, W2YT*

*Part two of a three-part article giving the authoritative low-down on why our high frequencies act as they do.*

IN PART *1* OF THIS SERIES, which appeared in December *CQ*, the author described the various means by which a radio wave may be transmitted over great distances by means of ionospheric reflections.

He concluded that, with the exception of occasional instances of sporadic-E reflections and aurora rebound, the ionosphere has negligible effect on the propagation of signals on amateur frequencies above the six-meter band. Most of the unusual DX which is experienced on the higher bands is brought about by effects occuring in the troposphere, or "weathersphere"—the lower layers of the Earth's atmospheric blanket.

Useful propagation of signals at frequencies above about 100 mc occurs almost entirely in the troposphere, and is affected by such factors as the refractive effects of air, diffraction around natural or man-made obstacles, reflections from solid objects or discontinuous air masses, and the topography over the signal path.

For purpose of reference, the National Advisory Committee on Aeronautics has defined a so-called "Standard" atmosphere based on homogeneous, or "well mixed", air conditions in the Temperate Zone. In this standard, air temperature decreases with altitude at a rate of 6.5° C per Kilimeter (3.6° F per 1000'), starting from a sea-level value of 15° C with a dry air pressure of 1013.2 millibars. The water vapor pressure is specified as 10 millibars at sea-level, decreasing with altitude at a rate of 1 millibar per 1000 feet. This is the condition for an average relative humidity of 60%[1].

Weather conditions seldom remain normal for extended periods of time, and wide variations from the standard atmosphere described above may be experienced. It is the effect of these variations that bring about most of the vagaries of v.h.f. and u.h.f. propagation.

## Snell's Law and the Index of Refraction

The phenomena of refraction is evidenced when light waves or radio waves enter the boundary between two media of different refractive indices. The familiar effect noted when a pencil is inserted into a bowl of water is a manifestation of the refractive phenomena, and is illustrated in *Fig. 3*. Snell's Law defines the angle of apparent bending, in terms of the refractive indices of the two media.

The velocity of propagation of an electro-magnetic wave in any medium is the speed of light divided by the index of refraction of the medium. In the moist standard atmosphere the index of refraction decreases linearly with height at a rate of about $8 \times 10^{-6}$ units per hundred feet. As a radio wavefront moves through the atmosphere, the upper portions move at a greater velocity than the lower portions, resulting in a continuous downward bending of the rays. The rate of curvature is approximately 1/6 that of the curvature of the earth. This condition is known as "Standard" atmospheric refraction. This "standard" refraction is the basis of the well known curves plotting geometrical line of sight against radio line of sight which show the distance along the radio line of sight to be about 15% longer than the geometrical.

Montgomery[2] and others[3] have pointed out that the refractive index of air is practically independent of frequency but is a function of air density and the ratio of water-vapor concentration to absolute temperature, increasing with both of these.

While visible radiation follows Snell's law as evidenced by the fact that light rays from heavenly bodies, slightly below the geometric horizon, can

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* *Senior Engineer, Radio Propagation Laboratory, The Pennsylvania State College, State College, Pa. On special leave from RCA Service Co., Inc., Camden, N. J.*

1 The Propagation of Radio Waves, Vol. 3, OSRD, Published by National Defense Research Committee, Washington, D. C.

2 R. B. Montgomery, Bulletin American Meteorological Society Vol. 28, pp. 1-8, Jan. '49

3 Morris Schulkin, VHF New Jan. 1950

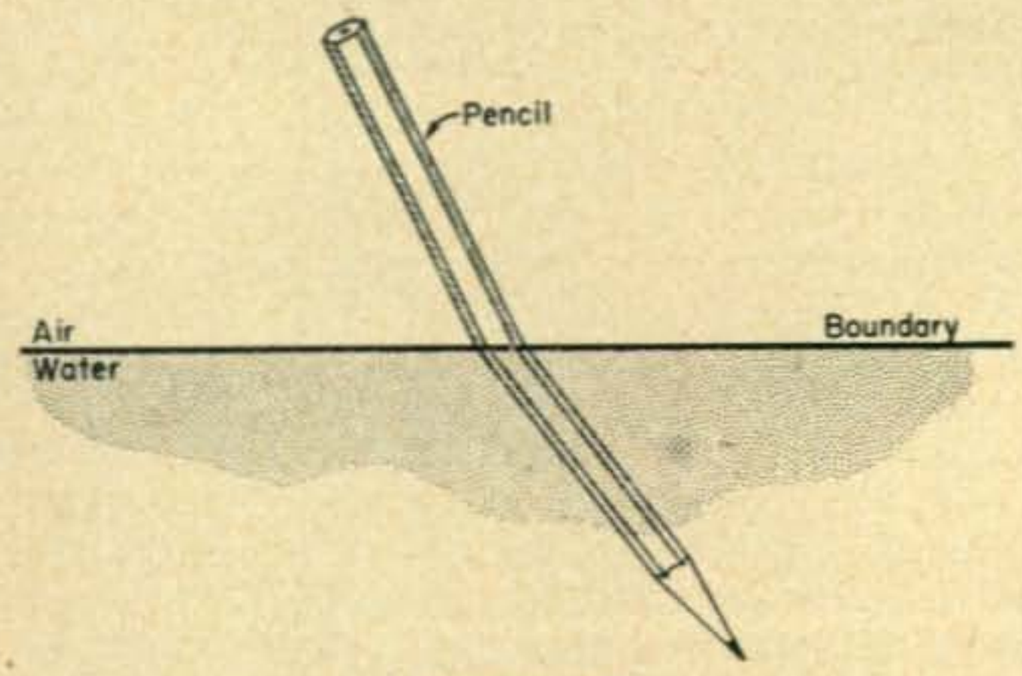



**Figure 3**

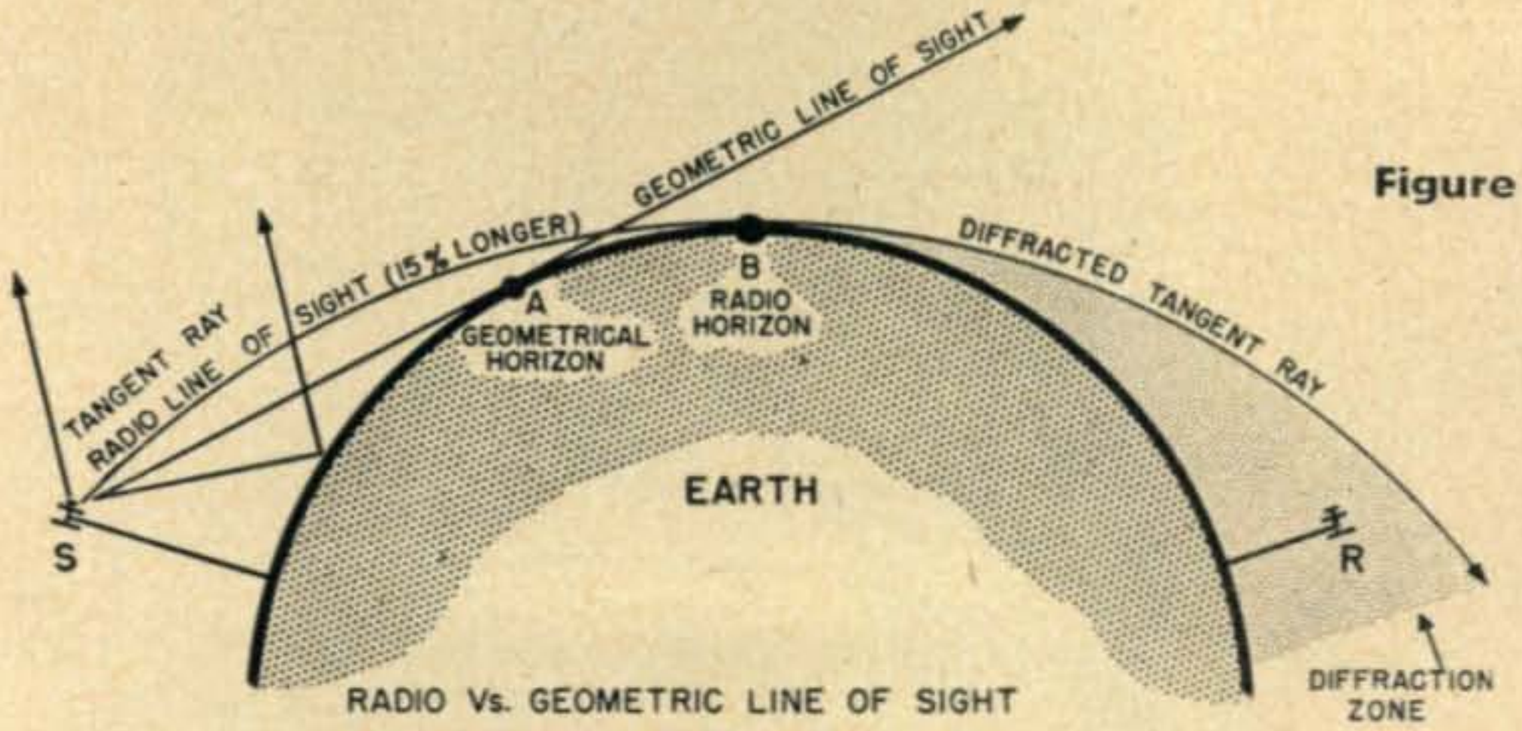



**Figure 4**

RADIO Vs. GEOMETRIC LINE OF SIGHT

The Ray diffracted below the Radio Horizon adds to the Radio Line of Sight.

Refraction in a Standard Atmosphere causes a Ray propagated tangent to the Earth to bend approximately 1/6 that of the curvature of the Earth.

be detected by the eye, the composition of the atmosphere influencing the index of refraction may not affect light and radio waves in the same manner. In general, the refractive index affecting radio waves depends greatly on *water vapor concentration*, while that affecting light waves is independent of water vapor but is more a function of *temperature*. These facts should be committed to memory as they are necessary to an understanding of VHF and UHF propagation. Possibly it would help to recall to mind a familiar manifestation of each condition. Every 2 meter addict has noted abnormal propagation conditions when a ground fog existed, i.e., when the water vapor concentration was high. Also, while it will be shown later on that temperature inversions cause the change in refractive index affecting propagation over abnormal distances, it is the fact that they are also conducive to the concentration of moist air masses below them that has an important bearing on the index changes.

Many of us have not been to the desert countries so have not had the opportunity to see a mirage at first hand, but we have all seen pictures of them depicting the optical line of sight extended far below the horizon. They are attributed to sharp temperature inversions caused by the re-radiation of the intense solar heat absorbed by the desert surface.

In dry air the refractive index for light and radio waves is about the same, and in air of constant water-vapor concentration the gradient of refractive index is about the same. On the other hand, if the air masses contain a a varying degree of water-vapor concentration, the gradient may be quite different for each band.

### Diffraction

Another factor affecting radio wave propagation in a standard atmosphere is a process known as "Diffraction". It may be defined as that tendency of a wave to curve around opaque objects into the shadow area. The diffracting process adds considerable distance to the radio line of sight, the earth itself being the diffracting medium. The theory of diffraction ties in with Einstein's laws of gravitation involving the bending of waves by a mass. The efficiency of diffraction decreases rapidly as the wavelength decreases.

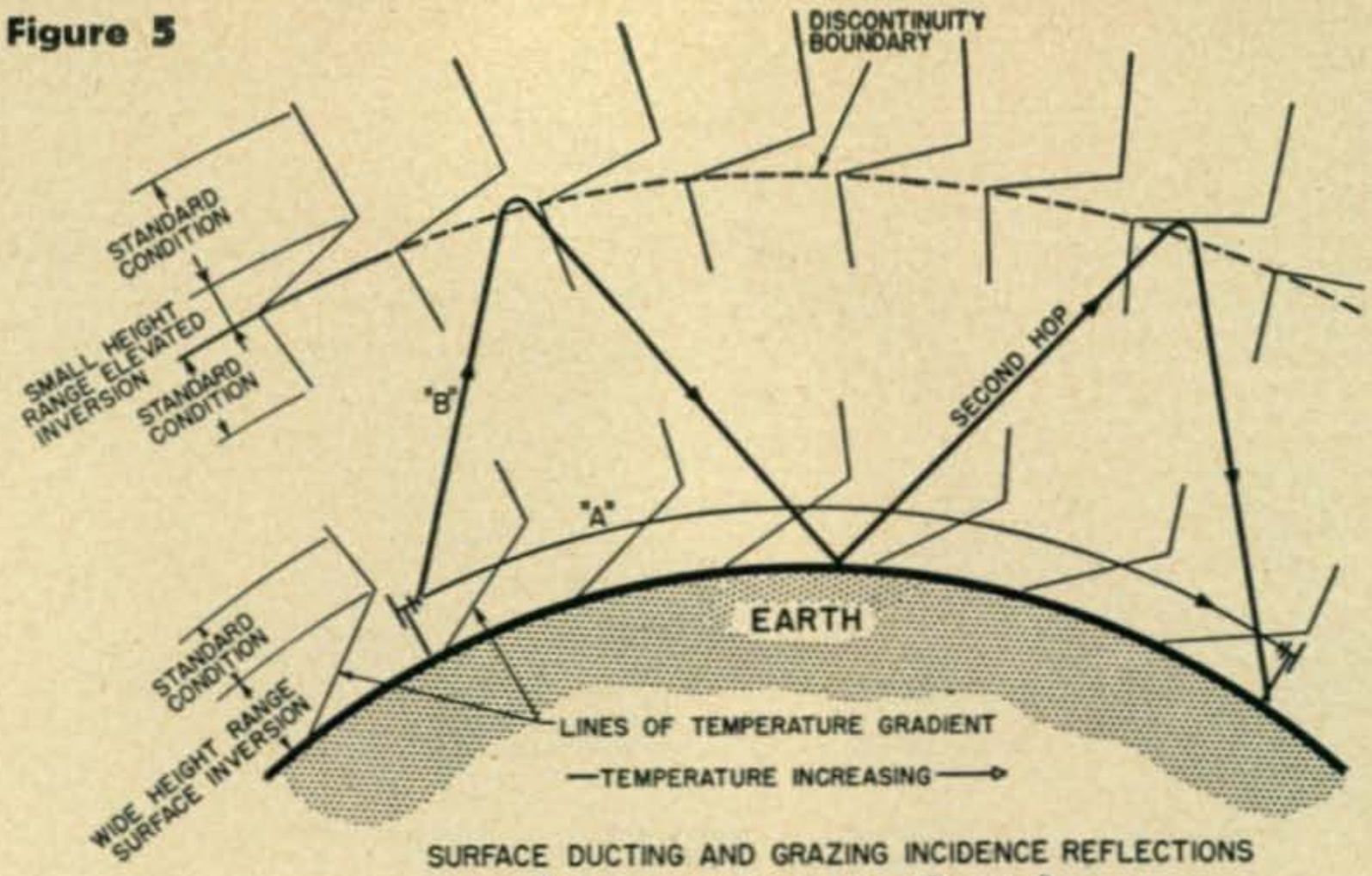
Numerous examples of long range contacts made via the diffractive process might be cited. In order to be certain that diffraction only is involved, contacts should be made over a long period of time under varying weather conditions, over ranges considerably greater than the line-of-sight range. The schedules kept between W2NLY and W2YT daily at 8:00 AM over a 70-mile path during the winter of 1947-48, the similar evening schedule of W2DFV and W2PAU over a 75-mile path, and other similar accomplishments might be considered a demonstration of propagation by diffraction. The beam antennas were at an average height of 50 feet above ground, which was virtually flat between the stations involved. The average input power was well under 100 watts. These distances are approximately *twice* the distance that might be expected from radio-line-of-sight propagation. Signals are usually much weaker and less predictable in the diffraction zone than in the true line-of-sight area, so antenna gain, transmitter power, and receiver sensitivity have considerable bearing on the success of contracts into this zone.

VHF propagation, then, in a standard atmosphere, involves signals which may be received via: (1)-radio line of sight, (2) reflection from a point on the earth's surface between the transmitting and receiving antennas, (3) the signals reaching the receiving antenna by the diffraction process and (4) reflections from obstacles such as houses, hills, trees, etc. along the ray path; all subject to the refraction phenomena previously described. The net signal represents the vector sum of these components. *Fig. 4* illustrates VHF propagation paths in a standard atmosphere.

### VHF Progagation in a Non-Standard Atmosphere

While it is satisfying and necessary to have a clear conception of propagation in a standard atmosphere, we know, of course, that conditions in the troposphere are not always standard. It is the sub standard and super conditions, in fact, that provide such intense interest for the VHF addict.

**Figure 5**




SURFACE DUCTING AND GRAZING INCIDENCE REFLECTIONS
Path "A" – Super Refracted Wave "Ducting."
Path B – Wave Reflected at Grazing Incidence at Boundary of Small Height Range Elevated Inversion.

Weather conditions in the troposphere frequently cause it to become stratified in horizontal layers and patches in which temperature and moisture content are non-standard. A layer is called *sub standard* where the lapse rate of the index of refraction is less than in standard air. It is called *super standard* when the lapse rate exceeds that of standard air and is the result of a temperature inversion or a positive lapse of water vapor concentration.

Throughout the literature of VHF propagation the terms lapse, lapse rate, gradient and slope appear. It seems worthwhile in the interest of clarity, therefore, to digress for a moment to point out that they all refer to one and the same thing and are used interchangeably. Briefly these terms refer to the *rate of change* of the index of refraction with height as compared with its linear change of $0.8 \times 10^{-6}$ units per 100 feet in height in a standard moist atmosphere. When this rate of change exceeds that existing by definition in standard moist air, the gradient of the slope is referred to as *negative* and when less than standard the gradient is considered *positive*. These are the conditions existing in a super-standard and sub-standard atmospheric layer respectively.

Montgomery (4) divides super standard atmospheric layers into two types which are defined as follows: Type 1, in which the lapse rate of the index of refraction is such that a ray is bent more than in standard air but less than the curvature of the earth; Type 2, where the lapse rate is sufficient to bend the ray more than the curvature of the earth. The critical lapse rate, dividing these two types, causes a ray to bend an amount equal to the curvature of the earth and is $4.8 \times 10^{-6}$ units per 100 feet.

The bending of radio waves moving horizontally is determined by the shape of the curve of refractive index vs. height. Hence it is easy to visualize ways in which a signal might be propagated out to great distances under certain combinations of abnormal refractive layers. All of the so-called "modes" of abnormal v.h.f. transmission such as ducting, extended diffraction (or "local range" openings), skip, and scattering may be explained by the phenomena of abnormal refraction, or "super-refraction".

It is the variations in rate of change of refractive index, and the height and thickness of the atmospheric layer in which these variations occur, that determines the so-called mode of propagation. And these variables are, of course, dependent on discrete meteorological conditions existing along the propagation path between the transmitter and receiver.

As illustrated in *Fig. 4*, let us consider three rays transmitted from the beam antenna. One, at a high angle, is shown penetrating the atmosphere, while a lower one is directed down towards the earth and is in turn reflected at an acute angle into the atmosphere. A third ray is shown directed toward the horizon. This ray is known as the tangent ray. It is the energy that penetrates the region beyond the point of tangency of this ray with the horizon that permits reception beyond the radio line of sight. This region is known as the diffraction zone and, as previously noted the efficiency of the diffraction process in standard air falls off rapidly as the frequency increases. However, in non standard air, the changes in the gradient of refractive index may cause the location of the tangent ray to vary considerably and thus account for the so called "local openings" or extended diffraction zones with which we are all familiar. A type 1 super standard layer existing close to the earth, or one containing a positive water-vapor lapse rate, that bends the ray less than the curvature of the earth, can cause this effect.

Propagation by reflection and multiple hop occur when a non standard layer is located at high altitude and when the difference in the dielectric constant, (defined as the square of the refractive index) at the plane boundary between the standard and non standard layers or air masses is sharp.

4 R. B. Montgomery, Bulletin American Meteorological Society, Vol. 28, pp. 1-8, Jan. '47

A ray impinging on this boundary at near grazing angles of incidence will be reflected back to the earth.

Propagation via "scatter" falls under this category if we consider "patches" of air masses, differing sharply in dielectric constant from the surrounding standard air, along the propagation path, as being the reflecting media.

And this brings us up to the controversal subject of "ducting", about which so much has been written by highly competent authors in the past, Booker, Rydbeck, Barlow, Montgomery, Burrows, and Gilmer, to mention only a few. Possibly much of the confusion in the amateur ranks concerning VHF propagation via ducts is due to the varying meteorological conditions that make this possible and its dependence on frequency and duct thickness. While it is convenient to visualize duct propagation in terms of a natural "wave guide", it must be borne in mind that the parameters of a metallic wave guide and an atmospheric duct are quite different, the efficiency of the first being dependent on the dimensions of the metallic container for a discrete frequency while the latter depends on the gradient of the rate of change of the refractive index in a non standard air mass with layer thickness, its altitude and the wave frequency.

But let us continue with our ray tracing. If a type 2 super standard layer exists close to the earth, the lapse rate of the refractive index is by definition sufficient to bend a ray more than the curature of the earth. Thus a ray propagated tangent to the earth will not reach the radio horizon but, by the process of super-refraction, it will be bent down to the earth where it will be reflected by the surface up into the layer again and once again bent down to the surface and the level where it is horizontal and will continue to "duct" as far as the type 2 super standard layer exists. This is the familiar type of duct noted in the microwave spectrum, and is generally caused by a surface temperature inversion.

During the recent war Dr. H. G. Booker (5) reported abnormal 1.5 meter radar reflections in the Mediterranean Sea and Indian Ocean from land areas at distances up to 1500 miles, which he attributes to ducts formed by temperature inversions. The frequency that can be propagated by a duct is a function of the duct "thickness". If, therefore, a type 2 layer is formed by a temperature inversion at high altitude, two meter ducting may take place between the earth's surface and the inversion area.

Rydbeck (6) gives the relationship between the duct thickness and wave length that can be trapped as $\lambda_c = \frac{4h^2}{A}$, where $\lambda_c$ is the cut off wave length, h is the height (thickness) of the duct measured from the ground and A is the radius of the earth.

With this relationship in mind, it is a simple matter to calculate the required duct thickness to horizontally propagate a radio signal of a given frequency. As an example, let us work it out for the two meter band. Transposing, we have $h = \sqrt{\frac{A\lambda}{4}}$

Using 6000km as the earth's radius and inserting 2 for the value of $\lambda$ we have $h = \sqrt{\frac{6 \times 10^6 \times 2}{4}} =$

$\sqrt{3 \times 10^6} = 1730$ meters or approximately 5650 feet.

When considering the possibility of ducting it is also necessary to bear in mind that ducts can only form under very stable meteorological conditions. Such a condition might be satisfied, and two meter ducting occur, should a stationary high pressure area flatten out or elongate, and form a temperature inversion at a height of about 5650 to 6000 feet.

*Figure 5* illustrates the phenomena of ducting as it might apply to our two-meter band. The low-angle ray, "A", is bent in a critical-lapse-rate layer, so that it follows the contour of the earth's surface. Ray "B", the high-angle radiation, encounters an elevated discontinuous boundary which causes the wave to be bent back to earth, perhaps by successive hops.

Whether our two meter DX in the order of 500 miles and over is due to this type of ducting or is the result of long distance scatter from patches of high altitude discontinuity boundaries, poses a most interesting scientific question. The skip effect occasionally noted on long two meter DX is certainly easier to explain by the scatter theory than by the ground-based duct, which requires the transmitting and all receiving antennas to be within the duct.

## Fading

The line of demarcation between two dissimilar air masses is called a line of discontinuity. Fading is due to the fact that this line of discontinuity is not a flat reflecting surface like a mirror, but may undulate very much like great waves on the

*(Continued on page 54)*

5 Radio Refraction in the Atomsphere, "Weather," Feb. 1948

6 On the Propagation of Waves in an Inhomogeneous Medium. Transactions of Chalmers University of Technology, Gothenberg, Sweden, No. 74, 1948.

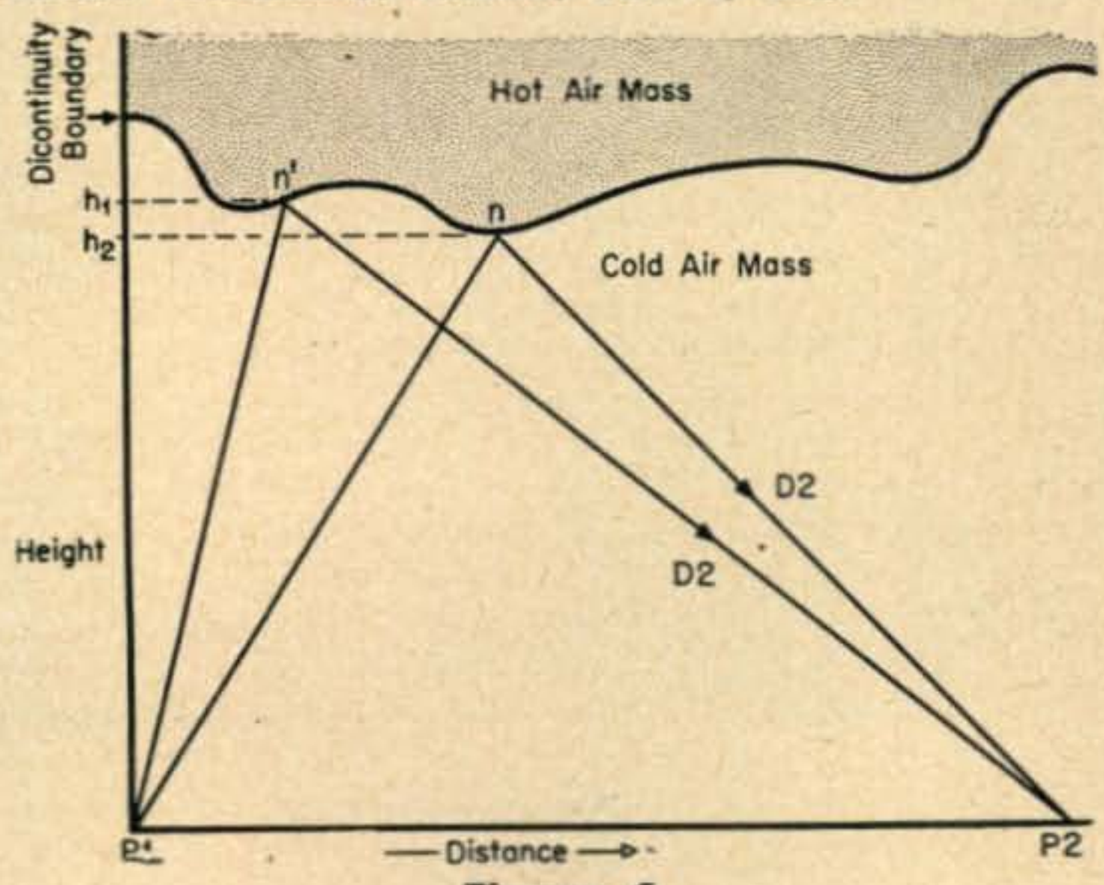



**Figure 6**

# POWER & RESISTANCE RAT LIGHT

IN TESTING RADIO TRANSMITTERS, it is frequently convenient to apply the operating load to the transmitter under test. With amateur transmitters this application may easily be accomplished by using special resistance units built for this purpose, or incandescent lamp bulbs. The former are more convenient to use in that the resistance is accurately known and is independent of the power being dissipated. They are relatively expensive, however, especially when several must be used to dissipate the output of a large transmitter. Incandescent lamp bulbs, on the other hand, are cheap, even in the larger sizes, though they have the disadvantage that their characteristics are not constant and are usually unknown except at rated load.

It was therefore thought desirable that the characteristics of the more popular size lamp bulbs be determined for all values of power dissipation within their ratings.

The circuit used to find this information is shown in *Fig. 1*. The circuit consists of a voltmeter and an ammeter to measure the lamp voltage and current respectively, for when the voltage and current are known, the resistance may be found from Ohm's law. A wattmeter was used to measure the power dissipated in the bulb. A Variac (not shown) was used as a source of variable voltage. The information desired could be found by using any two of the three meters, but all three were used to provide a check on each other.

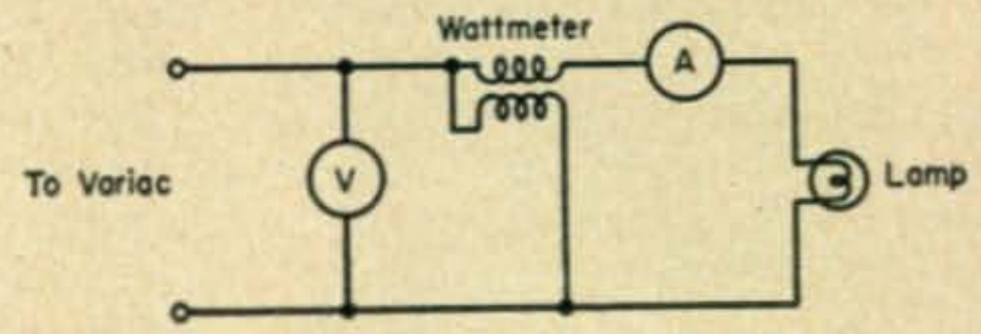



**Figure 1**

Since the voltmeter and the potential winding of the wattmeter were of relatively low resistance, they were placed ahead of the wattmeter so that these instruments would not be affected by the voltmeter or potential coil currents. With this arrangement, the voltmeter does not read the lamp voltage, but rather the voltage drop across the wattmeter, ammeter, and lamp. Since the resistance of the current coil of the wattmeter and the ammeter are low, the voltage drop across them can be neglected, thus simplifying calculations.

As r.f. current is more convenient to measure than r.f. voltage or power, the curves are shown

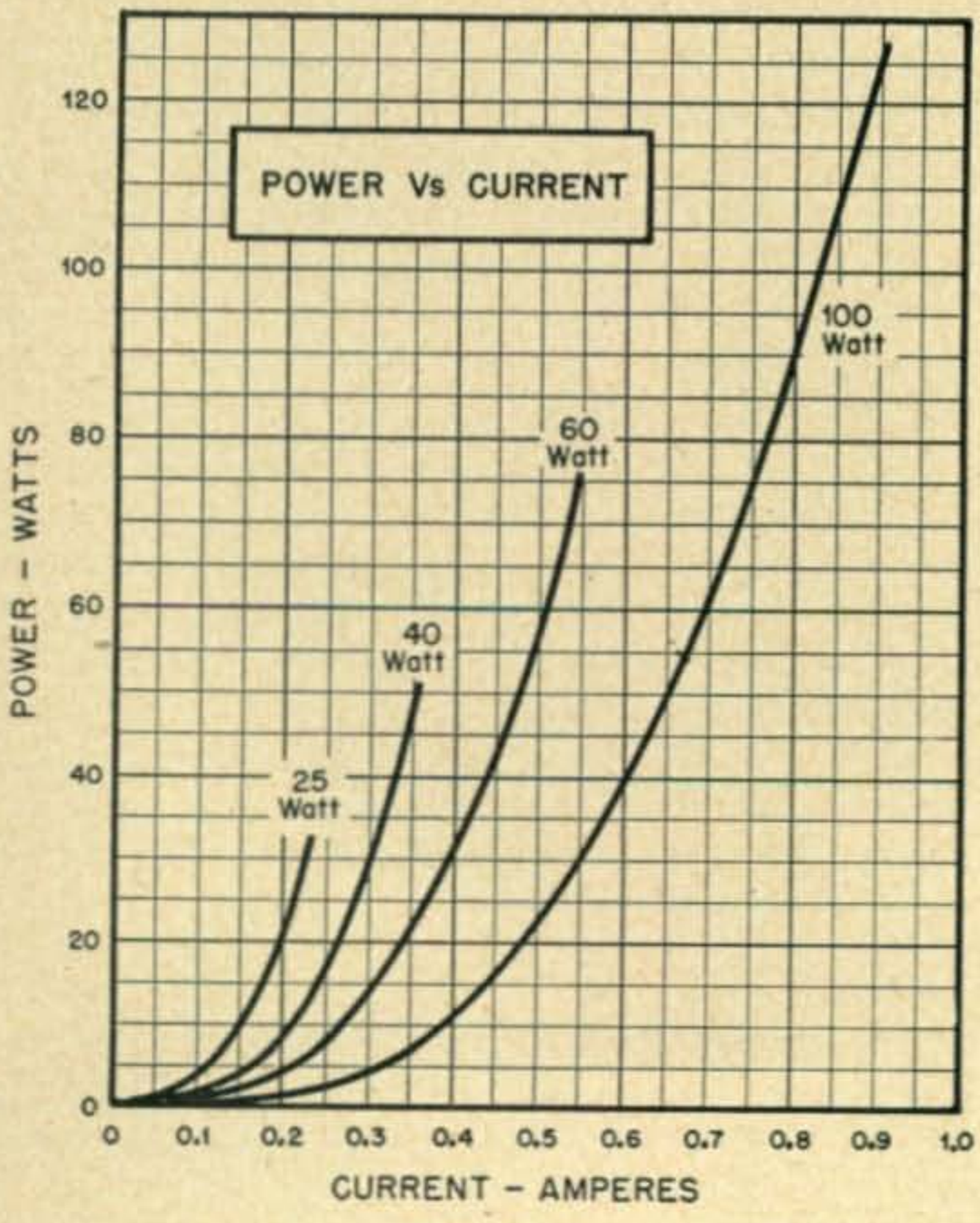



**Figure 2**

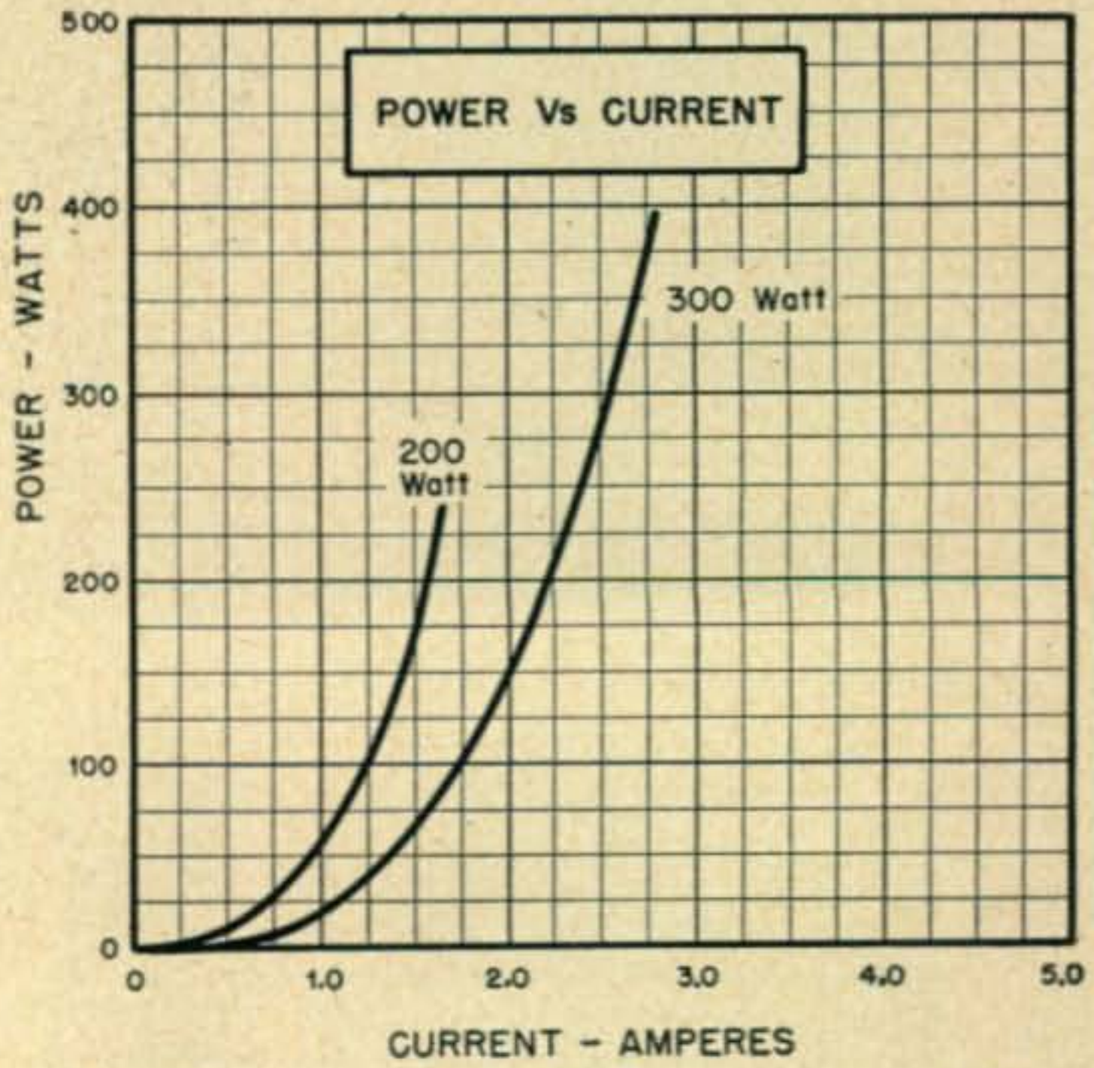



**Figure 3**

# INGS OF INCANDESCENT BULBS

JOHN J. NAGLE, W3JES*

* *2032 Belmont Rd. N.W.*
*Washington 9, D. C.*

with current as the known parameter. *Figures 2* and *3* show power dissipation *vs.* current, for six sizes of lamp bulbs. *Figures 4* and *5* show resistance *vs.* current for the same bulbs. These latter graphs will be useful in determining the size lamp bulb to provide the proper resistance for loading the transmitter. It may be seen from *Fig. 5* that a 200-watt lamp bulb operating with a current of 1.3 amperes provides a 72-ohm load, while *Fig. 4* shows that a 25-watt bulb with 0.07 amperes or a 40-watt bulb with 0.27 amperes provides a 300-ohm load. Of course, the bulbs should be capable of dissipating the expected output of the transmitter. If a single bulb will not dissipate the expected power, several should be used in series or parallel.

The series arrangement is somewhat more flexible in that bulbs of unequal ratings may be used. In this case the current through all the lamps is the same, so that the total power or resistance is the sum of the power or resistance of the individual units.

Units of unequal ratings should not be paralleled unless it is possible to measure the current through each branch separately. This is because the resistance of each unit depends upon the current flowing through the lamp, while the current in turn depends upon the resistance. Therefore, it

*(Continued on page 56)*

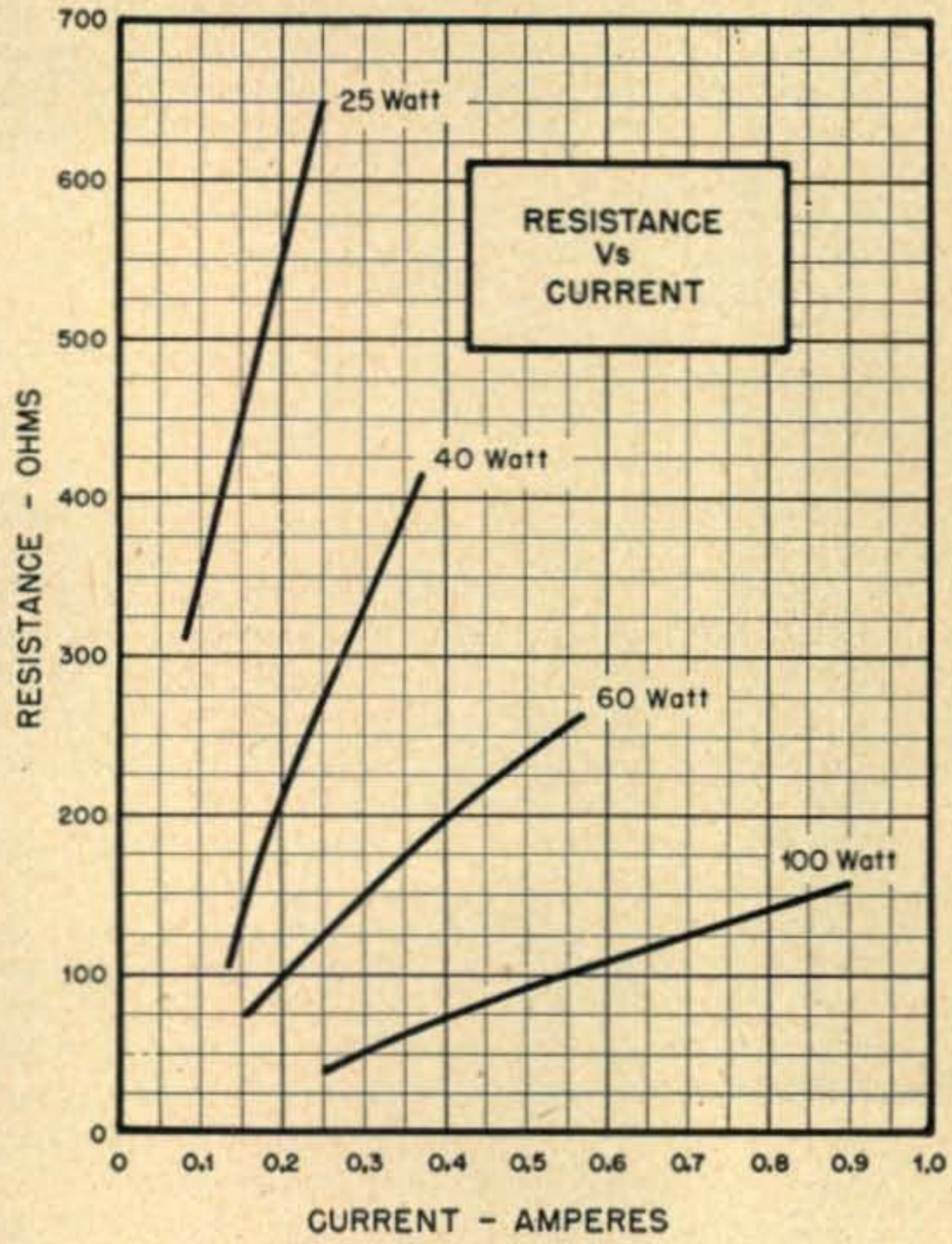



**Figure 4**

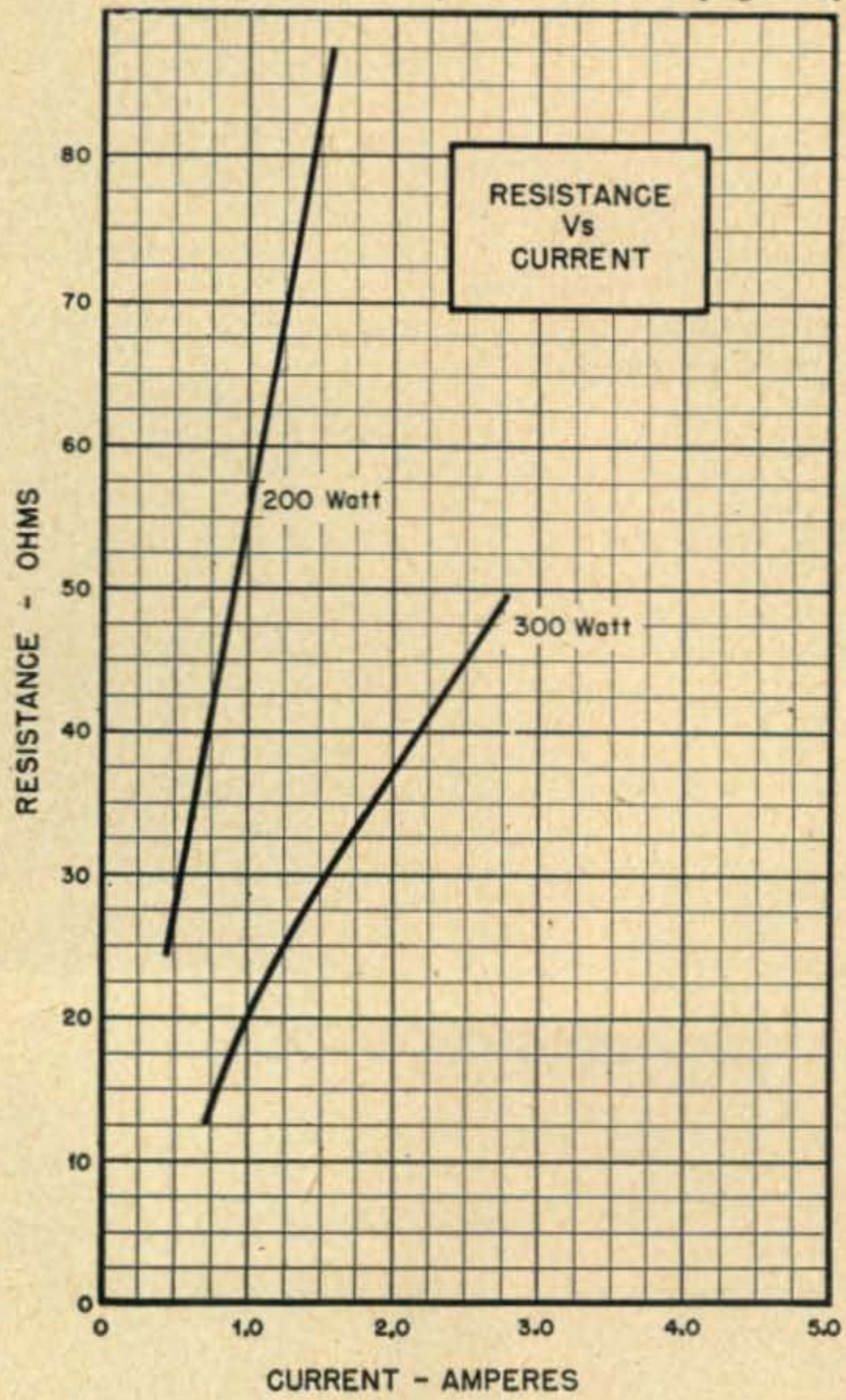



**Figure 5**

# DX & OVERSEAS

*(from page 25)*

modestly admits that it is entirely possible the KS4 call has something to do with his high returns on QSL's. . . . And by the way, KS4AI is back on the air and using a 10 and 20 meter beam, running about 250 watts. KS4AC is now using a Collins 32V1 and a cubical quad beam. . . .

ZL3AB, who is DX Editor of 'Break-IN," ran out of QSL cards after sending about 700 to the stations. Les owes about 300 more and would like for the boys to know that as soon as they can be obtained from the printer they too will be mailed.

KH6QH has shoved off from the Islands, and is now located in Palo Alto. He hopes to get his old call back, W6ORT. . . CE3AG worked a station signing VR6AB, who says he is on Pitcairn Island. Let's everyone face the East, keep our fingers crossed, and hope he is good. . . G3AKU is going nuts waiting for a card from VK1VU, the reason being this is the only one he needs for WAZ. Take it easy, Ron, you'll get it.

ZS8MK sent a message saying he had some tough luck and couldn't get in the contest on account of awaiting pistons, conrods, and rings for his Onan BC-12 power plant. Apparently, the Import Control System was holding up these parts. Shucks, there ought to be a way to get stuff through for DX men, it would seem to me.

VK2PV is still trying to get something out of C9AA, and at this point he is yelling for help. At the present time I couldn't even guess where you could find C9AA. . . . Oh, by the way, did you hear a guy in the contest signing W6RMG/HLI? That was quite a surprise hearing someone on in Korea. . . W4RBQ passes word along that ET6AC is W2YEJ, and to QSL via K2AJ. . . . A short time ago a letter was received from W6GEO, who, along with his XYL, is working at the airport at Keflavik, Iceland. They seem to like it very much up there, and the only Ham he has met so far was TF5TP, located in Akureyri. This spot is about 40 miles from the Artic Circle.


The latest news in DX, EAØAB

### 3A2AB - Monaco

The two fellows who went to Monaco deserve a lot of credit for a business-like way of getting on the air, which of course gave most of us a new country. It was especially good because it was done with the consent of the Monaco government, and was the first amateur station to operate from there. Yes, we haven't forgotten CZ2AC and 3A1A. DL4FS, Guy Kane, handled the c.w. end of things, while Don Ross, DL4VI, took care of the phone. They got on the air October 17th in the Royal Hotel located in Monte Carlo, and ran about 100 watts input. The antenna was a folded dipole. They made 581 QSO's which was very good considering poor conditions. Due to being situated under some high mountains, it was necessary for them to work the W's long way around. When the elevator was running in the hotel the line voltage went down to below 80, and since it was 42 cycle stuff, their equipmnt ran pretty hot. They operated until October 24th—then left for home as DX condiions kept pace with their financial conditions with both of them running low. I might mention that they have received a number of cards for QSO's they didn't have. They are sending out their QSL cards and would like to receive yours providing you worked them. If you didn't don't bother sending a card. Both Don and Guy got a big bang out of the trip and appreciated the snappy QSO's they had with most of the gang. Of course from our point of view I think we all got a kick out of hearing them on from Monoco and should appreciate their efforts. . Speaking of 3A1A—we have it on pretty good authority that he operated in Heidelberg—not Monoco. Better scratch one.

If any of you fellows work LJ2Z or LJ3B, don't toss it out as a phony. They are definitely O.K. and the correct mailing QTH will be found at the end of the column.

There have been a number of fellows recently that have wondered if now wouldn't be a good time to have another Marathon. As you recall, in 1948 we had a Marathon that ran for the year, but we decided against repeating if for the years 1949 and 1950. A great many fellows seem to think that with DX being on the rampage such as it was during those years it would be well to forget it until a future date. Now that conditions don't seem to be so good, generally speaking, and so many fellows making WAZ as well as having around 200 countries, it might be a good idea to stage another Marathon.

Of course it is a little late to start it as of January 1, 1951, but if I would get enough opinions in favor of it from you, I suppose we could start it any time during the year. Well, let's see what you have to say and we will go from there. Remember, we are just as interested in hearing if you are against it as we are if you are for it.

W6LER in the mad rush to get an antenna up for the Contest, put it up by the light of the Moon, and as Gordon says, "it worked accordingly"—lousy. He tuned it up on the garage roof,

# W. A. Z. HONOR ROLL

## CW & PHONE

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| W6ADP | 225 |
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| W6GRL | 224 |
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| W6ITA | 219 |
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| W3EVW | 218 |
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| W6SYG | 217 |
| WØPNQ | 217 |
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| W2PEO | 215 |
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| VK3BZ | 213 |
| W6TT | 212 |
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| W6MX | 211 |
| W6NNV | 211 |
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| W6BPD | 210 |
| W6MJB | 210 |
| W6OEG | 210 |
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| W9NDA | 208 |
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| W6SC | 207 |
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| W4BPD | 206 |
| LU6DJX | 205 |
| W6MVQ | 205 |
| W6PQT | 205 |
| W6ZCY | 204 |
| W6DI | 204 |
| W6PKO | 204 |
| VK2DI | 204 |
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| W4CYU | 203 |
| ZS2X | 203 |
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| W6RM | 202 |
| W6OMC | 202 |
| W6PB | 202 |
| W6AOA | 202 |
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| W7AMX | 201 |
| W6DLY | 201 |
| W6GDJ | 201 |
| W9KOK | 200 |
| KH6BA | 200 |
| VK5JS | 200 |
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| W6EFM | 198 |
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| WØDU | 197 |
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| W6RBQ | 196 |
| G4CP | 195 |
| W6UCX | 195 |
| W5KC | 195 |
| G6QB | 195 |
| OK1FF | 194 |
| W6GAL | 193 |
| W6TI | 193 |
| ZL1BY | 193 |
| W6AVM | 192 |
| W6HX | 192 |
| WØSQO | 192 |
| VK2NS | 191 |
| W6RW | 190 |
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| VK3JE | 189 |
| ON4JW | 189 |
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| W6EPZ | 189 |
| WØNTA | 188 |
| W6AMA | 186 |
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| W6RLN | 185 |
| W6SA | 184 |
| KH6VP | 184 |
| LA7Y | 182 |
| WØELA | 182 |
| W6KRI | 181 |
| W6IFW | 180 |
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| W6WWQ | 172 |
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| W6EAK | 163 |
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| W7OY | 163 |
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| W6PDB | 161 |
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| W6PUY | 160 |
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| W6MHB | 160 |
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| W6CYI | 157 |
| W7BD | 157 |
| WØOUH | 157 |
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| W6QD | 157 |
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| VK2QL | 151 |
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| W6FHE | 150 |
| W6EYR | 150 |
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| W3OCU | 210 |
| W3IYE | 209 |
| W1ENE | 209 |
| W1BIH | 209 |
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| W7ETK | 132 |
| W6TE | 131 |
| CR9AG | 131 |
| W6WJX | 131 |
| W5CPI | 130 |
| W7BTH | 129 |
| OE3CC | 128 |
| DL1DA | 127 |
| W9NZZ | 126 |
| VR5PL | 124 |
| W6MI | 124 |
| W6MUF | 122 |
| KG6GD | 121 |
| DL3DU | 118 |
| W7HXG | 118 |
| W6NRZ | 117 |
| KL7UM | 117 |
| ZS2EC | 116 |
| W6JWL | 114 |
| W6EYC | 114 |
| KL7GG | 114 |
| W6VAT | 110 |
| W6FBC | 110 |
| W7GXA | 105 |
| W6LEV | 103 |
| W7LEE | 91 |

### 38 Zones

| | |
|---|---|
| W2HMJ | 190 |
| W2PUD | 180 |
| CM2SW | 174 |
| W8KPL | 173 |
| W8FJN | 167 |
| W8EYE | 158 |
| W2SHZ | 158 |
| W2GVZ | 158 |
| W2UEI | 156 |
| LU7CD | 155 |
| 4X4RE | 146 |
| W3LVJ | 145 |
| W8ZMC | 143 |
| ZS2AT | 143 |
| WØAZT | 143 |
| ZL3AB | 143 |
| VE2BV | 140 |
| W9FKH | 135 |
| VE3ACS | 134 |
| W4FPK | 131 |
| W2PQJ | 130 |
| W3ZN | 129 |
| WØRBA | 127 |
| W9MZP | 126 |
| FE8AB | 126 |
| W9TB | 122 |
| GW4CX | 120 |
| W6ETJ | 119 |
| WØFET | 118 |
| VE7VC | 116 |
| W6CAE | 113 |
| KL7PJ | 109 |
| W7EYS | 107 |
| DL3AB | 103 |
| W6FXL | 92 |
| C1CH | 84 |

### 37 Zones

| | |
|---|---|
| W1KFV | 171 |
| W2PQI | 100 |
| W2ZA | 160 |
| W3WU | 157 |
| W4IWO | 149 |
| W3FYS | 147 |
| ZL3CC | 143 |
| GM2UU | 142 |
| W4ML | 140 |
| W2WC | 136 |
| W9HUZ | 134 |
| W2AYJ | 133 |
| DL1AT | 133 |
| W7HKT | 130 |
| W4DIA | 129 |
| VE5JV | 126 |
| W1APA | 125 |
| W9LNH | 122 |
| VE1EA | 116 |
| W6AX | 110 |
| WØFWW | 108 |
| W7PK | 104 |
| W8HSW | 104 |
| W2BLS | 99 |
| OH3OE | 93 |
| KL7KV | 88 |

### 36 Zones

| | |
|---|---|
| W4HA | 151 |
| W9WCE | 136 |
| W5MET | 130 |
| OA4AK | 128 |
| VE1PQ | 128 |
| I1IZ | 126 |
| W3AYS | 124 |
| F8TM | 124 |
| W9LI | 124 |
| SV1RX | 119 |
| W2BF | 115 |
| 4X4BX | 112 |
| OE1FF | 111 |
| G3BPP | 111 |
| W5CD | 108 |
| EA1AB | 103 |
| W2JA | 102 |
| W5BK | 99 |
| VE8AS | 98 |

### 35 Zones

| | |
|---|---|
| W2OST | 146 |
| W1BFT | 141 |
| W4DHZ | 132 |
| W9CKP | 132 |
| W5FXN | 125 |
| OZ7BG | 124 |
| W5JUF | 121 |
| G6QX | 121 |
| W6ZZ | 120 |
| W9RQM | 119 |
| CO6AJ | 119 |
| W9DGA | 115 |
| W9FNR | 114 |
| W8AVB | 113 |
| WØGBJ | 110 |
| W2HAZ | 109 |
| KZ5IP | 108 |
| ZL1QW | 99 |
| KL7CZ | 69 |

### 34 Zones

| | |
|---|---|
| W1DEP | 150 |
| W8NSS | 133 |
| W1NLM | 130 |
| W4IYT | 127 |
| W3MZE | 126 |
| W1MRP | 118 |
| W5NTT | 107 |
| W8JM | 102 |
| W6VBI | 100 |
| G2BVN | 91 |
| W9WEN | 83 |
| W8PCS | 80 |
| W6EUV | 66 |
| W6OKL | 61 |

### 33 Zones

| | |
|---|---|
| W4QN | 110 |
| W2SEI | 100 |
| W8QUS | 85 |

## PHONE ONLY

### 39 Zones

| | |
|---|---|
| W6DI | 192 |
| VQ4ERR | 187 |
| W6VFR | 173 |
| HB9DS | 164 |
| W7HTB | 161 |
| VE7ZM | 145 |
| DL1FK | 125 |

### 38 Zones

| | |
|---|---|
| W2BXA | 168 |
| W4CYU | 160 |
| ZL1HY | 157 |
| W1HKK | 153 |
| W6KQY | 151 |
| W9NDA | 149 |
| G8IG | 147 |
| F9BO | 143 |
| W6AM | 137 |

### 37 Zones

| | |
|---|---|
| XE1AC | 192 |
| W1JCX | 179 |
| W9RBI | 175 |
| PK4DA | 170 |
| W3LTU | 169 |
| W8REU | 163 |
| CE3AB | 163 |
| W7MBX | 158 |
| VK3BZ | 158 |
| W6WNH | 157 |
| G3DO | 155 |
| G2PL | 154 |
| W6PXH | 153 |
| W8BF | 146 |
| W3JNN | 144 |
| W6TT | 139 |
| F8VC | 124 |
| W7MBW | 107 |
| C1CH | 83 |

### 36 Zones

| | |
|---|---|
| W1NWO | 174 |
| W1MCW | 171 |
| W1BEQ | 164 |
| W9HB | 160 |
| W4ESP | 152 |
| W2DYR | 140 |
| W9BZB | 139 |
| GM2UU | 135 |
| W9HP | 131 |
| W6PDB | 130 |
| W4INL | 129 |
| W1FJN | 128 |
| W8AUP | 128 |
| G6BW | 127 |
| VE7HC | 123 |
| VE3BNQ | 122 |
| WØHX | 120 |
| W3GHD | 114 |
| W8CYL | 112 |
| W3DHM | 96 |
| W6SA | 92 |
| F8DC | 87 |

### 35 Zones

| | |
|---|---|
| HC2JR | 158 |
| W4HA | 142 |
| W6PCK | 141 |
| W9RNX | 140 |
| W2RGV | 136 |
| W6CHV | 133 |
| W2GHV | 131 |
| HC2OT | 131 |
| WØEYR | 131 |
| W9BVX | 130 |
| WØPRZ | 124 |
| W9CKP | 124 |
| G8QX | 123 |
| W8ZMC | 122 |
| WØPUE | 117 |
| W5LWV | 108 |
| W4OM | 106 |
| W3PA | 105 |

### 34 Zones

| | |
|---|---|
| W5ASG | 141 |
| LU8CW | 129 |
| W5KC | 125 |
| W2ZVS | 125 |
| W4LZM | 124 |
| I1AXD | 124 |
| W6UZX | 123 |
| W8BIQ | 122 |
| W5JUF | 117 |
| WØANF | 115 |
| W1BPH | 105 |
| W8UIG | 100 |
| W4IWO | 100 |
| W8QBF | 92 |
| WØBFB | 70 |
| W2NXZ | 65 |

### 33 Zones

| | |
|---|---|
| W9MIR | 131 |
| W5ALA | 122 |
| W9WCE | 119 |
| W3KT | 118 |
| W2ZW | 115 |
| I1VS | 115 |
| W8BFQ | 114 |
| W8SDR | 113 |
| W8NSS | 112 |
| VE3BQP | 108 |
| W2PQJ | 100 |

and it looked pretty good with the standing wave ratio 1.5:1, but when he hauled it up on the pole it was 5:1. . . . W1FH has his new 3-element rotary now resting happily on top of his 70 foot steel tower. I don't know how a beam can be happy, but maybe you can figure it out. Anyway, Charlie is at a new QTH, having been off the air for about five months, and says the new spot is probably a little better than his old one. Oh, woe is us. His first one with the new deal was EAØAB, 14305 phone. . . . Welcome to OZ7BG to the Honor Roll. Incidentally, his father is OZ7EU, who happens to be the only other OZ in the Honor Roll. . . .

G6QX has been troubled with TVI, so he has put his 7 and 3.5 megacycle finals in a fairly large size, air tight, metal box with a blower supplying air for cooling purposes. Bob says he plans on doing the same thing with the other two finals while conditions are what they are.

W4VE thinks his sojourn in Washington is about over, and within a few months you may see him setting up shop in another call area. Doc has done so much of this during the past 15 years that he thinks practically nothing of it. Is that right, Doc?

KH6BA said we were a little confused when we mentioned sending some gear to VR1C. It wasn't VR1C, it was VR1F, who happens to be the only one operating 20 meters and is on Canton Island, which shows up on the country list as British Phoenix. The operator is Don Schroder. There is another Ham there, VR1E, but from the looks of things, he won't be on 20. He instead will make the 10 meter boys happy.

KH6BA has regular skeds with VR1F with the thought of getting him to QRO and get a little DX minded. VR1C is operated by the U.S. Coast Guard on Makin Island, which is in the Gilberts. VR1A, 1B, and 1D are on Tarawa, which is also in the Gilberts. Most of this info was passed along to KH6BA by VR1B, who as Wireless Officer in the Colonial Service, issues all of these calls. Andy, who is the KH6 QSL manager, has accumulated quite a few cards and letters addressed to VK4SI/VR1 and he is returning them to the senders, as he is quite certain the station was NG....

EAØAB is apparently new to DX, but is learning fast, and apparently with the right spirit. From what I have seen, he QSL's rather promptly. In similar letters to W6AM and W4TO, EAØAB indicates that every time he gets on the air there are at least twenty or twenty-five W's calling him, and he figures it might take two or three years to work 25,000 W's and then he can begin working other countries. He says he has only been on the air a month and he has great trouble with W QRM. At the present time he is using a couple of Hertz antennas but is building a rotary, which he may have in operation by the time you read this. Here is a quote from one of his letters: "I have only 100 watts, but it is sufficient to go out on the air and make all USA go behind me, the same as many dogs behind one cat." Sense of humor, eh what?

It might be of interest to you, since it is puzzling W9HP, that VK9JC counts the same as the territory of New Guinea. The station is located on Los Negros Island. This, of course is separate from Papua territory. . . . While on this country business, there are a flock of stations falling under the country of Antarctica. For example, CE7's, VP8's, and LU3. Not all of these with this prefix, of course, are in the Antarctic area, but regardless of the country designated by the prefix, they count as one country.

PY1AHL tells me that Brazil has now authorized operation of c.w. from 21.0 mc to 21.1 mc, and c.w. and phone from 21.15 to 21.45. By the same token, they lost 50 kc. on the 20 meter band. So don't be surprised if some PY asks for a cross band check with him being on the 21 mc band.

W4LZM says it looks as though he is being transferred from Jacksonville, with a probable destination being the Bureau of Aeronautics in Washington. . . . OK1VW adds a batch of new countries but is still waiting for a card from C8LS for his 40th confirmed zone. . . . W4CY says some of the boys don't think he ever got a card from AC4NC, and he occasionally gets the 'horse laugh." We saw the card, and W4CY has a WAZ certificate.

We are glad to add I1AXD to the phone section of the Honor Roll. . . . SM7MS still needs Zones 23 and 39. At this time, it looks a little rugged to get anything in Zone 23, but 39 is still very possible. SM7MS, like most everyone else is having trouble getting QSL cards out of certain stations. I guess this is a problem that we just can't overcome 100%.

Bob MP4BAL, and his XYL, Cobi.

A lot of the boys want me to publish a list of the stations that don't QSL. To this I say, "Oh please now." Many of the stations you would like to have on this black list are pretty well known as "not QSLing." Some of these stations have written me giving their views on why they do not send a card. Quite a few of the reasons were brought on by W stations, and in many instances where I may not agree with them, they are entitled to their own belief on why they do or do not send cards. On the other hand, certain stations that some of you would like on this black list do QSL, maybe not to you, but to some of the others. Obviously, you can't truthfully say that these fellows do not QSL—they just don't do it 100%. Up to the present time, I haven't felt like sticking my neck out too far on this subject. It seems to be out continually on one thing or another, and I'm sort of in favor of keeping on my shoulders what is left of the head. Maybe one of you fellows would like to stick your neck out and a "letter to the editor." Don't all rush for the honor, as I don't know that we would print them anyway. The above just goes to show you what a change of the weather will do.

*(Continued on page*


## Conducted by E. M. BROWN, W2PAU*

THE VHF DX SEASON CAME TO A SUDDEN END for many of us on Saturday, November 25, 1950. A couple of innocent-looking storms which had been hanging off the Northeast Atlantic coast combined forces and swept inland, bringing winds of hurricane proportions to the entire Northeastern section of the country. As the storm moved to the west it met snow-laden air from the central part of the country, resulting in rear-record snowfalls in Western Pennsylvania, Ohio, West Virginia and Tennessee and adjoining states. The results were catastrophic for a very large percentage of the v.h.f. workers who had let their ambitions for bigger and higher antennas outstrip their abilities to design storm-proof structures!

Few of the brotherhood escaped unscathed. W2BV's 32-element beam snapped off the top of his tower like a toothpick. W2BAV, it is reported, lost just about all of his mountain-top installation. W2NLY was fairly lucky-his beam stayed up, but was battered and bent almost out of commission. W2JAV's tower folded over. K2AZ, situated on the beach at Sea Isle City, lost his entire layout, including the cottage and the tower. Here at W2PAU we were fortunate in escaping serious damage when the 50-foot A frame crashed down on the roof. Our estimate of the mortality rate on v.h.f. beam antennas in the Northeast is about 50%!

Needless to say, the bands have been abnormally quiet since this debacle! Some of the more persistent of the gang are showing up with hastily-rigged indoor antennas or quick repair jobs. But it will be quite some time before the big guns are all back in action again.

The news of the storm has over-shadowed the more routine news of band openings, DX, etc. In fact, cut off as we have been from our usual long-range QSOs since the loss of our main sky-piece, we have not heard any late news about outstanding work on our u.h.f. or v.h.f. bands. This "quiet period" has given us a good chance to do some serious thinking about another aspect of our hobby—one which seems to have been neglected to a great extent lately.

### Emergency Preparedness and Civil Defense

At this time Civil Defense and Disaster Service planners are working overtime in their attempts to prepare their communities for any forseeable emergency— man-made or natural. To date, the status of the radio amateurs in this planning has been very poorly defined. In the event of a peacetime disaster which might disrupt normal communications, the amateurs are and have always been ready to lend assistance wherever possible. But in the event of war—??? During the last two major conflicts, radio amateurs as such were ordered off the air immediately. Their facilities and experience, their networks and organizations, were virtually disregarded in the gearing of the nation to a wartime regime.

Next time, (if there must be a next time), we are assured, things will be different. If we show that we can do the job, we may be used as part of the Civil Defense Organization. On what basis? Facilities for local communications will be the primary requirement, and of all our bands, ten, six, and two meters will be the most suitable, and most probably available. Ten meters might be used on a conditional basis, as the DX abilities of this band would have an important bearing on security matters in time of war. All of which explains why we're discussing this matter in our 'VHF" column.

We certainly have a long way to go before we can offer any sort of a workable emergency-comcunications plan utilizing six-meter or two-meter amateur facilities to the defense planners. In many of our larger cities, local v.h.f. activities has been maintained at a uniformly high level. In most of these cities a reasonably large number, of v.h.f mobile units have been put into service and operated with surprisingly successful results. However, in many other sections of the country (not excluding some of our largest cities) activity on the v.h.f. bands has been so sporadic and scattered that there has been little incentive for the gang in these areas to develop mobile gear of these bands.

We find it hard to explain the reluctance of some of the hams to exploit the higher bands. In many ways our two-meter band is the best band for local work (out to 50 miles or more) that we have available at this time. It is virtually immune from the effects of natural QRN. The problem of QRM from DX stations is just about non-existent. Antennas can be made fairly small and inconspicuous, if local coverage is all that is desired. Indoor antennas, even high-gain beams, are practical. Due to the absence of QRM, low power is generally sufficient to provide solid coverage of any of our biggest cities. The problem of TVI should be easier to cope with than on any of the lower frequency bands, since none of the harmonics of the two-meter band fall into TV channels.

Mobile operation is in many ways more practical here than on the lower bands. Even if the security considerations mentioned above did not dictate the use of the v.h.f. bands for civil defense planning, the qualifications of the bands themselves should!

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## Two-Meter Mobile Considerations

Mobile operation on the v.h.f. bands poses some unique problems. Although it is possible to get on the air by tossing a simple modulated oscillator and a super-regenerative receiver into the car and hanging a "J" antenna on the window frame, this type of installation is certain to lead to disappointments. In just about all sections of the country the trend on the two-meter band has been toward the use of superheterodyne converters working into narrow-band i.f. amplifiers for fixed-station receivers. This implies that the station equipped with a modulated-oscillator transmitter is not going to be able to communicate successfully with a majority of the fixed stations. Nor is the MOPA approach much better. It seems to us that the only proper approach to the problem of mobile transmitter design is to assume that crystal control is necessary. Of course, a stable VFO would be just as good, but have you considered all the problems involved in holding a VFO to a frequency stability of about twenty parts per million as it is jostled around in a mobile installation? That's what's needed, if you're going to work most of the stations now on the band!

The problem of transmitter power is another tough one to decide. In the Philadelphia-Camden area the average power input of the two-meter mobile transmitters now on the air is in the order of 5 watts. This is quite a bit less than the average input of the ten-meter mobile gang, and may account to a great extent for the somewhat poorer coverage which the two-meter boys are experiencing. The concensus now seems to be that we should aim a little higher—perhaps inputs in the order of 10 watts would be a better compromise between battery-drain and results. Most of the commercial mobile services have found it necessary to go to still higher power for consistent coverage. The most popular mobile transmitters for police, taxi, telephone and similar applications run in the order of 50 watts input. (Nevertheless we have had a lot of enjoyable QSOs during the past two years on two meters with our mobile rig, which runs 2.25 watts input to the pair of 6C4s in the final. Don't let this talk about high power scare you off!)

The ideal receiver for v.h.f. mobile work would probably be a narrow-band superhet, with all possible means of noise elimination. Although this is easy to say, it sure ain't easy to do! As many of the fellows who have tried to build converters for their BC receivers have found, the problem of oscillator stability is nearly impossible to lick without going to a crystal-controlled high-frequency oscillator. It is probable that if the demand for two-meter converters suitable for feeding into the typical car radio continues, that crystal-controlled double superhets will come into popular use. Our own opinion is that they would be mighty tricky to tune while bouncing along in an automobile. (And there will still be plenty of other stability problems!)

The next approximation to the ideal would be the use of a somewhat wider-response i.f. system, to minimize the problems of receiver oscillator stability. This is a good, practical solution, and has been used successfully by many of the gang. The bad part about it is that it requires virtually another complete receiver in the car, with the attendant battery-drain and space problems. However, if you can see your way clear to mounting a 522 (or equivalent) i.f. system somewhere in the car—it may be remotely located in the trunk—you'll be well on the way to having a good amateur mobile two-meter receiver. One way to cut down on the number of tubes required in the i.f, noise limiter, and audio system of this type of installation, is to go to a super-regenerative second detector. Properly handled, this circuit can give performance as good as almost any other type of detector under typical mobile conditions, and the band width can be made sufficiently small to eliminate most of the QRM problems which may be encountered. The noise-limiting action of a super-regen detector is quite effctive, and is probably as good as any other type of AM noise limiter.

The easiest solution, and the one which has been adopted by the majority of the mobile operators within our circle of acquaintances, is to use the old, familiar straight super-regenerative receiver. Bad as this may sound, it's a lot better than nothing! It is essential to include an r.f. amplifier as part of any super-regen receiver. It is virtually impossible to receive even very strong signals in the neighborhood of any super-regenerative receiver without an r.f. pre-amplifier—and a lot of those with r.f. stages are still pretty offensive. But an r.f. stage does help to cut down radiation and should be included even though the improvement in performance does not seem to justify the added complexity and size of the amplifier. Let's not rule out the "hiss-masters" — without 'em there'd be a lot less guys on two-meter mobile today! And there is one real bonus in using non-selective receivers in the cars—they can, in a pinch, receive the signals of modulated oscillator transmitters, and if we are ever called upon to provide battery-operated "handy-talkie" equipments there's a good chance that they will be just that simple.

Some of you are sure to be wondering why we have said nothing about FM. Although there is a great deal of evidence to the effect that the use of FM would be advantageous in a mobile system such as we are discussing, the fact remains that there are very few ham stations equipped with good FM receivers. And there is no standardization as to deviation or a.f. response characteristics. Unless an entire network is set up with standardized FM equipment, most of the advantages of FM would be lost. The use of AM (and for mobile, the more AM the merrier!) makes it possible to receive the signals on almost any ham receiver, even the broadest super-regens.

Now for the final consideration in the mobile installation—the antenna. Here we are going to sneak in a dig to the effect that it is a lot easier to rig up a mobile antenna using vertical polarization then using horizontal! But we realize that many sections of the country are firmly in favor horizontal—and in these sections the mobile should equip his car with some sort of horizontally polarizaed aerial system or take a licking of 3 or 4 S-units!

There have been several proposed solutions to the problem of designing an omni-directional horizontally-polarized array suitable for mobile use. The "Halo" is one answer—but more than one should be stacked to give reasonable gain. The "Turnstile" will give a general-coverage pattern but it takes four dipoles in a stacked turnstile arrangement to do the work of a single vertical

dipole! A "swept-back" dipole or "Ram's Horn" system has been used in some areas, for example, on the FM-equipped busses and trolleys in the Washington, D. C. area. In many cases, it is practical to mount a small directional array on the car, perhaps with means for rotating it from the inside. This is the ideal arrangement, as antenna power gain goes up fast when directivity is employed. (And here the horizontally-polarized guys are lucky—those elements are sure twig-catchers!)

There are fewer problems involved in a vertically-polarized installation. A simple quarter-wave rod operated as a ground-plane radiator against the metal top of the car does a pretty good job. Many of the boys have found that a vertical cowl-mounted standard broadcast set whip will do O.K. if it is entended out to about ¾ wave length. (Apparently it works as a form of J" antenna, with the windshield support post forming the other leg of the matching stub of the "J"). Any form of dipole antenna, if arranged so that a substantial part of the radiator extends above the top of the car, will serve the purpose.

But at best, these antennas are a lot smaller than those used by the ham mobile operators on the lower bands. If we are to equal their accomplishments on the v.h.f bands we must use larger aerials. A two-element vertical colinear mounted on the rear bumper of a car is about equivalent to the typical ten-meter whip in size. Seems to us that it would do a better job than an 18" whip on the roof! We can hope to gain more through the development of bigger and better antennas for mobile use than in any other department. And don't forget the benefits of height. If you plan to operate from the car in a fixed position for any length of time, why not bring along a length of extension feeder and a long pole for the antenna—it will help a lot!

There's a lot more that we'd like to say on the subject of v.h.f. mobile operation, but perhaps we've already overdone it in this space. The subject is of great interest to many of us. To those of you who can't see much sense in even talking. about v.h.f. mobile work, we apologize, and we'll be getting back to DXing in the near future!

## The Month in Review

October 24 to 27: The two-meter band was in good shape for long-range tropospheric contracts in the Gulf Region. W5DSB heard W4HHK early in the evening of the 24th and, during the Gulf Coast Emergency Net drill, caught W5DCV of Austin. Later he worked W4HHK, W5QIO, heard W4KIP of Atlanta, but no QSO resulted. Activity was at a high level, with W5QME, W5EYY, W5SM, W5NLP, W5JBW, W5RCI and W5AOA all on deck. During the evening of the 25th W5AGJ of Dallas got W5JTI and W5MKP. W5FSC got Arkansas for his 5th state. W5FEK had 4 contacts with W5JTI in one evening! The 26th seems to have been the best night of this opening. W5JLY of San Antonio got W5EM near New Orleans, and there were many opinions expressed that if there were any real activity in Georgia and Alabama, working these states would have been a cinch!

October 28: An aurora opening affected both the six and two meter bands. On six meters, W3OJU worked W1PWW at 1435 EST. VE1PQ heard several W1s between 1450 and 1506 EST. W4AO was active on two meters, and his log shows a good cross-section of the activity, with W1s IZY and HDQ, W2PV, W3LNA, W3NKM, W8DUL, W9s SUV, WOK, EHX, EGH and VE3AIB, and all worked; and W1MNF, W2NLY, W4IKZ, W8WXV and W8FQK heard but not worked. The aurora session apparently continued until about 1930 EST. The effects of this ionosphere storm continued throughout the week with occasional scattered reports of auroral effects noted on six meters. The only reported sporadic E activity in the northern hemisphere during this period was a contact between W7FGG and W7JPA at about noon on the 29th. Considerable six-meter DX activity, possibly of the sporadc E variety, was noted in South America during this period, however.

October 29: A two-meter troposphere opening across the northeast part of the country gave several of the boys in Central New York state a chance to swell their states-worked totals. W2ZHB got W9NSF, who was booming into Rochester with an S9 signal. Other W9s worked by W2ZHB were FBJ, ASM, GSY, ZHL and GWL. Others in the Rochester area who participated in this one were W2UAD, W2TKY, W2YYI, W2RTB, W2UXP and W2ORI. W9UIA got W2GBK for state #10 and W8NNF for state #11. W9GSY sez that he sat there and worked 8 W2s, 2 W3s and 2 W8s, and didn't even go out to turn the beam once! This was apparently a typical ground-wave opening; much of the area affected was covered by a heavy fog. No signals west of the 9th district were reported heard in New York, and apparently the opening did not extend much beyond Rochester in the East.

November 10: WØBJL reported that he had several nice two-meter contacts over the 300-mile plus path between St. Louis and Wisconsin.

November 13-19: W7QLZ reports that two-meter signals between Phoenix and Tucson were the best he had ever heard them. On the night of the 15th W7NVN was booming into Phoenix like a local.

November 18: The six-meter band came to life with a nice sporadic E session during the late hours of the morning. W8UZ and W8NQD reported W5QME, W5DSB, W5FSC and W4MS between 1050 and 1155 EST. W4MS heard the W9MBL Beacon, and then went on to work W8NQD, VE3AET, VE3AXM, VE3ARV and W8UZ. November 25 to December 5: This period will probably go on record as being just about the worst for v.h.f. activity of the entire year. We heard that there was a bang-up ionosphere storm scheduled. Did anyone hear any results from it? We were too much concerned about storms in the lower atmosphere to worry much about the ionosphere. And now, just as we have most of the debris cleared away, come reports of new hurricane warnings posted on the Northeast Atlantic coast. We hear that tornadoes have cut a wide swath through the Midwest Section. Floods threaten in many sections as the warm spell melts the heavy snowfall of last weekend. Well fellows, let's put 'em back up bigger and better this time!

## In the Mail

W5FEK tells us that he is building a new 15-element two-meter array using 5/8-wave spacing between the stacks. He passes along the information that the Metal Goods Corp. sells 1/8-inch diameter hard drawn aluminum rod which is as cheap as

*(Continued on page 51)*


Conducted by RALPH V. ANDERSON, W3NL*

WITH winter approaching many will be making "southern" trips. If you plan to visit Mexico, be sure to investigate the possibilities of operating mobile while in this country. For further information you might contact W9LLX, or XE1PA/PB who may be able to assist you. One item worthy of repetion is to make a schedule with someone in your home town with definite times and frequencies even though you know you will not be in his area. Quite often you can contact a third station who can hear both of you and traffic can be relayed. Because of many requests we once more ask all operators to be sure and indicate on a "mobile" qsl that the station is mobile so he can get proper credit for mobile operation. Preferred method is to follow the call by the word "mobile" or "/m". This seems to be the pet gripe of mobile operators, leading by a wide margin the one about the high-power boys sliding in on their frequency.

### The Akron Group

The Akron Group consists of about 30 mobile units in the Akron area, practically all of which are ten meter phone. The group operates more or less as a branch of the Buckeye Shortwave Radio Association, but the mobile group is not limited to members of the Buckeye Club. The net frequency is 29.560, with 29.520 as an alternate. Activities are controlled by a fixed Net Control station. The group has plotted signal strengths between mobiles spotted at various strategic points throughout the area and the Net Control and other fixed stations in order to provide the best signal propagation routes from one point to another. As an example of activities a "hidden mobile hunt" was staged. Activity was controlled by the Net Control station who plotted signal strengths on a map of the city. It did not take long to locate the station which "just happened" to be conveniently by a tavern and the proper "refreshments."

As is usually the case most of the fellows operate ten although a few of them are multi-band. W8LBH is just completing an aeronautical mobile installation.

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* *Send contributions to R.V. Anderson, 2509 32nd St., S.E., Washington 20, D. C.*

### Primary Protective Circuits

One of the greatest problems of mobile installations is that of fusing the dynamotor. At the high currents-low voltages encountered, resistance values that normally would be ignored will cause considerable loss in high voltage. The large size wire used from the battery to the dynamotor creates the problem of inserting an adequate fuse, or circuit breaker. One of the most common fuses employed is the "60 amp" type usually employed in commercial circuits. Physically this type works excellently, and connections are easily made with large wire. One thing sometimes overlooked however is that a 60 amp-115 volt fuse is not a 60 amp-6 volt fuse; however this can be remedied by installing lower amperage 115 volt fuses. Many of the fellows use the circuit breaker from the PE10 unit. Two of the circuit breakers are rated (1) 40 amp release with 7 amp contacts and (2) 7 amp release with 30 amp contacts. Most fellows find however that the former alone will serve satisfactorily even though the contacts are rated only 7 amps.

In any event be sure to fuse all circuits. We still recall the qso we overheard when one fellow didn't use a fuse and a short-circuit resulted in burning up his car.

### Maritime Mobile Amateur Radio Club

Activities of the MM's have been hampered somewhat by the peculiar behavior of the ten meter band. Some of the gang have made some excellent contacts while within the three mile limit when they are no longer classed as a maritime mobile and therefore are not restricted to the ten meter band.

Additional fixed-stations qualifying for the MM certificate by working 30 MM's are W6GA W3AS, W1RYS, W2MEG, G6KC, W4PO W2DFS, and W1ASJ. When you forward your 30 qsl's to W3NL for confirmation purposes, do not include return postage. The club pays this expense and *requires* that the Secretary return cards by registered mail.

### National Calling Frequency

Don't forget that 29.640 has been established as the national mobile calling frequency. There are a great many standby receivers constantly monitoring this frequency.


**Conducted by LOUISA B. SANDO, W5RZJ***

HOW MANY OF YOU have worked YL W6HBO /MM? That's right, /MM. Billie Adels, who hails from San Francisco, is, to the best of our knowledge, the only woman radio operator in the U.S. Merchant Marine. Seems we're rather late in hearing about it, but for the past six years she has sailed aboard foreign and American ships; on foreign ships during World War II because the U.S. government wouldn't allow U.S. shippers to employ women. Right now, and for the past year, she's on the *SS Gulf Banker,* plying the Caribbean Sea.

We heard about W6HBO from YLRL P/C W1QON, who in turn learned about her from W8DQO, Marge, who has worked W6HBO/MM several times. Marge, by the way, has gone all out for contacting /MMs since she first got on the air in January '49. Holder of No. 1 /MM Honorary-Associate certificate, to date she has worked 115 /MMs, 86 confirmed.

Seems that *CQ* really gets around—and that the YL's column gets read! A note from W2EHR, Marguerite Beneke: "Tex and I moved into a hotel in Indianapolis several days after *CQ* (Sept. '50) appeared with my writeup in the 'YL's Frequency'—and it seems that every ham's MYL had read it! Thought you'd like to know that they were all in accordance with my *first* reactions and wanted to know *how* to change and enjoy ham radio! Tex and I left Indianapolis after a week, ready to collapse from the 24-hour activity on 10 meters. We were given a royal welcome—even a hasty hamfest occurred Labor Day—and all due to your *CQ* article. If only 10 meters would open now while my call is familiar to *CQ* readers, maybe I'd get out better with my little 'peanut whistle'!"

## YL/OM Contest

Initiated last year, and found to be so popular it will be continued, is the YL/OM Contest, sponsored by YLRL. Here are the dates; mark 'em down in your calendar of ham activities: Saturday, February 24th, 6 p.m. EST, to 11:59 p.m. EST Sunday, February 25, 1951. Any and all licensed OMs are eligible to participate; YLs must be members of the YLRL. Operation may be phone, c.w. or both, with cross-band and c.w. to phone QSOs permitted. Exchange QSO number and location. For scoring count one point for each station worked (YL to OM, or OM to YL *only*); multiplied by the total number of States, Canadian Provinces, and Countries (outside W/VE) worked. Stations and multipliers count only once, regardless of bands or modes of operations used. Logs must be postmarked not later than March 3, 1951, and mailed to YLRL V.P.: Dorothy Willett, W8UDA, 3513 Fleming Road, Flint 5, Mich. Confirmations are not mandatory, but will assist in cross-checking if necessary. Please send in logs regardless of size of score. Prizes: For the highest OM score, a gold loving cup donated by W8UDA. For the highest YL score, a silver loving cup donated by W1BFT. Both cups will be awarded on a yearly basis, with a three-time winner obtaining permanent possession. Awards will be made to the highest phone scorers as well as to the highest c.w. scorers, both YL and OM and, in addition, to the second and third place scorers in the over-all competition.

Make it a date!

## Here And There

Another YL has been appointed as SCM. In the middle of October W6YYM, Ellen White, took over those duties for the San Diego Section. "SCM means work," says Ellen, "but the type of work I enjoy very much, so hope for cooperation from all S.D. area." W6YYM, by the way, is now attending State College with the ambitious program of an engineering course.

Other S.D. news: W6IGP, Carol, had to resign as president of the club as she's working nights at CONVAIR. W6YXI, Neva, is taking over, and we hear there are big plans under way for the club's annual Christmas dinner, to which members' OMs and jr. ops are all invited.

Latest convention, and about the last for the season, we guess, was at Burlington, Vt., in October. It brought together these YLs: W1MDV, W1RYJ, W1SAJ, W1MWI, W1FTJ and VE2HI.

Romance, wherever it may be and in whatever manner it may be carried on, always pulls heart strings. Recently, way out in this far corner of the U.S., we came across this headline in the *Alberquerque Journal*: "W4KYI and W3LID Wed After Radio Courtship." A good writeup, too. Seems that on October 30th W4KYI, Frances Lee Brigman, and W3LID, Jack Krepp, were married at Kannapolis, N.C., after a courtship via ham radio to which other hams had been listening with interest for nearly a year. And to keep the ceremony really a ham matter, W4GOB performed the ceremony, W4IYM was best man, W4LSB was matron of honor, W4CXI gave the bride away and W4NJG stood by to receive congratulatory messages for the couple. After giving the bride away, W4CXI, Frances' father, "broadcast" the ceremony by giving a running account of it to W4NJG, but, of course, other hams all over the East Coast listened in and radioed their congratulations.

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* *Send all contributions to Box 35, Jemez Pueblo, New Mexico.*

FB Frances and Jack, and congratulations from all the rest of us!

**Travelogue**

Due to space limitations in December *CQ*, the account of our visit to YLs en route to the West had to be held over. Picking up the track again, as you saw from the new call (and how we hated to give up OOH after having it in three districts!) we did make it back to New Mexico. From Chicago, where we had to QRT the story of the first part of our trip, we headed south to St. Louis, and half way mark across the country.

Stopping just outside of St. Louis at Alton, Ill., W9ILH, Carrie Jones, and her OM, W9ICN, made us welcome. Carrie had been working 20 phone all day with the TVI-proof station ICN had newly completed for her, and a beautiful set-up it is. A 75A receiver, a 32V2 (completely TVI-proofed by ICN by the dint of much time and labor) as an exciter into a kw. final, and a 20-meter rotary atop a 60-ft. steel tower. Both ICN and LH have been on the air for twenty years. Now Dale does all the building and Carrie all the operating—what we'd call an ideal arrangement! A former secretary-treasurer of YLRL, Carrie operates c.w. and phone, both DX and rag-chewing, has 35 wpm CPC, has twice been SCM, has held commercial tickets and during the war taught communication at Scott Field.

During the evening WØDBD, Leta Willis, and her OM, WØNEV, came over to rag-chew and we all had fun looking over Carrie's scrapbook of photos, many of them of the YLs at earlier club meetings, Field Days and hamfests. Seems the St. Louis area once had quite a group of YLs but a number of them have now moved elsewhere—W9JTX, etc.

Leta, like Carrie, is an old-timer in ham radio, licensed since 1929. Former president and earlier secretary of YLRL, Leta has been active on most bands, phone and c.w. During the war she, too, taught code at Scott Field, and she has also taught in the public schools. Not teaching this year, we'll be looking for WØDBD on the air.

We had hoped to meet some more of the St. Louis YLs, but the particular evening we were there happened to be the occasion of a meeting of the St. Louis Area Radio Club Council and both WØPFO. Marie Van Aller, and WØGOJ, Alice-May Stewart (who is secretary for the Council) had to attend the meeting. Sorry to have missed you gals, as we especially would have liked to hear about Alice-May's recent vacation trip to Hawaii. We hear that, among others, she met KH6AM, JQ, AEY, FD and FE.

The following day, driving through the rolling Ozark country, brought us to Rolla to visit WØBPE, and his XYL. Having corresponded with Maxine for some time, we knew she had been studying for her ticket, but were surprised to find she had already taken the exam and is now the proud owner of WØ. Maxine, by the way, is working for the Geodetic Surveey while her OM finishes up his degree in EE, then she hopes to finish up her degree, too. Right now they're both on the air on 40 and 80 c.w. using a couple of ARC5's and a BC348 receiver. In addition to hamming we found we shared hobbies of Kodachrome slides and record collecting, so another pleasant evening was stored away for memory.

Leaving early the next morning—for Owen had to get to classes and Maxine to her job — we reached Bolivar, Mo., just in time for lunch with WØRAW, Bertha Bland, and OM, WØFXW. Formerly living in Kansas City, WØFXW recently retired as district chief on K.C. fire department, they sold house and furnishings and bought themselves a 30-ft. house trailer and a Chevy suburban to pull it, with the idea of traveling anywhere fancy happens to take them. Of course, visiting hams will be part of the schedule, and they were at the QTH of WØDEQ when we caught up with them—just in time, too, for they were about to leave for the Rio Grande Valley and Southern Texas. WØFXW and WØRAW are well equipped hamwise for their travels (and all ways, too, in their comfortable trailer). They can operate mobile as well as portable for the suburban is equipped with TBS transmitter and separate converters for 10, 20 and 75, and a whip antenna. In the trailer they have a 32V2 transmitter, NC183 receiver and various antennas to be strung up as the location permits.

While Bertha whipped up lunch in her trailer kitchen, Stan told us how she got her ticket. Seems Stan wanted to learn the code to get his own ticket so he got a key and oscillator and had Bertha send to him until he was copying at about 8 wpm. Then he switched to tapes and over-the-air copying. One evening after Stan had his ticket they were visiting another ham and listening to some c.w. on the receiver. Bertha commented, I can copy that." Stan handed her paper and pencil and she copied solid sections of it, much to his surprise, for it was about 18 wpm. Having learned the code while she sent to Stan, Bertha copied the c.w. in her mind as she did her work in the kitchen, unconsciously building up speed as he did with his tapes, etc. Delighted Stan encouraged her to study theory and had her building equipment in his workshop. Both WØFXW and WØRAW are now Class A so you'll be hearing them on most bands this winter far from the snow flurries and wherever the sun shines warm.

After nearly two weeks of traveling and visiting, pleasant as it had been, we were ready for home so settled down to two days of steady driving across Kansas, Colorado and over Raton Pass down through New Mexico to sunshine, blue skies and life in my OM's Indian village. To all of those who showed us such wonderful hospitality, our sincere thanks. The pleasant hours and new friendships will long be remembered. 33.

YLs attending the San Antonio Convention in August. L. to r., standing: W5PTW, KQG, OQT, MJU, DRA, PFU, OTU, JAD, and PKL. Seated: PTR, QXR, PTI and DQF.

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# The Monitoring Post

*gleaned by* THE BRASSPOUNDER

AMATEUR RADIO IN CIVIL DEFENSE must be carefully planned from many angles, as was pointed out in a recent bulletin issued by a Civil Defense Commission. Stating that ham radio could be of great value if properly used and carefully controlled, it also mentioned there is the possibility that frequencies finally allocated by the FCC for this work may be beyond the capability of most amateur sets. How true! And that is exactly what the amateur has been shouting for—frequencies beyond the capabilities of present ham sets, because we feel that an encroachment on our bands, even for a secondary means of communications in civil defense work, would mean a loss of ham freqs. But we also know that in a matter of minutes we can tune our rigs to freqs that the FCC will come up with, and those of us now operating on bands far removed from what may be allocated can rebuild in a matter of hours to put good signals on CD frequencies.

For civil defense communications we want freqs specifically for that purpose, which would be emergency amateur communications, and these frequencies should be set aside for all emergency amateur communications whenever any emergency arises, whether it be in line with defense or natural disaster.

This bulletin also contends that well-organized saboteurs could easily break into an amateur network of stations and spread false rumors and distorted instructions which would hamper civil defense operations. Is this any different, because it would be an amateur network, from a network of commercial stations, or even the usually dependable network of telephone lines? It would be a cinch for a well-organized group of saboteurs to tap civil defense telephone lines, which would be the first place such saboteurs would strike, to spread false rumors and distorted instructions.

The bulletin concludes that for the foregoing reasons, inclusion of ham radio facilities in local CD communications plans must be carefully considered and no undue reliance placed on them, and that local authorities must assure themselves that the operational plan adopted by amateur radio operators will minimize the possibility of misuse by unauthorized persons.

Obviously, the author of this bulletin has been misinformed about ham radio and does not know the basic requirements of the FCC regarding the use, or misuse, of ham stations, or any other radio station, for that matter. Such things as these are making it difficult for the ham to get going in CD work. The FCC will set up the rules and regulations, and the armed forces and all other interested agencies will be heard by the FCC before such rule-making, and when the time comes to go into actual operation, strict adherence to these rules will be observed, for the ham knows why the rules are made. Civil defense authorities do not have to worry about the operational end of ham radio in CD. They will do well to take the lead in bringing pressure at the top, so that the FCC can get to work on the job of clearing all agencies involved and then allocate frequencies.

The Nortown RC comes up with a new slate of officers for the next year: *VE3AEJ*, pres.; *AAW*, v.-p.; *BSX*, treas.; *BVC*, *sec.*, and handling the several committees are: *VE3DGX, KA, DBU, BLU, BXF*, and *DN* editing the club bulletin. The license plates on the car of *VE3AHA*, Nortown club member, cause a great deal of comment, as it should among the hams: ONT 1950, "73D88." . . . The Schenectady ARA was represented in the fall VHF QSO Party by *W2RMA, IEC, UKA, EFU, YIK, PNQ, GTC, ACY*, and *OPQ*. . . . The Hilltop ARC in Massachusetts has a new set of officers in *W1SPH*, pres.; *CLU*, v.p.; *SPF*, treas.; *SAS*, sec. *W1EJD* is the retiring prexy.

Back from the great beyond via ham radio: On Sept. 21, Pfc. Albert Haebe was reported wounded in a War Dept. telegram to his parents; Sept 28, a second wire told he had been killed in action at Inchon on Sept. 21; on Oct. 2, funeral services were held at a local church for their son; 6 P.M. the same day a third wire came announcing Albert still alive; Oct. 3 the War Dept. telephoned Albert's parents telling them to ignore earlier telegrams, but gave no details; on Oct. 6 a letter from a nephew told of seeing Albert alive and well in a U. S. Navy hospital in Japan; then came a ham radiogram stating: "I hear I was killed. I am all right, up and walking around. I have been so busy getting shots of medicine I have not had time to write. Please don't get mad at me. (Sig.) Albie." And when Albie's father was told by *W2BO*, delivering the message by telephone, the signature was "Albie," he was overjoyed and convinced his son was still alive.

An error in the Atlanta Ham, official organ of the Atlanta RC, had the boys craming to beat the Dec. 31 deadline for Class A tickets, but the following issue gave them a breather when it was announced the deadline was Dec. 31, 1951, not 1950. . . . Last year's Field Day activities proved an expensive outing for the Atlanta RC. *W4ZD*, who loaned his jeep to the club, had it returned to him after the jeep had overturned in an accident. However, the club made good and ZD is ready for winter driving again. . . . The Ottawa RC began another year with election of officers. They are: *VE3KH*, pres.; *BCL*, v.-p. and activities manager; *CBJ*, tech adviser; *AP*, sec.; *VE2AM*, treas.; *BEB* and *BAZ*, publicity; other committee members are: *VE2AJR, VE3PG, OA, ALJ, MX, AOX, BBW*, and *AJU*.

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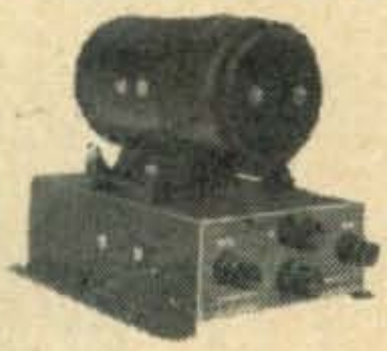
The finest in mobile rigs available today. 30 watts power, class B 100% modulation, with push-to-talk and built-in coaxial type antenna relay. Xmttr complete with tubes, coaxial antenna connector, mounting brackets, etc. *Shipping weight 15 lbs.*

**Complete with Tubes**.....**$99.55**



### SUBRACO DS400

Dynamotor supply. 6 V. DC input, 400 V. at 175 ma. output. Complete with built-in control relays, filter, etc. *Shpg. Wt. 10 lbs*.....**$79.95**

### KOLLSMAN Remote Reading THERMOMETER

There are thousands of applications for this BRAND NEW (Aircraft Surplus) unit. Complete with 12 ft. of tubing in woven copper sleeve. Black Face, Illuminated Dial. Temperature Range from —40° to +120°F. At a fraction of initial cost .....**$ 4.95**

### GRID DIP METER

**MILLEN 90651**
**$55.00**

**VISIT HARVEY'S AUDIO-TORIUM** — Come in and visit our new Sound Department... all these items and many more on working display at all times.

Telephone: LUxemburg 2-1500

hrc HARVEY RADIO COMPANY INC.

**103 West 43rd St., New York 18, N. Y.**

**NOTE: In view of the rapidly changing price situation in both complete units and components we wish to emphasize that all prices are subject to change without notice, and are Net, F.O.B., N.Y.C.**

*When writing to our advertisers say you saw it in CQ*

## DX & OVERSEAS

*(from page 34)*

KL7UM says he has established the SOFODC Club, which means Sweating Out Fade Outs During Contests. He says all members can readily be identified by the absence of finger nails and speaking in a husky whisper—having of course lost their voices. KL7UM winds up by telling me that there is really nothing wrong with him, it is just that his head jerks once in a while.

A couple of the local boys tell me CR5IA has been worked on about 7005, while LI3ECU on 14030, and YI3DYN also on 20, can be had. . . . People are still asking about VQ9AA, but as far as we are concerned, he is still NG. . . . W9TQL has heard PX1Z, PX1Y, and PX2B during the past couple of months. Remember PX1A? However, some day, some time, someone is actually going to show up in Andorra. Until then, you too can sign PX, if you want to join the leg pulling brigade. . . .

I1ER is a real old timer in this Ham radio game—in fact, I recently saw a splash from the New York Telegram dated January 9, 1926, showing that he was the first in a New Zealand-Italy contact. This QSO was actually made on May 31, 1925, and in addition to this, on June 14th of the same year he was in the first Argentina-Italy contact. The station I1ER worked in New Zealand was none other than ZL4AO, who of course everyone knows. Nice going and congratulations, Mario. Keep up the good work.

W9FKC has a batch of QSL cards from AP2F. Although he has mailed them out to the fellows direct, some might have been missed, and if you are one of them, get in touch with Mike. In fact, you might send him a copy of your log, giving complete data of the QSO.

CE3AB has brought his country list up to date with the addition of about 25 or 30 new ones. In fact, it looks like almost a new list in itself. However, he was just one of many who hasn't had the time or taken the time to keep his Zone and Country totals on a current basis. We wish everyone would take this as a hint and bring yours up to date. (ENV says, "This goes for you, too, Herb.") By the way, CE3AB raises a pretty good point. He would like to know if we could indicate in the column when new stations are reported as being worked, if they are on c.w. or phone. In the past I have made a practice always of indicating if the station was on phone, hoping that everyone would assume the stations not labeled would be c.w. Since most of the stuff reported is c.w., I believe we will continue this way, but frankly, I wish the phone contributors were more numerous than they are. If any of you boys happen to be phone operators and haven't tossed anything our way, why don't you take a crack at it, and let's see if we can't get a little more A3 news in the column.

Will somebody please help W7BTH find Zone 34 which he seems to be missing. . . . . W4JDR has word that ON4QF's trip to PX is off for this year. Naturally, this isn't good news, but QF I'm sure will keep trying. . . . W6KQY, who works

# SEE LEO FIRST . . . for National RECEIVERS

**START THE NEW YEAR RIGHT . . .**
**GET ON THE BEAM WITH A NATIONAL RECEIVER**
*Deal with Leo and Save . . .*

## NATIONAL NC-125 RECEIVER

Covers 550kcs to 36 mc in 4 bands Voice or CW Up-to-the minute features include: AVC, automatic noise limiter, antenna trimmer, variable CW pitch control, separate R.F. and audio gain controls, jack for phone or NFM-73B adapter, volt. reg., stabilized oscillator, audio amplifier essentially flat to 10,000 c.p.s. when used with phono. Built in Select-O-Ject.

**$149.50**

**Matching Speaker . . . $11.00**

**LOW DOWN PAYMENTS**


Leo I. Meyerson, WØGFQ

## NATIONAL HRO-50 RECEIVER

Built-in power supply on separate chassis. Front panel oscillator compensation control. 20 to 1 precision gear drive. Provisions for NBFM adapter. Push-pull audio output. Speaker matching transformer built into receiver with 8 and 500/600 ohm output terminals. Packed with important new features.

**$359.00** (less speaker)

HRO—TS, 10" PM Speaker in matching cabinet . . . . . $16.00

**LOW DOWN PAYMENTS**


**FREE**

## WRL 1951 CATALOG

Send for the new 1951 complete WRL catalog containing everything new in radio and television. Deal with the "World's Most Personalized Radio Supply House."

**CU ON 20 - 10 & 75 METERS**

## GIANT RADIO REFERENCE MAP

*Just right for your control room walls. Approximately 28" X 36" Contains time zones, amateur zones, monitoring stations. Mail coupon today and . . . . . .* **25¢**

## NATIONAL RECEIVERS

**NC-57 B. . . . . $99.50**
**Select-o-jet 3 . . . . . $24.95**
**NC-183 (with matching speaker) . . . $295.00**
**NC-173 (with matching speaker) . . . $210.50**

WRITE FOR DETAILED SPECIFICATION EQUIPMENT SHEETS
WRITE - WIRE **PHONE 7795**

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C-1

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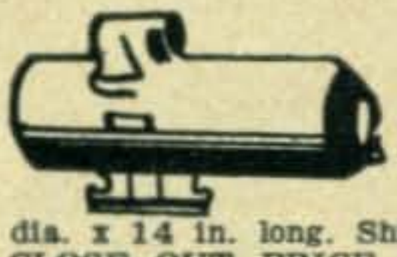


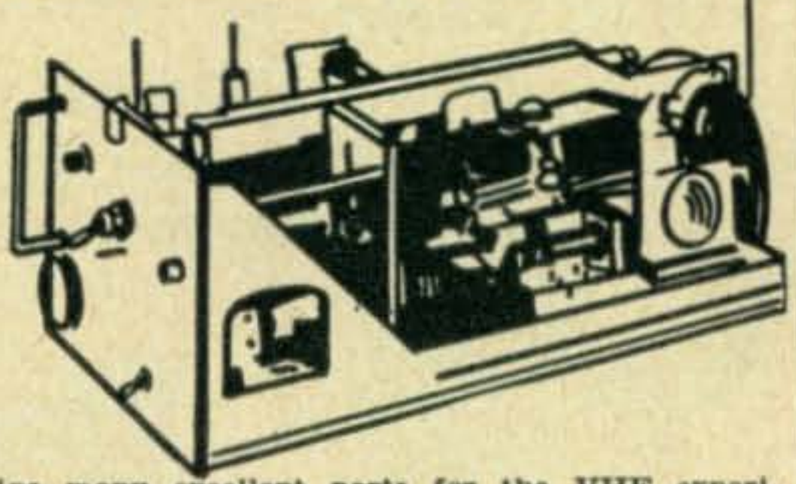
## PE-101C DYNAMOTOR . . $1.95

New—Original Packing

Made for the BC-654-A 420 Mc. Trans.-Rec. Input 13 or 26 V. DC. Output 400 and 800 V. DC. and 9 V. AC. Will operate on 6 V. DC. at reduced ½ voltage. Size approx. 4 in. dia. x 14 in. long. Shipping wgt. approx. 15 lbs.

CLOSE OUT PRICE ..... **$1.95**

## T-39/APQ-9 RADAR TRANSMITTER



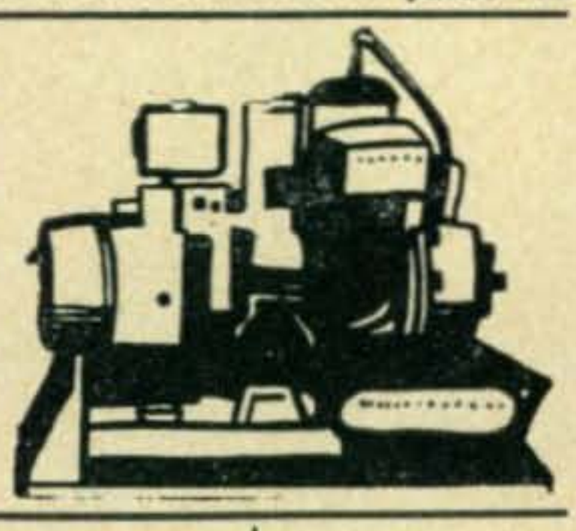
This is the transmitter described in the February "CQ" for conversion for the 420-450 Mc. Amateur band and is now being subjected to approval by the F.C.C. for the 465 Mc. Citizen's band. The oscillator has excellent frequency stability. Two-way communications for distances of 22 miles have been reported.

If conversion is not desired, the transmitter contains many excellent parts for the VHF experimenter such as a cavity oscillator using 2—RCA 8012 tubes rated at full output to 500 Mc. Tubes are forced air cooled by 24 V. DC. motor which is easily converted for 110 V. AC. operation. Other valuable parts such as switches, potentiometers, gears, revolution counter, etc. make this an offer not to be repeated. PRICE ..... **$5.00 ea.**

**PP-51/APQ-9 POWER UNIT** ..... **$1.50 ea.**

Used for operation of above unit. Contains 2-4 mfd. 1000 V. Condensers, 2—1 mfd. 1500 V. Condensers, transformers, power resistors, etc. A useful item for parts or in conversion of above unit for amateur use. Unit complete except tubes. PRICE ..... **$1.50 ea.**

## (HRU) DC POWER SUPPLY



24-28 V. at 70 amp. 2000 watts gasoline engine generator with electric starter. Power supply which can be used to operate 24-28 V. equipment, start airplane engines, charge batteries, as a welding machine, lighting system, or for amateur radio station. 21½" x 17½" x 24⅝". Wgt., 115 lbs. These units sold as removed from aircraft: No check can be made but most look little used and no previous complaints.

PRICE ..... **$49.50**

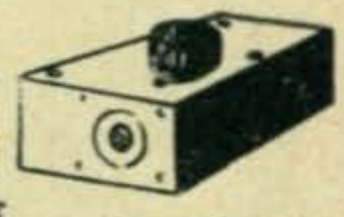
## BC-745 "HORSIE-TALKIE" 3.95 ea.

Here's a swell portable transmitter and receiver operating on 75 meters. Total range 2-6 Mc. These were made for operational distances of five miles; however, greater distances are obtained under favorable conditions. Add only tuning unit desired (not included), chest unit T-39 and batteries and you are ready to operate. Wgt. of entire unit approx. 13 lbs. These units are all in good condition; in fact, most are brand new.

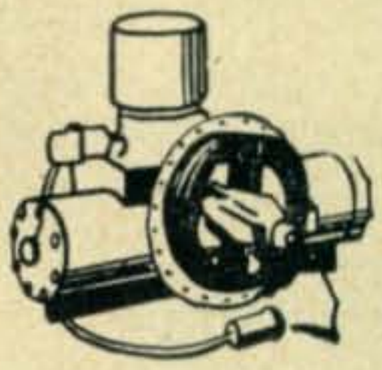
PRICE, less tubes—**$3.95**
with tubes—**$6.95**
T-39 Chest Unit, New—**$2.50**
PE-157 Power Supply Unit ..... **$4.95**
These units used to power BC-745 from 2V operation. (Loudspeaker has been removed).
BB-54 2 V. battery for enclosing in above supply and operation (New, dry-charged) PRICE **$2.95**

FT-338-A Mounting rack for vehicular mounting of supply. PRICE ..... **50c**

## NEW BC-631-B JACK BOX 19c



This small box measures 2¾" x 2¼" x 1⅝" and contains a 10,000 ohm potentiometer with knob and a 6 terminal Jones type terminal strip. Ideal for remote volume control for headphones, etc. Worth the price for potentiometer alone. BRAND NEW, Moisture-proofed packed ..... **19c ea.**



## A-5 AUTO PILOT SERVO M-1 BRAND NEW $4.25

Has ¼ Hp. 24 V. DC motor speed 6000 Rpm to pump hydraulic fluid to selected cylinder for rotation of cable drum. A ham with a little mechanical ability can convert this to rotate his beam by wrapping cable around the drum and his beam mast. Dog included for disconnect of drum for free rotation.

NEW—ORIGINAL PACK ..... **$4.25 ea.**

## NEW PANEL METERS

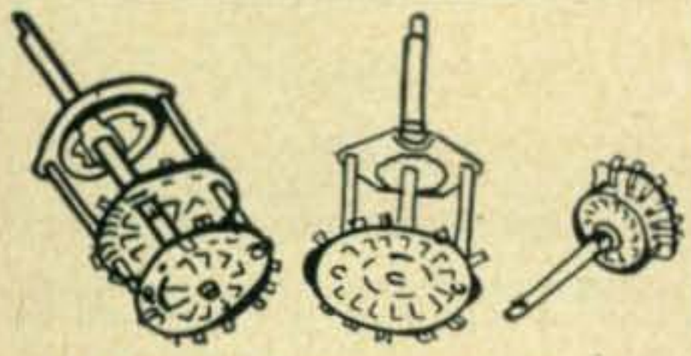
0-30 Amp. DC 3" Hoyt, **$1.50 ea.**
0-30 V. DC 3" Hoyt **$1.50 ea.**
*0-600 A. DC 3" Hoyt **$1.00 ea.**
0-30 V. DC 2" Aircraft Type (black face) GE, Weston or Westinghouse Type, 1 W **$1.50 ea.**
*0-240 Amp. DC Weston, GE or Westinghouse Aircraft 2" ..... **$1.50 ea.**
*0-480 Amp. DC Weston, GE or Westinghouse Aircraft 2" ..... **$1.50 ea.**
0-150 V. DC Weston 2" Aircraft type . **$2.50 ea.**
*0-60 Amp. DC 2" GE Aircraft type .. **$1.50 ea.**
0-150 Amp. DC Westinghouse Aircraft Type, 2" Type F-1 ..... **$2.00 ea.**
*Uses external shunt (not incl.)

## DC AMMETER 49c ea.

2", 0-25 amps full scale. Brand New, CLOSE-OUT PRICE **49c ea.**

## CB-221 FREQUENCY METER—$49.50

Just received a nice lot of these at a price which we can pass along to our customers. Covers the range from 125 to 20,000 Kc. Accuracy of .01%. Furnished complete with calibration charts and ready to operate by connection of batteries by an AC power supply (not furnished). Guaranteed good .... **$49.50**
Above model with audio modulation — **$15.00 extra**



## ROTARY SWITCH KIT, 10 ASSORTED—$1.95

Contains 10 rotary switches of various types, all brand new. 10 for .... **$1.95**

## MIDGET VARIABLE CONDENSER— 15c

5-17 mmfd. capacity. Size 1⅛" x 1⅛" with 1½" shaft extension. PRICE NEW ..... **15c ea.**

**TWO-WAY PILLOW SPEAKER**
**HI Z CRYSTAL TYPE**
**Also serves as a Microphone**

A compact speaker ideal for use wherever private radio listening without disturbing others is desired. Works under a pillow. Requires only a simple hookup for use with any radio or amplifier.
**Manufactured by Brush Development Co. No. 17824.** .....

PRICE Close Out ..... **New $2.50 ea.**

## D-E OXYGEN CYLINDER $1.95

Made of stainless steel. Holds 500 cu. in. at 400 lbs. pressure. Non-shatterable. Ideal for air compressor, reserve tank, airhorn installations, floats, etc. Has approx. ½" dia. overall pipe thread at each end. Wgt. 5 lbs. Size overall 24" L. x 6" dia.
PRICE ..... **$1.95**

## 3 OHM 25 WATT OHMITE RESISTERS

About 10,000 in stock. New. Close Out at ..... **$5.00** per 100

## CATHODE RAY TUBES BRAND NEW

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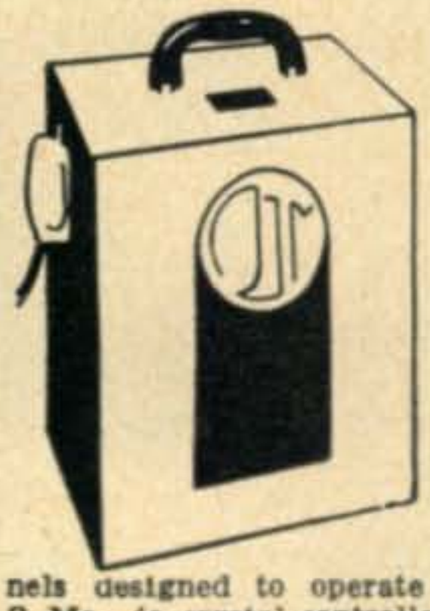
|---|---|---|---|---|---|
| 3BP1 | — | $2.75 | 5NP1 | — | 1.95 |
| 5AP1 | — | 2.75 | 7BP7 | — | 1.95 |
| 5BP1 | — | 3.50 | 9LP7 | — | 2.25 |
| 5HP1 | — | 2.50 | | | |

# ESSE RADIO CO.

**41 WEST SOUTH ST.
INDIANAPOLIS, IND.**



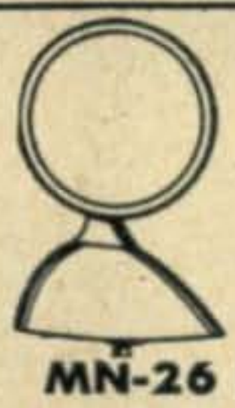
## JEFFERSON - TRAVIS MARINE RADIO TELEPHONE

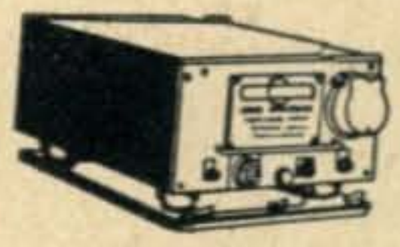
The Jefferson-Travis Model 52, 5 watt Marine Radio Telephone, has been specifically designed to provide radio telephone service on sail boats, small power boats and other craft with no electrical installation or where it is not desirable to use existing power. This unit would also be desirable for the amateur 75 meter band for mobile or portable operation.

The model 52 has two channels designed to operate in the frequency range of 2 to 3 Mc., is crystal controlled in both receiver and transmitter and can operate with a self-contained rechargeable battery pack, sold as optional equipment, on an external 6 V. DC power source. Battery drain is very slight for this equipment and approximately 10 hours of operation may be obtained from the self-contained battery listed below. The cabinet is made of sheet steel finished in Copen blue wrinkle inside and outside and is protected from corrosion by an intercoating of zinc chromate. The control panel is equipped with a horizontal key type switch to select either two of crystal controlled channels. The vertical push-to-talk key type switch in a combination on/off and volume control knob. A hand type microphone of rugged construction is included and conveniently mounted on the left side of the unit. Speaker is self-contained. Weight of unit, less battery, is approx. 12 lbs.

These units were manufactured and made to sell for much more than our asking price. From reports and information obtained by E.R.C. before the purchase of these sets, we were told that they are operating from 35 to 50 miles of the coast to shore stations or between other craft. We were not fortunate enough to obtain a large quantity of these units; therefore, rush your order to assure your purchase of one of these excellent bargains. This is brand new factory-packed merchandise. OUR PRICE ..... **$59.50**

BATTERIES, suitable for above equipment—Willard rechargeable storage batteries, brand new. Shipped dry. 6 V. battery in spill-proof clear plastic case. Uses standard battery electrolyte available at any drugstore. 1.265 specific gravity. PRICE ..... **$3.00**





## MN-26 RADIO COMPASS—BRAND NEW $47.50

Here's an item for any ham, boat owner, or aircraft use. These units were made by Bendix Aircraft Company and sold for hundreds of dollars. They are brand new surplus and a nicer looking piece of equipment cannot be found at any price. Two sodels available. MN-26-C operates from 150 to 1500 Kc. MN-26-Y operates from 150 to 695 Kc. and 3.4-7 Mc. All made to operate from 28 V. DC source but may be converted by good technician for any supply source. I repeat—these are brand new—

PRICE COMPLETE less cables ..... **$47.50**

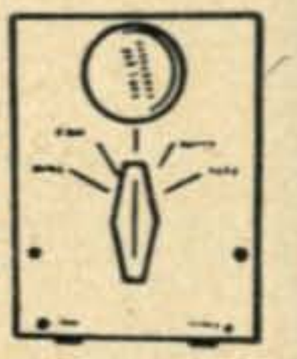
## HEADSET ADAPTOR

MC-385 ..... 19c

Here's an item very useful for impedance matching of low impedance 600 ohm headsets to hi impedance 8000 ohm outputs. Makes your low impedance phone much more versatile. Just plug—Headset 33 or HS-38 into adaptor and plug adaptor into output. USED 19c

NEW ORIGINAL BOX **35c**

## JACK BOX BC-1366



Contains 2-pole 5-position switch, Rheostat, 2 phone jacks, etc. In aluminum case 3¼" x 4⅜" x 2¼". PRICE **19c** ea.

## C-2/ARR-2 REMOTE CONTROL BOX

Brand New . **19c**

These units are housed in black crackle finished case Size 4⅛"x3¼"x1¾". Contains useful parts such as rotary switch, 2 potentiometers, gear mechanisms, J-201 Jack and knobs. BRAND NEW, PRICE ..... **19c**

## RECEIVER TUNING CRV-23254 75c

Used with CRV-46151 Receiver for vernier tuning. Has beveled dial with hairline cursor. Bands are 200-560, 560-1600, 1600-4450, 4450-9050 Kcs. Each band spread over about 28 degrees of dial edge. Has provision for flexible tuning shaft or can be adapted for direct drive on any tuning shaft. Black crackle finish. Size 5" x 3" x 2" overall. PRICE BRAND NEW ..... **75c**

## AAF PUBLICATIONS

Made of heavy material fabric covered. Has three post clamps for holding your technical manuals or may be used for looseleaf or magazine binder. Keep each year's copies of your various radio publications intact. Size 9½" x 11½". Holds thicknesses up to 2¾ inches. BRAND NEW—PRICE ... **29c** ea.

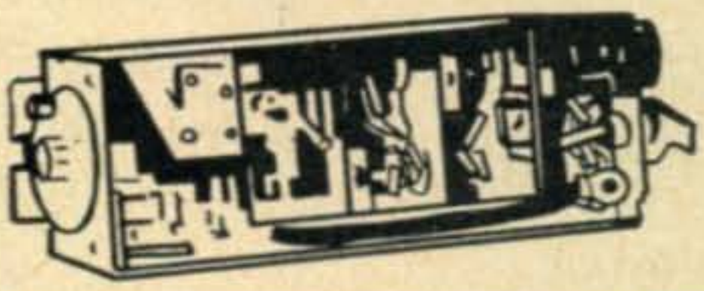
## RATCHET MOTOR NEW NEW 39c

Operates from 12-24 V. Similar to motor used for automatic tuning of SCR-522. This motor measures approx. 3" x 3⅞" x 1½". Has provision for coupling to 5/16" shaft. Ideal for remote tuning of mobile and other equipment. Rotates approx. 1 rev. per sec PRICE BRAND NEW .. **39c**

## 6 VOLT STEWART-WARNER HEATER FAN MOTOR—59c

This motor was made for Stewart-Warner auto heaters but may be adapted to many other uses. New but some are dirty, guaranteed operation. Size 2¼" dia. x 2½" length with ½" of ¼" shaft extension.

## ARR-1 RECEIVER 234-258 MC—$9.25



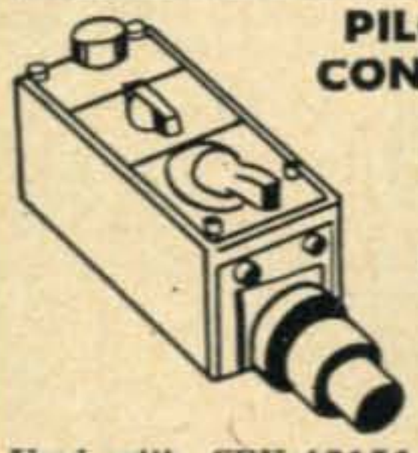
Ideal for mobile receiver or converter on above frequencies. Contains 4 — 954 type Acorn tubes, connectors, etc.

PRICE **$9.75**

## LUBRICATING AND PRESERVATIVE OIL—19c qt.

A high quality oil for guns or any application where a light oil is needed. Specification No. L1165M Packed in quart tins 16 to case, 8 per carton. No less than 1 carton sold. PRICE .... 12½c per qt.

## PILOTS CONTROL BOX TYPE CRV-23254 75c



Used with CRV-46151 Receiver for remote control of volume, selection of any one of six frequency bands. Has off/on switch or selection of C.W. and M.C.W. and M.V.C. or A.V.C. Black crackle finish. Size 2" x 2½" x 5" high. PRICE BRAND NEW. .. **75c**

## POWER RESISTORS 2500 OHM 25W.

Wire wound resisters with wire pig tails. Close out of 5000. ..... **$5.00** per 100

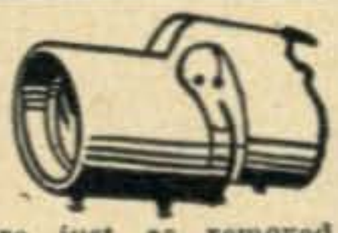
## RG-8/U CO-AXIAL CABLE $8.95/100ft.

52 ohm impedance. Black vinyl cover over outer conductor. Max. operating volts 4000 RMS. Only 2. 1 DB attenuation per 100 ft. at 100 Mc.

This is an item getting scarce on the surplus market.

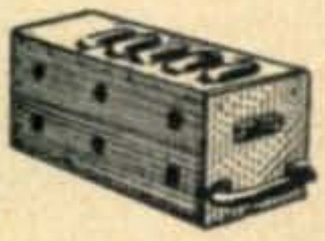
Lengths to 500' $8.95 per 100'

## IN-DICATOR SCOPE ID-41/A PQ-13 $3.95



The scopes are just as removed from aircraft containing APQ-13 Radar Equipment. Contains many useful parts such as 5FP7 CR tube, 1—6AK5 tube, 5 grain-of-what pilot lights, magnetic deflection yoke, condensers, resistors, potentiometers, sockets. CLOSE-OUT PRICE ..... **$3.95**

## TURBO AMPLIFIERS



Originally made for use on 110 V. 400 Cycle, the boys are finding lots of uses for the components of this item. The power transformer has been found adaptable to 60 Cycle 110 V., giving 300 V. CT and 30 V. outputs at very small current drain, about .5 Amp. on 30 V. winding. Also used as small transceiver modulation transformer and output transformer. The case is useful for building other equipment, measures 8¾" long x 4½" high x 4" wide. Other components such as carbon resistors and sockets. Less tubes. Lots of 10 — 29c ea. **35c** ea.

## MOBILE ANTENNA MOUNT

**75c**

**L**

This mount has heavy spring base to prevent breakage of mast and allow antenna to be tied down to vehicle top. Threaded bushing takes 7/16 dia. Threaded MS51 mast section. Bottom bushing 11/16" dia., 3" long, with ½" dia. hole. Entire unit measures 9½" long. 1½" dia. overall.

NEW ..... 75c ea.

## HONE and WHETSTONE

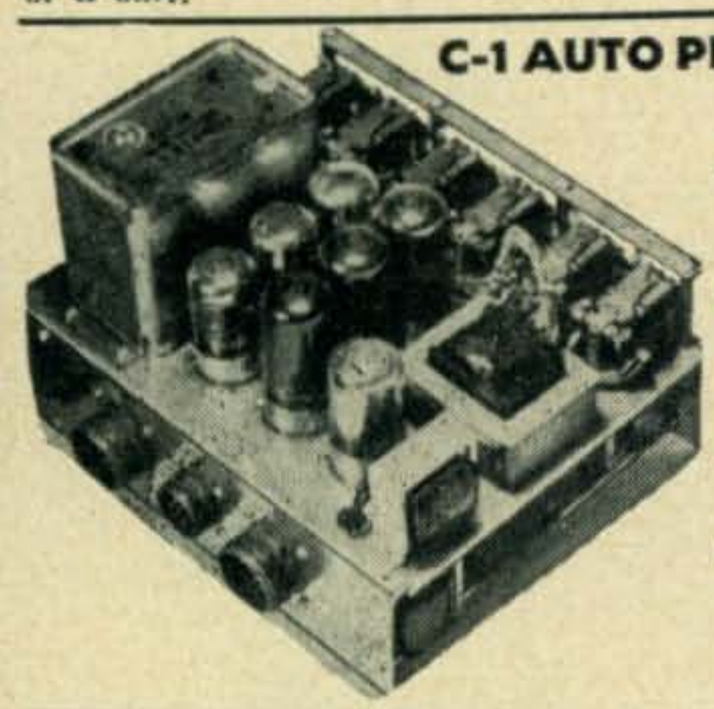
HUNTER'S and FISHERMAN'S SPECIAL! ALSO FOR HOME WORKSHOP and MACHINE SHOP

ORDER NOW

Fine quality, high-grade knife, fishhook, tool and hand-axe sharpener and polisher. U.S. Government surplus. Light weight (weight less than 1 ounce). Size, ⅛ inch wide x 4 inches long. One-half of instrument is finest possible whetstone and other half is cork rust remover and polisher. Any trapper, hunter, fisherman, hobbyist or machinist cannot afford to pass up this bargain. To close out now 5c each lot of 6 only.

**5c ea.**

## C-1 AUTO PILOT CONTROL SYSTEM



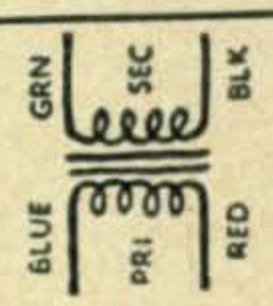
The electronic brain for the C-1 Auto Pilot, contains relays, pontentiometers, transformers, sockets, condensers, etc. No tubes.

Price ..... **79c** ea.

## OUTPUT TRANSFORMER 39c

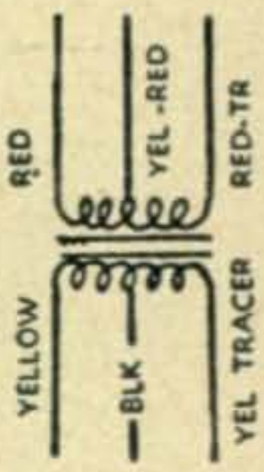
For 12,000 Ohm plate to B+ single ended 7B5 or equivalent at 10 Ma.
Sec. 200 Ohm headset at 50 Milliwatts level.
Dimensions: 1 5/16" x 1⅛" x 1 13/16".
Vacuum impregnated with varnish.
Wire lead lengths 3½" to 9½" stripped and tinned.

9G1006 — BRAND NEW ....**39c**




## VIBRATOR POWER TRANSFORMER

Manufactured for Harvey-Wells for use in aircraft transmitters. These are brand new quality merchandise. Dimensions 2⅝"x2⅛"x2 3/16". Secondary consists of 3320 turns No. 34 wire center tapped. Primary 6 V. consists of 54 turns No. 16 or larger center tapped. Pri. 12 V consists of 126 turns No. 20 or larger center tapper. Core 1" stack with electrostatic shield between windings. Will deliver 300 V. 65 Ma. with 4.6 Amp. at 6 V. input, or 1.8 Amp. at 12 V. input.

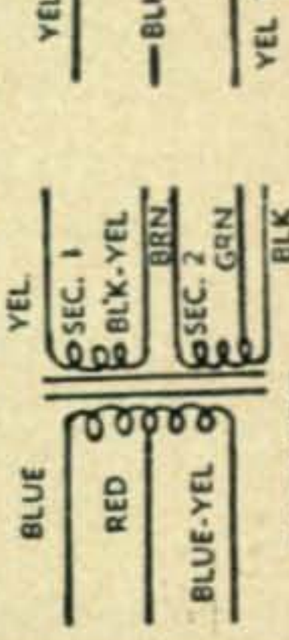



C-8075—2 6 V. .... ..**85c** ea.
E-8075—1 12 V. .... ..**49c** ea.

## MODULATION AND OUTPUT TRANSFORMER 50c

Transceiver transformer originally manufactured for Harvey-Wells aircraft transceivers.
Notes: Pri. 10,000 Ohms P-P, push-pull 7C5's or equiv. 79 Ma. Freq. 300-3000 CPS
Sec. 1—6000 Ohm 50 Ma. DC modulation wind.
Sec. 2—200 Ohm .5 Watt level tapped at 3.2 Ohm 3 Watt level. Used in 3 modes of operation:
1. Pri. 2—7C5's Sec. 1 6000 Ohm load Sec. 2 open.
2. Pri. 2—7C5's Sec. 1 open Sec. 2 3.2 Ohm load
3. Pri 2—7C5's Sec. 1 open Sec. 2 200 Ohm load

Transformer vacuum impregnated with varnish.
Dimensions: 2 13/16"x1⅝"x1¾".
Wire leads approx. 4-6" long.
9D1003—BRAND NEW .....**50c**



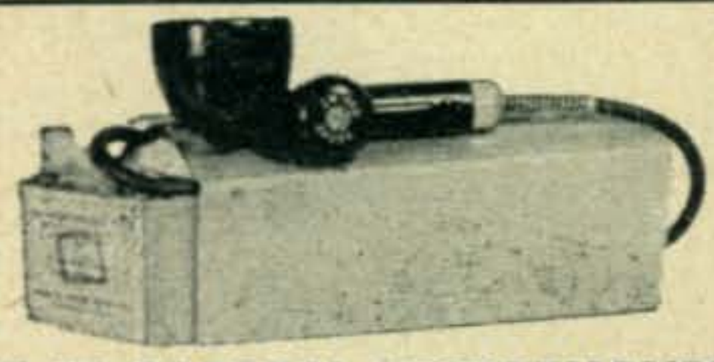

## AVIATION DYNAMOTOR—

## BRAND NEW $2.95

Eclipse Bendix. Input 28 V. DC 4 Amp. Output 425 V. 163 Ma. Made to be used with GF-11 Transmitter, but contained in base. Circuit fused. A fraction of their value. .....ONLY **$2.95**

## SCR-269-RADIO COMPASS $99.00

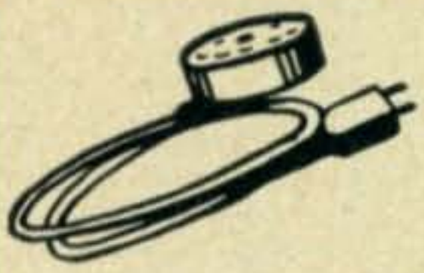
Brand new complete, ready for installation on your plane or boat, except for electrical cables.
PRICE .....**$99.00**
BC 433 G Compass Receivers only as removed from aircraft w/tubes .....**$21.50**

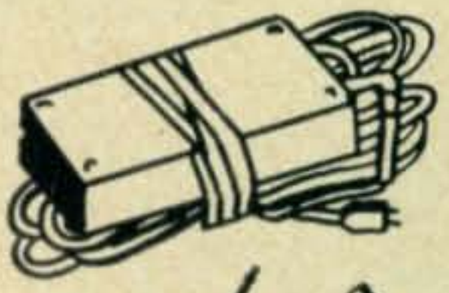


## T 17 CARBON MICROPHONES

New T17B .....**$2.75**
Army Rebuilt & Repacked .....**$1.75** ea.
Used—As removed from Aircraft .....**75c** ea.

## CARBON THROAT MICROPHONE





Ideal for plane, portable or mobile operation, also for construction of lie detectors, toys, etc. You can't afford to be without a few at the price. Adjustable elastic strap fits any neck. Works into 200 ohm impedance input circut. Used, but in good condition. **25c**

CORD SET CD508A For use with above microphone or with T-30 throat microphone. PRICE NEW, complete with SW-141 switch ..**49c**

CORD SET CW-49561. For same use as CD508-A above except has chest push-button type switch.

PRICE ..**49c** ea.

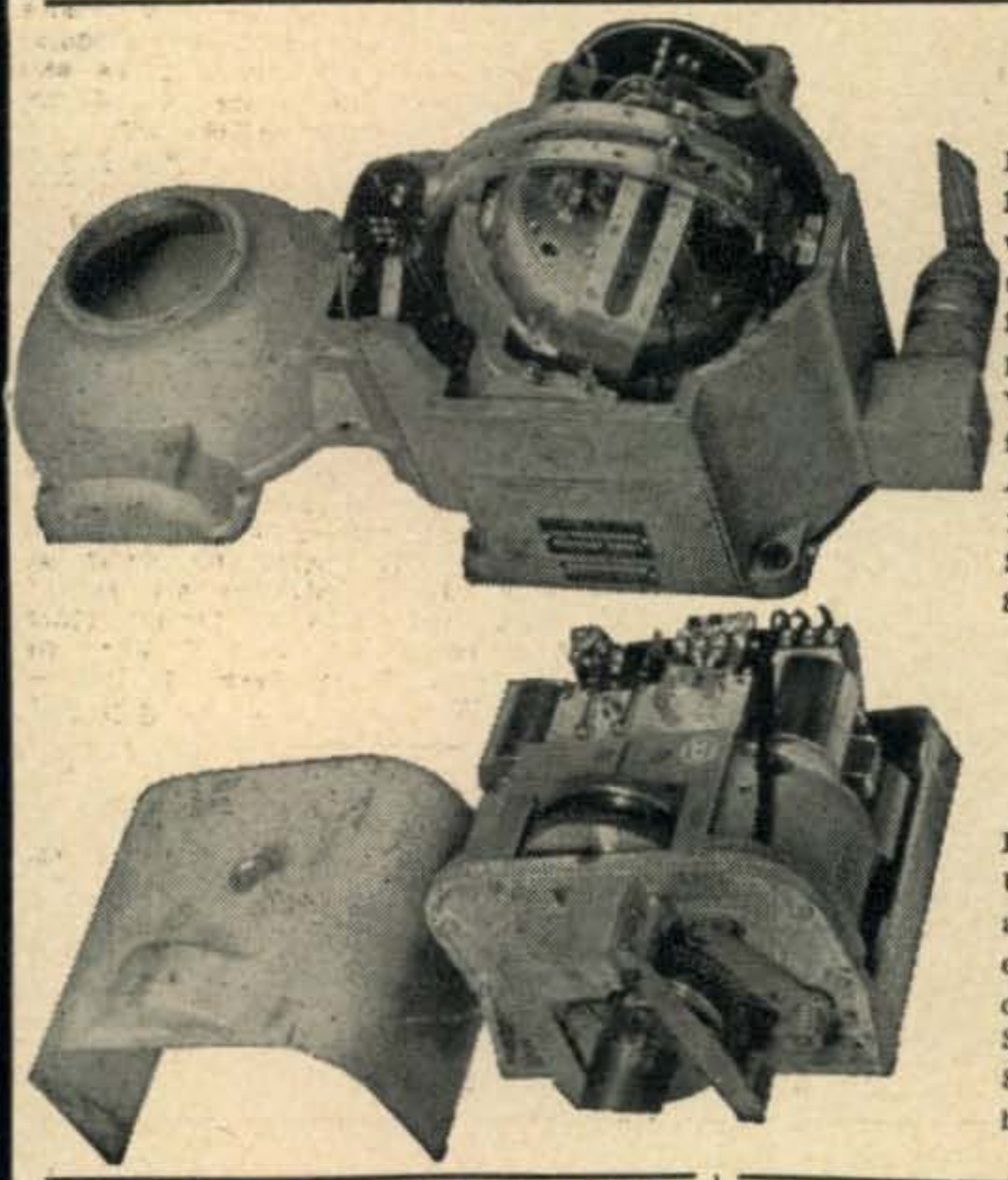
## BC-3657 & BC-1033-B MARKER BEACONS

BEACON RADIO RECEIVER. Used to receive 75 Mc. marker beacon frequency to actuate self-contained relay giving visual indication. May be used for controlling door or light circuits. 24 V. DC filament and plate operation. PRICE
BC-357 ....**$1.95**
BC-1033-B . **3.95**

**TERMS:**

Cash with orders for prompt delivery. Or 25% depost with orders, balance C.O.D. No orders under $2.00 can be accepted due to these special price concessions.

# ESSE RADIO CO. 41 WEST SOUTH ST. INDIANAPOLIS, IND.



## C-1 GYRO

E2L3
Part of the C-1 Auto Pilot which is sold separate and may be used to conduct many interesting and amusing experiments. Operates from 24 V. DC or may be operated for short periods on 110 V. AC Gyro will run for approx. 15 minutes after actuating. Size approx. 8" x 8½" x 8½" .....New **$7.95**
Used **$4.95**

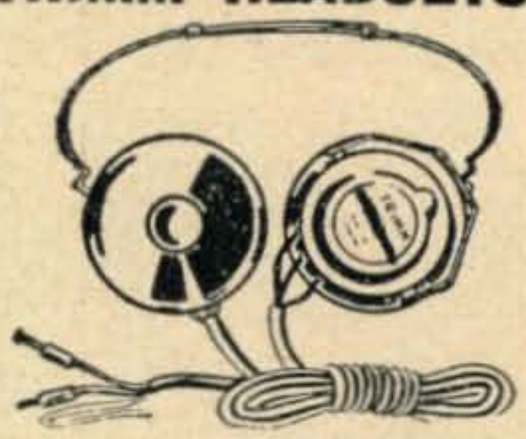
## C-1 SERVO UNIT

E2L4
Use to rotate beam antenna, actuate boat rudder control, etc. Contains 24 V. motor, clutch, relays, etc. Reversible. Size overall approx. 10½" x 8½" x 6½". Ideal for light hoisting .....**$5.95**

## SA-13/U ANTENNA KNIFE SWITCH

**$1.49** ea. NEW
These are Brand New Individually moisture proofed packed. Manufactured by Square D Mfg. Co. ....Price New **$1.49 ea.**

## TRIMM HEADSETS



## HEADPHONES
## BRAND NEW 79c PR.

Dual with cloth covered headband. Trimm Rex type low Z.

## TOW TARGET WINDLASS ASSEMBLY TYPE C-5

This winch looks similar to an overgrown fishing reel. Has level wind attachment. Size overall approximately 20" high x 26" wide. The steel drum measures 12½" in length x 12" diameter and holds 7000 ft. of ⅛" steel cable. A lever controls the energizing switch and braking mechanism. These winches have been found priceless for erection of television antennas in this area. You may use the 24 V. DC operated gear reduction type motor included or remove motor assembly and attach pulley for other motorized operation.
PRICE, to close out 17 of these winches **$39.95**

## TYPE A15 OXYGEN MASK

New in original box. Use in aircraft, paint spraying or give the kids. .....**49c ea.**
D-2 Oxygen bottle with regulator for attachment to above mask. Used, but like new. Shipped less oxygen due to I.C.C. regulations. The complete outfit ideal for aviators, or to set you back on your feet after a hard night out. Price, D-2 bottle **$2.50** Complete bottle & Mask **$2.75**

## MALLORY AC MOTOR STARTING CAPACITORS

Here's a chance to stock practically a full line of motor starting capacitors at very little money. Stock is clean and fresh, guaranteed quality merchandise.

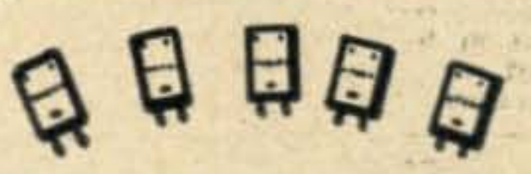
Application: These capacitors are for use in starting AC capacitor type motors and replacement wherever motor capacitors are used.

**ROUND TYPE:**
**35c** ea.

| Catalog No. | Mfd. | Volts AC | Size (Dia. x L.) |
|---|---|---|---|
| MSU121 | 26 | 110 | 1⅜"x2¾" |
| MSU122 | 32 | 110 | 1⅜"x2¾" |

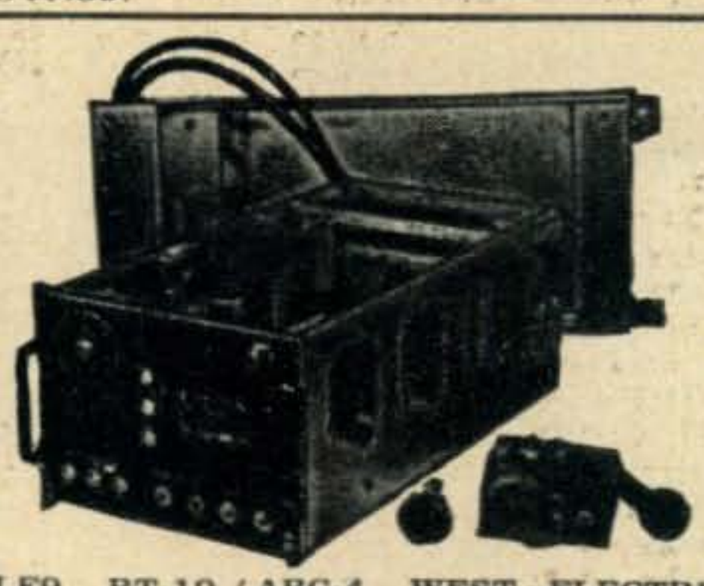
**RECTANGULAR TYPE:**

| Catalog No. | Mfd. | V. AC | Size (W.xL.xH.) |
|---|---|---|---|
| MSG220 | 32 | 110 | 2 x3½x3½" |
| MSG221 | 53 | 110 | 2 x3½x3½" |
| MSF224 | 86 | 110 | 1¼x4½x4½" |
| MSF227 | 108 | 110 | 1¼x4½x4½" |
| MSF229 | 124 | 110 | 1¼x4½x4½" |
| MSG230 | 145 | 110 | 2 x3½x3½" |
| MSG231 | 161 | 110 | 2 x3½x3½" |
| MSF232 | 161 | 110 | 1½x4¼x4¼" |
| MSG250 | 26 | 220 | 2 x3½x3½" |
| MSG251 | 32 | 220 | 2 x3½x3½" |
| MSF252 | 32 | 220 | 1¼x4½x4½" |
| MSG253 | 43 | 220 | 2 x3½x3½" |

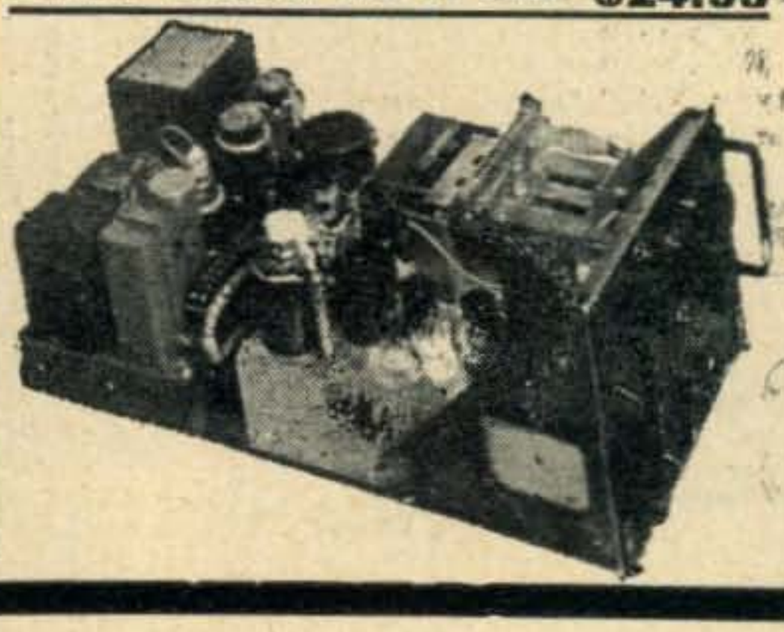


## MOUNTED CRYSTALS - - 10 for $1.95

Still available are the following crystals, all brand new, individually packed. Mounted in SR-5 holders. Close out price, choice of any 10 .....**$1.95**
7280, 7290, 7300, 7320, 7340, 7670, 7680, 7690, 7700, 7950, 7990, 8130, 8245.71, 8250, 8251.77, 8252.73, 8367.27, 8450, 8451.43, 8452.94, 8477.14, 8480, 8486.25, 8488, 8520, 8541.43, 8547.69.



4LE9 RT-19 / ARC-4 WEST-ELECTRIC TRANSMITTER-RECEIVER. For 100-152 Mc. operation. Similar to 522 except more compact. Complete with all tubes. **$24.95**



## PHILLPS SCREWDRIVERS 10c each box of 24.

Phillip's Cross point screwdriver size 3/16" x 3" blade. .....**15c** ea.
Carton of 24 **$2.40** ea.

## SCR-522 TRANSMITTER RECEIVER

A-1 condition. Removed from aircraft. Suitable for re-installation in aircraft. Price, complete with dynamotor and remote control .....**$75.00**
Used condition, not guaranteed, less dynamotor and remote control **$30.95**

## ASSORTMENT OF IF AND RF TRANSFORMERS

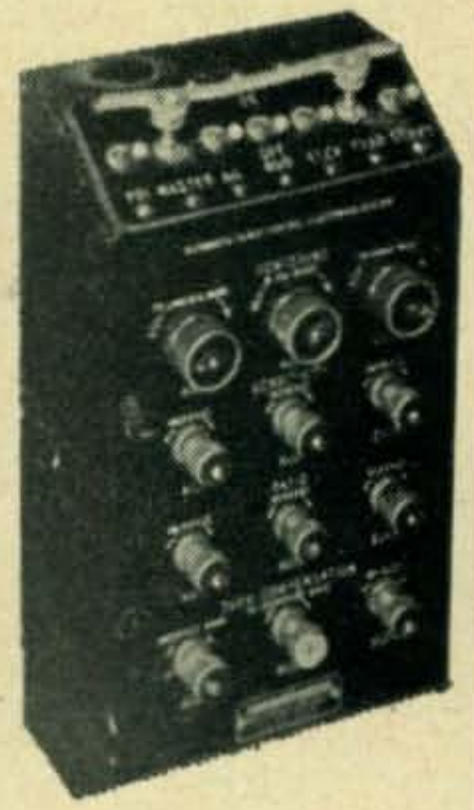
This assortment contains 12 brand new replacement transformers for many of the Government surplus receivers and several RCA type.
PRICE .....12 for **$1.49**

## PACKAGE OF 13 NO. 4 LORD SHOCK MOUNTS

Lord Shock mounts, #4, Size 1½" x 1½" with mounting hold spaced 1⅝" O.C. Center hole drilled for ¼" bolt. Packed 13 per package, brand new.
**$1.00** per package

## T-26/APT-2 RADAR TRANSMITTER

E1A3
Contains tunable VHF circuit using 2—JAN CTL 703A's or 368AS tubes. Other tubes are: 2—5R4GY's, 1—2X2, 1—807, 1—6AG7, 2—6—AC7's, and 1—931A. Other parts such as 24 V. DC motor and blower, HV condensers and transformers, terminal strips and Amphenol connectors, knobs, fuse holders, etc. make this unit invaluable for parts alone. Weight approx. 45 lbs. Size 21"L x 10½"W x 7¾"H, in metal case. Price .....**39.75**



## C-1 AUTO PILOT CONTROL BOX

Contains many useful parts such as numerous toggle switches, potentiometers, instrument lights, etc. CLOSE OUT .....**$2.75 ea.**

## 20.000 V-25 MFD CONDENSER

**$4.50 ea.**

Manufactured by G.E. Solar, and Aerovox, Brand New. Close Out ....**$4.50 ea.** Ship. wt. approx. 35 lbs.

## Flexible Resistors

**75c per 100**

1 ohm 3½ watt flexible wire wound resistors. Length of body 3½" with 2" pig tail leads. Close out **75c** per 100. About 100,000 in stock.

## SCR 625 MINE DETECTORS

**$79.50**

This is the good one with 30" or more penetration. Metallic detector only. Only a few left on the market Close Out ...**$79.50 ea.** Batteries for above **$4.50 per set**

## HV BLEEDER RESISTOR 39c ea.

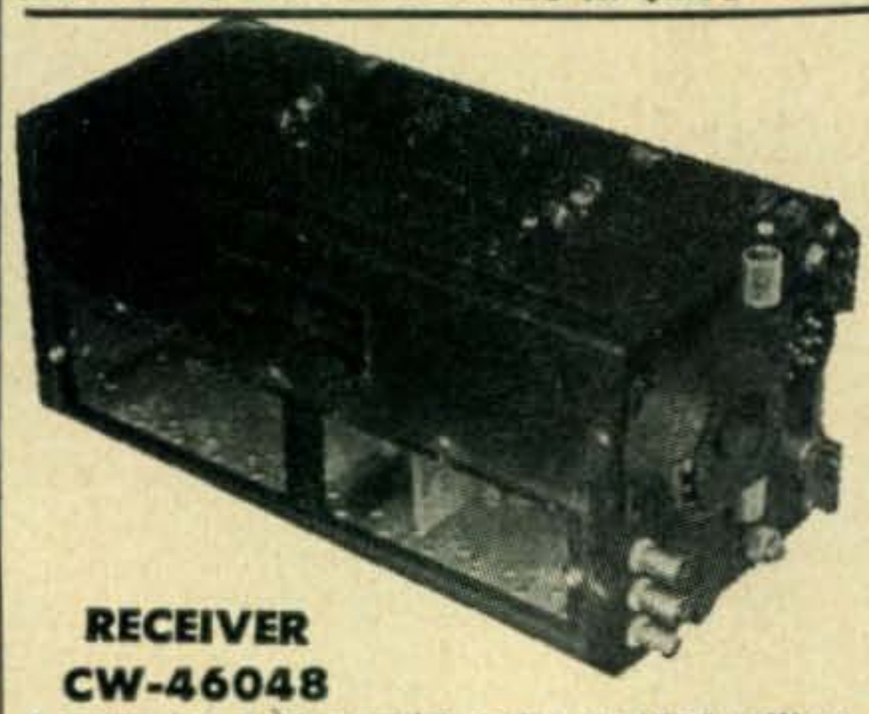
160,000 ohm high voltage type ceramic body resistor. Wire wound. Length 11½", Dia. ¼". Clip type terminals. **39c ea.** or **$20. per hundred.**

ORDER EARLY FOR PROMPT SHIPMENT

## KIT OF CERAMIC FORMS

**25 for $2.79**

Here is a kit of ribbed and grooved ceramic coil forms of various groove and length combinations all 2" in dia. and up to 6⅝" in length. All low less material. Worth the price for any one. Brand New 25 for $2.79



## RECEIVER CW-46048

A really hot receiver which makes an ideal auiliary for the ham shack or for mobile installation. Made to operate from 12 or 24 V. DC systems; however, tubes may be wired in parallel for 6 V. filament operation. Tunes frequency range of 195 Kc. to 13,575 Kc. with the plug-in tuning coils listed below. Contains six tubes. Size 6½"x6½"x15".

**$5.00**

**TRANSTAT VARIABLE TRANSFORMER $22.50 ea.**
Input 90-130 V. 60 cycles. Output 115 V. Max. Current 30 Amps. Ideal for TV regulation.

SWITCHBOARD BD-57-A. Contains motor alternator operates from 12 V. battery to give tone code modulation for code instruction. Has 60 circuit jacks and approximately 25 patchcords and plugs. Ideal for student code instruction or telephone switchboard. Price .....**$12.95**

## BRAND NEW 12 V. AIRCRAFT BATTERY

**$8.95**

This is an ideal emergency power source for your operation of surplus equipment. Place battery in service by filling with miture of sulphuric acid and water of 1.265 sp.g. These batteries are housed in corrosion-proof cases to protect other surrounding equipment. Size 1¼" wide x 10" high x 5½" deep. PRICE—BRAND NEW .....**$8.95**

## TUNING COILS 75c ea.

**DUAL RANGE-kc .....75c ea.**
O/P-187-305/281-455
Q/G-524-844/2960-4620
QF-524-854 & 1975-3320

**SINGLE RANGE-kc .....$1.00 ea.**
H-3865-6265

## AIRCRAFT COMPASS

These compasses removed from surplus aircraft and in good condition. Has 3 V. illumination bulb connected through resistor for proper aircraft pri. voltage. Self-contained compensating devices. Size 3⅛" dia. 3⅞" long, with 1¼" illumination socket extension. PRICE .....**$5.95**

# ESSE WILL BUY ANY THING ELECTRONIC

*especially large quantities of tubes*

**Some of the equipment listed below in urgently needed by our company to meet the dmands of customers and we will pay the highest cash price. Send letter with full description describing condition and quote price. We will immediatly answer and if we can use your equipment, we will authorize you to send it to us C.O.D.**
**We are dealers in surplus elctronics and we are interested in anything dealing with or television. We are especially interested in large quantities of surplus and anything that can be bought at a bargain price. Please don't hesitate to write us imdiately. Quote us prices on what you have and give us a full detailed description.**
**W ewillnot answer any letter unless description and price is quoted.**

## WE NEED AT ONCE!

- BC-348 Receivers, AC or DC models
- BC-312 Receivers
- BC-221 Frequency Meters
- SCR-522 Transmitters & Receivers
- Hallicrafters BC-510 Transmitters
- Any factory built transmitters and receivers such as Hallicrafters, National, Temco, Collins, RCA, RME, Hammerlund, Millen, Meck, Harvey-Wells, Meissner, Sonar, McMurdo-Silver, Gonset, Stancor, Bud, etc.
- Amateur or commercial sets
- Large stocks of tubes
- Large stocks of transformers
- Large stocks of condensers
- Large stocks of resisters
- Large stocks of speakers
- BC-224 Receivers
- BC-342 Receivers
- Police type VHF transmitters and receivers for mobile application
- Collins ART-13 Transmitters
- ART-13 Dynamotors
- APS-13's
- SCR-269F or G Fairchild or Bendix ADF's
- Headphones in quantity lots
- Microphones in quantity lots
- Field telephones
- Sound-powered telephones

**Unless otherwise stated all of this Equipment is sold as used.**

**We are especially interested in any factories, dealers or other outlets giving us a list of surplus electronic equipment that is for sale so that we may submit our bid.**

### ESSE'S GUARANTEE

**If not satisfied with any equipment purchased from us—you pay transportation both ways and return within 5 days for cheerful refund.**

# ESSE RADIO CO.

**41 WEST SOUTH ST.**
**INDIANAPOLIS, IND.**

**TERMS:**
Cash with orders for prompt delivery. Or 25% deposit with orders, balance C.O.D. No orders under $2.00 can be accepted due to these ope-

at this phone business, logged VP8AK and VP8AP. . . . W6AM was the first W contact for VP8AT on 14002. He was T9 and running six watts input. Don also worked him on phone, but the VP8 has no phone of his own.

If I haven't said so already, 3A2AB takes the prize as the most frequently reported this month. . . . W2ZVS hooked CT3AV on phone for his 125th. . . . W9ABA says that everytime he wants to get a shot in the arm, he goes over to the shack of W6WKU, who incidentally is now located in W9, and takes a look at his number 16 WAZ certificate. WKU is not as yet on the air, but will probably be on shortly.

A few of the boys said they got a mild surprise when they heard W6QD on in the contest. That's nothing—W6QD was also surprised to find himself on the air. And speaking of surprises, G2MI was also in there and it was the first G2MI-W6QD QSO in years. Art apparently agrees that VQ9AA is a sour one, but gave me some good news when he said there should be a genuine VQ9, as well as a ZD7 on the air early in '51. Then too, ZS2MI is due back on Marion Island again soon....

**SOUTH AFRICIAN DX CONTEST**

The South African Radio Magazine is sponsoring a DX Contest. The first weekend for c.w. will start at 0001, January 20, 1951, and end at 2400 GMT, January 21. The second weekend will be for phone, starting on 0001 January 27 and ending at 2400 January 28. The bands to be used will be 40, 20, and 10. Serial numbers shall be exchanged. Those for c.w. will consist of six figures, the first three being the report on c.w., or in the case of phone—two figures. Serial numbers will change with each contact. When you work the first station, your number will be the RST report plus any three figures. Your second contact will be the RST report plus the last three figures of your first contact. You then continue on with this method. Contest logs must be received no later than April 30, 1951. Address them to Contest Committee, P.O. Box 3911, Cape Town, South Africa."

Gene Black, W2ESO, is now editor of CQ and in behalf of the DX Committee I would like to have him know we wish him well. Gene has been rather close to CQ for a number of years and should do an excellent job in the saddle. Congratulations, Gene, you had better get your blue pencil sharpened. That's it for this month. 73.

**Q T H COLUM**

| | |
|---|---|
| **EAØAB** | Angel G. Margallo B., Apartado Correos, Post Box 195, Santa Isabel, Guinea Espanola. |
| **ET6AC** | Via K2AJ |
| **LJ2Z** | Box 3009, Oslo, Norway. |
| **LJ3B** | Box 3009, Oslo, Norway. |
| **VP8AT** | Barry Goss, South Georgia, Via Falkland Islands. |
| **VR6AB** | Bob Barrymore, Box 2, Rock Harbour, Pitcairn Island. |

## VHF - UHF

*(from page 37)*

aluminum "clothes line" wire, but it is easier to use for antenna elements because it comes straight and stays that way!

W9RBI reports that ZK2AA has been waiting

for a suitable crystal to get him on six meters. Koss has shipped, via Air Mail, a rock which will put ZK2AA on 50.422 mc. It should arrive at Niue Island any day now, giving the six-meter gang another potential DX contact.

W2NLP has written to us in an attempt to clear up an impression which inadvertently slipped into our recent story on Ham TV. Ray points out that his TV system does not require the "borrowing" of sync and blanking signals from a TV broadcast station, but will run very well on its own locally-generated sync signals, even when no TV broadcasts are available. This, in fact, was the system used by VE2HE in his experiments.

WØIHD wants us to know, first of all, that he is not located in Chillicothe, Missouri, as we erroneously reported in an earlier column, but is actually situated in Overland, a suburb of St. Louis. Charlie reports that the slack season for two-meter DX is setting in, but that the Tuesday Night Net, presided over by Ol' Faithful Himself, WØKYF, still meets at 7:30 PM every week. Following roll-call the net takes a general standby on the band looking for anyone who may wish to call in—local or DX. Their average coverage is about 150 to 200 miles, so it still takes a band opening to bring in the stations in the Kansas City area. WØKYF, on 144.45 mc, runs 250 watts input with a five-over-five antenna. WØBJL, 144.018 mc, has a fine location and his 100-watt rig and 3-over-3 sky piece make plenty of noise. On the military side is K9FAE, at Scott Field—the station of many operators! This station is GI-equipped using a BC640 running about 175 watts input and a BC639 receiver. WØIHD operates on 145.026, and runs 80 watts to an 829 in the final with a 16-element beam about 53 feet in the air.

A two-meter traffic net has been in operation along the Missippi Valley for the past couple of months. W9EHX started the ball rolling. Messages start somewhere in Wisconsin, generally at W9AFT or W9FPE, and are relayed via W9EHX, WØKYF, WØIHD, WØPLJ, W4HHK and finally reach W5JTI in Jackson, Mississippi, who starts them on the return route. One typical message went from South Dakota to Mississippi and returned in one night.

A swell letter from DL4XS tells us of the trials and tribulations which he went through in order to set up a two-meter DX factory at what looked like an ideal site—a hilltop location in Wiesbaden, Germany, with no houses within 3 miles, a clear shot in most directions, but no power! With the help of German ham friend DL3KE, who also had ambitions for v.h.f. acheivement, the job was finally done. A good low-noise receiver, a 16-element array, a 2.5 kw MG set, and 829 amplifier for 'phone work and an outboard amplifier which could handle 500 watts on cw—the works! The results? From April to October, six countries worked, 103 stations worked, 118 QSOs over 20 miles, of which 31 were over 365 miles, and several over 400. The European DX record of 520 miles was made with DL4XS/DL3KE on one end, and G5BMZ on the other. Jo says "If we hadn't run out of land we could have stretched that DX record out to 800 miles easy, according to the weather maps."

DL4XS is now plugging for a DX v.h.f. relay system to connect Northern and Southern Germany. The idea is winning more converts to two meter

# Good News For Hams!

# UP GO VALUES, DOWN GO PRICES ON NEW & SURPLUS HAM GEAR

## CRYSTALS FOR S.S.B. EXCITER

**AS IN NOV. '50 QST—LO. FREQ.**

**Also many other uses—in FT 241-A Holder—½" Pin SPC. Marked in 54th OR 72nd Harmonic MC Freq. Listed Below by Fundamental Frequency. Fractions Omitted.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 412 | 429 | 446 | 485 | 497 | 390 | 401 | 372 | 381 | 450 530 |
| 413 | 431 | 447 | 487 | 503 | 391 | 402 | 374 | 383 | 452 531 |
| 414 | 433 | 448 | 488 | 504 | 392 | 403 | 375 | 384 | 461 533 |
| 415 | 434 | 462 | 490 | 506 | 393 | 404 | 376 | 386 | 465 536 |
| 416 | 435 | 468 | 491 | 507 | 394 | 405 | 377 | 387 | 526 537 |
| 418 | 436 | 472 | 492 | 509 | 395 | 408 | 379 | 388 | 529 538 |
| 419 | 437 | 473 | 493 | 511 | 396 | 409 | 380 | | |
| 420 | 438 | 474 | 494 | 516 | 397 | 411 | | | |
| 422 | 440 | 475 | 495 | 518 | 400 | | | | |
| 423 | 441 | 477 | 496 | 519 | | | | | |
| 424 | 442 | 479 | | | | | | | |
| 425 | 443 | 481 | | | | | | | |
| 426 | 444 | 483 | | | | | | | |
| 427 | 445 | 484 | | | | | | | |

EACH 49c | EACH 79c | EACH 39c | EACH 99c

**Special - 200 KC XTALS without Holders.**

**21/32 x 23/32 — 69c EACH — 3 for $2.00**

## HAM CRYSTALS

**FT-243 Holders—½" SPC. FRACTIONS OMITTED**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 4190 | 6873 | 7840 | 3735 | 5850 | 6406 | 6705 | 7506 | | |
| 5030 | 6906 | 7873 | 5305 | 5873 | 6425 | 6740 | 7540 | | |
| 5485 | 6973 | 7906 | 5677 | 6875 | 6440 | 6806 | 7573 | | |
| 6006 | 7740 | 7973 | 5706 | 5900 | 6450 | 7306 | 7640 | | |
| 6040 | 7773 | 8273 | 5740 | 5906 | 6473 | 7340 | 7673 | | |
| 6073 | 7806 | 8306 | 5750 | 5925 | 6475 | 7373 | 7706 | | |
| 6106 | | | 5760 | 5940 | 6506 | 7406 | 7806 | | |
| 6140 | | | 5773 | 5973 | 6540 | 7440 | 8340 | | |
| 6173 | | | 5775 | 5975 | 6573 | 7473 | | | |
| 6206 | | | 5806 | 6273 | 6606 | | | | |
| 6773 | | | 5825 | 6340 | 6640 | | | | |
| 6840 | | | 5840 | 6373 | 6673 | | | | |

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| 6370 | 6750 | 7810 | 2105 | 2258 | 2390 | 3202 | 3550 | | |
| 6450 | 7480 | 7930 | 2125 | 2260 | 2415 | 3215 | 3570 | | |
| 6470 | | | 2145 | 2282 | 2435 | 3237 | 3580 | | |
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| 20 x 20 - 20 | 150 25 | 2.20 | .80 | 40 x 20 - 20 | 150 25 | 2.30 | .83 |
| 20 x 20 - 200 | 150 25 | 2.65 | .96 | 40 x 30 - 20 | 150 25 | 2.35 | .85 |
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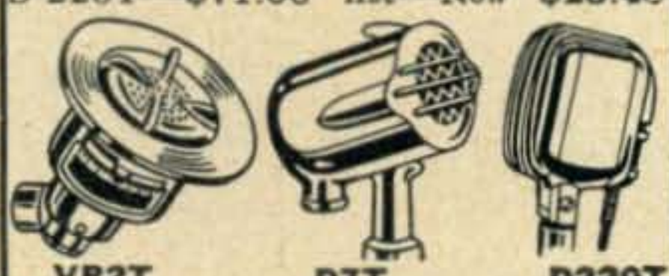

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| 250 | .219 | 12.85 |
| 75 | .344 | 8.96 |
| 245 | .344 | 14.11 |
| 50 | .469 | 7.05 |
| 100 | .469 | 11.62 |
| 150 | .469 | 12.95 |
| 75 | .719 | 12.85 |
| 200-200 | .077 | 6.58 |
| 100-100 | .219 | 14.11 |
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every day, and they now lack only two stations in critical spots to complete the chain. If DL4XS stays in Germany he'll be a top contender for v.h.f. honors next season, but if that Stateside assignment to a post near Denver comes through—watch out for the fireworks when the first good East-West openings show up next year!

From G5BY comes news that arrived too late to be included in last month's column. October 21, G5BY worked G2CIW cross-band, from 435 to 144 mc. G2CIW reported that Hilton's 435 mc signals were S3 to S7 in strength over the 206-mile path. G2CIW was using a bi-directional 8-element array. His receiver was the popular (in England) crystal diode mixer into a communications receiver. . . . During the period from Oct. 16 to 20, G5BY had 7 QSOs with G6IK 161 miles away. G5BY's signals have been reported heard in London, over 180 miles distant, causing considerable increase in interest in the 435 mc band in that city. . . . Due to the threat of severe winter weather the transmitter at G5BY has been removed from the top of the tower and re-installed in the shack. Open-wire line is now used to feed the antenna, and all the contacts noted above were made under these conditions.

In closing, we wish to take this opportunity to wish you all a Happy New Year. May 1951 be filled with even greater activity on the v.h.f. bands than was 1950....Best of luck, *73 Brownie, W2PAU*

## PROPAGATION

*(from page 29)*

surface of the ocean due to changes in temperature within the inversion zone. Movement of the air masses may also cause signal attenuation due to diffusion. This effect may be visualized by considering a flashlight's beam of light directed into a turbulent brook. The light beam is defocused and reflected in diffused rays, resulting in great loss of light along the reflected beam path.

*Fig. 6* shows how a discontinuity of varying height with time may cause fading. There are two conditions to be considered: (1) The rays arrive at the receiving point by different paths and (2) they arrive with different amplitudes.

In condition 1, the ray is reflected to position $P_2$ from point n at height h and also from point n' at height h' of the boundary. The distance along the path $P_1 n\ P_2$ is shorter than the path $P_1 n'\ P_2$. Therefore the rays arrive with their fields out of phase in proportion to the time required for the rays to travel the different distances. If the ray path from position $P_1$ to position $P_2$ via $n'$ was longer than that via $n$ by one half wave length, the voltages induced in the receiving antenna by the two arriving rays would be 180° out of phase, thus cancelling each other and the signal would drop to zero. As it is obvious that several different paths may be possible, the signal may vary from zero to S9, depending on the phase relationship of the fields of the arriving waves.

The difference in characteristics between two air masses may also vary with distance along the discontinuity. This would, of course, affect the reflection coefficient or refractive index and may result in rays arriving at point $P_2$ with varying

amplitude. This is the case of condition 2. As these air masses may be moving from west to east at an average speed of say 15 miles an hour, it is easy to visualize how the moving hills and valleys of the discontinuity boundary may effect the multi path reflections and account for DX signals fading up and down from 0 to S9 during a QSO.

*(This completes part B of a series of articles by Mr. Underhill on VHF Radio Wave Propagation. Part 3 will discuss in greater detail the influence of the troposphere on v.h.f. band conditions, and will also set forth the latest ideas on prediction of band openings.)*

## LIGHT BULBS

*(from page 31)*

would be difficult to determine the percentage of the total current flowing through any one branch.

Identical units, on the other hand, may be paralleled. In this case the total current is divided by the number of branches and the power found for each branch. This branch power is then multiplied by the number of branches to find the total power dissipated.

It should be noted that the ratio of hot to cold resistance varies by a factor of at least two. Thus one would be in considerable error to measure the resistance of the lamp with an ohmmeter when it was cold and use this value of resistance when the lamp is hot. Similarly, one would be in error to find the resistance of the lamp by taking the lamp ratings and applying the formula

$$R = \frac{E^2}{W}$$

and using this value of resistance when the lamp was not operating at its full ratings.

Since these measurements were made at 60 cycles, where stray capacity effects are negligible, care should be taken when the lamps are used at radio frequencies, especially at frequencies above 10 mc. Leads should be as short as possible and should be brought away from the tank coil at right angles.

It may thus be seen that by using *Figs. 2* and *3*, the power output and efficiency of a radio transmitter may easily be found; while *Figs. 4* and *5* may be used to find the resistance of a lamp bulb when the current flowing through it is known.

## LOADING COIL

*(from page 22)*

By making the loading coil smaller than required, and then adding a variable inductor in series for adjustment, losses are not appreciably increased. Many transmitters used for 75 mobile, such as the BC-696, already have a continuously-variable loading coil of the trolley wheel type built into them, and are a natural for this method of adjustment. Similar variable coils are available on the surplus market and can be added to transmitters lacking them. If a

separate coil is used, the closer it is mounted to the antenna the better. In any case, since the fixed loading coil has a higher $Q$ than the variable one, it should be carefully adjusted to tune with the variable at minimum inductance on the highest frequency, and then inductance added in the variable to work on lower frequencies in the band.

It is important that stray capacity to ground beyond the loading coil be kept to a minimum—that is the basic reason for mounting the coil out in the weather, and letting it form the bottom part of the antenna itself. Even a very small amount of capacity will cause increased loading coil loss, since the high voltage appearing beyond the coil will produce high current in even a few micromicrofarads. An additional 25 μμf will double the capacity into which the loading coil looks, and double the current through the loading coil for the same radiated power. Of course, since this capacity combines with the 25 μμf antenna capacity to make 50 μμf, of some 800 ohms instead of 1590 for the loading coil to tune out, it requires only half the loading coil inductance, and the resistance of the coil goes down to half what it was. But the loss in the coil goes down only directly with its reduced resistance while it increases as the square of the increased current. Curve (*c*) of *Fig. 1* shows the effect of 30 μμf of stray capacity on coupling efficiency. This is about the minimum strays to be expected if the loading coil is mounted inside the trunk of a car. If RG-8/U or similar line is used to connect between the loading coil and the antenna, even more stray capacity will be encountered—RG-8/U is 29.5 μμf per foot.

**Moral:**

**Use the longest antenna you can get away with.**
**Build the best loading coil you can.**
**Mount it in the clear.**
**Tune it by series inductance.**

## SCRATCHI

*(from page 4 )*

gation conditions are big cause, and the club are finally adjourning for the evening.

Next morning a wee small voice keep talking to me, telling me that maybe last night are something different from just a hot DX night, so I finally taking the antenna matching network and connecting it to my small portable rig, and tuning it up on my half-wave antenna. The antenna are reely sopping up the RF out of the final, so I deciding to give it a try on the band. I turn on the receiver, tune across the band, and find nothing on except two locals practising see-w and one or two weak W9's calling seek-you. Still in the experimental mood, I connecting the receiver antenna terminals to matching network, and again listen across band.

Hon. Ed., sensational is the word. Superstupendous is a better one. You wouldn't believing it. The first thing I hearing is two VKs having ragchew. The next cupple kilocycles are running into a round table of Gs holding their afternoon tea and crummpit session. Are even finding call with prefixes I having to look up in DX Log. After shock are wearing off a bit, I rushing and phoning all ham friends, local broadcast engineers, and are even about to call local FCC inspector before

thinking better of it. Guys are soon showing up, and Scratchi are giving them reel demonstration. I zero portable rig in on the DX, call him once, sign once, and he comes back like rubber ball on elastic band. Hon. Ed., there wasn't anything I couldn't working. It was almost too easy.

Fellows kept coming in and out of shack all day, and by evening some big shots engineers from coast are coming in, having made special flight over from Los Angeles. They are asking me all sorts of questions, saying I biggest genius since Macaroni. Of course, I telling them I can't answer questions on my antenna matching network until I are having proper patent protection. One fellow are waving checkbook in my face, telling me just the naming the figure and it's mine. Even Brother Itchi are properly impressed, and he finally getting me over in a corner and asking if it's all true, and I are having to modestly admit that it is, that there is no longer any doubt that Scratchi is a red-hots genius.

Later that night, or I should be saying morning, every one are finally gone, and as I are about to go to bed, I start thinking. If this antenna matching network is such a miracle when using five watts of power, think what would happen when hooking it to my Arizona kilowhat. No sooner thinking than acting, I rush into shack and disconnecting matching network and putting it in antenna feeders for big rig. I check it in receiver—using antenna relay so network in for both receiving and transmitting—and band are still sounding like middle of DX contest. Are so sensitive Scratchi are heering two Russian locals talking politics.

When filaments warm up I throw the big switch and WHOOOM!! big flash are occuring and antenna matching network are splattered all over shack. Nothing daunted, Scratchi quick rush to junk box and pull out another shield box, and are all set to start to build another antenna matching network when horrible realization are being realized!!! Hon. Ed., I not recalling what I using or how I putting together the first matching network. I quickly start looking to see what is left of the original, but all I find is several short pieces of wire and one plate of the selenium rectifier. Hon. Ed., how can this happen to me? To Scratchi himself? Fame, fortune, even money, all lost.

Well, that's the sad tale. If you are interested in having someone teach a class in Stupidity, I can bring excellent qualifications.

Respectively yours,
*Hashafisti Scratchi*

## PORTABLE PINT

*(from page 15)*

antenna. When the two 6BJ6 262-kc i.f.s have been adjusted, a 1600-kc modulated signal should be fed into $G_3$ of the 6BE6 and the trimmer condenser $C_{17}$ adjusted for maximum output of the loadspeaker, or maximum reading of a v.t. voltmeter connected to the diode load resistor. Next, the 1600-kc stage should be aligned and finally, the first oscillator, the mixer, and the r.f. stage. Oscillator tracking is effected by moving the top turn of the oscillator coil and cementing it when the correct position is found.

To save space the power supply is built directly onto the base plate of the cabinet, since it need not be removed for band changing or other adjustments. The power transformer is wound on a 2-1/4" long bobbin, which fits over a 1-1/2" stack of 1" wide laminations with 465 turns of No. 22 B. & S. enamelled wire for the primary and 1350 turns No. 26 B. & S. (tapped at 675) of enamelled single silk wire for the secondary. The twelve selenium rectifiers, which are series-connected in four groups of three to form the arms of the bridge, are mounted as a unit on the side of the cabinet (by means of threaded rod and small fibre plates) in two rows of six, as may be seen from the photograph; this enables them to be easily inserted after the transformer and choke have been mounted. The small relay on the right hand side changes the high voltage from the receiver to the transmitter and a similar relay mounted adjacent to the PA tank coil changes over the antenna. Sixty volts negative bias is supplied to the transmitter by means of two *Burgess* type U-20E hearing aid batteries connected in series and mounted in the power supply compartment. The jack seen at the right hand side of the power supply panel is connected in parallel with the send/receive switch and is used for remote control.

## CONTEST OPERATORS

*(from page 24)*

an intemperate amount of assorted groceries it has to digest them. To meet this overload the stomach has to call for added blood supplies from the circulatory system. The extra blood is provided by drawing it away from other parts of the body. To be highly perceptive and active the brain demands a plentiful blood supply. If the stomach has put in prior claim the brain goes short. The net result is mental lethargy and sleepiness. Observe Great Uncle Wilberforce snoring on the couch after Thanksgiving dinner for a tangible example of this phenomenon.

During the contest we are making greater demands on our system—doing more work—than one might imagine. The human machine has to have fuel but at the same time should not have a great load placed on its digestive apparatus. The answer is light, easily digestible meals at comparatively

short intervals, preferably ones suggested by the family physician.

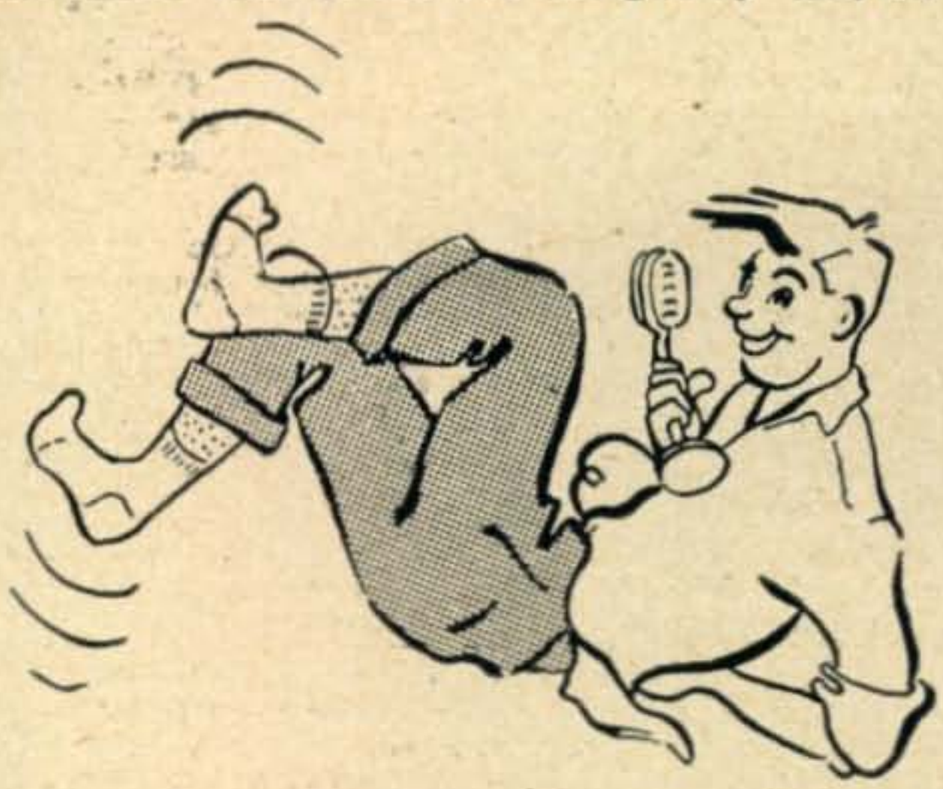
It will come as no news that you never get something for nothing. This applies equally to the body under stimulant. The strong black coffee of boiled owl fame will certainly speed things up for a while but the inescapable fact is that eventually that "lift" has to be paid for, plus interest, in the form of a later and deeper sag in one's energy.

The same rule applies to alcoholic stimulant to an even greater degree. Last of all are the actual drugs such as benzedrine, etc. No one in his senses should use them unless he has already checked his tolerance to them with his physician. Here again we have the temporary boost followed by the inevitable following depression. Too much smoking—the traditional piled ash tray on the operating table—is no help. Certainly those of us who are habitual smokers should not suddenly cut ourselves off for the contest period but, equally, we should avoid the all too common practice of chain smoking our way through two or three packs in a night. Pleasant as it may be to many people, it is still a fact that nicotine is a powerful drug and an overconcentration brought about by a sudden increase in consumption of tobacco cannot but have a negative effect on the alertness and vigor essential in a contest.

Sleep, unfortunately, cannot be stored. Once we have had a good night's rest and, so to speak, recharged our storage battery, we cannot put any more ampere hours into it by sleeping on. The operator should be normally rested at the beginning of the contest but there is no profit in trying to sleep solid for a couple of days in advance. The fortunate ones are those who can catch a cat nap at will. The restorative effect of a sleep of only a half or a quarter of an hour is out of all proportion to the time involved. When the band goes flat or it looks like the rig should cool off a bit the wise operator will lie down and relax as completely as his temperament will let him. If he can sleep, it is an added bonus. The quality of being able to drop everything, physically and mentally, and take quickly to sleep has been one possessed by Napoleon, Foch, Edison and many other "greats."

All of the break periods should not, however, be spent in rest. A little light exercise is indicated to keep the system happy and the circulation active. A stroll around the block and a breath of fresh air will send the operator back to his key or microphone a few minutes later feeling much

fitter and on the ball. A quick cure for a sudden wave of drowsiness is to lay flat on one's back on the floor and pedal an imaginary bicycle for



a minute or two. This somewhat undignified maneuver serves to get the blood stream into brisk action and by gravity to push some blood back into the head to nourish the brain.

Yelling is hard work—except perhaps to Dodger fans. The contest telephone operator needs sufficient gain in his modulator so that there is no need to raise his voice above or even up to conversational level. Hand held microphones are another needless load of work to be carried. To pick a microphone up to yapping position seems a small effort (in the first hour or so that is)—as the hours wear on it gets heavier and heavier. A stand or table microphone is indicated. It should, however, be borne in mind that we lose all our profit of saved energy if the microphone is so placed that every time we speak it is necessary to lean forward or crane our necks around to get into proper modulating position. The author's opinion is that the ideal microphone is the one that can be worn—much like those used by central telephone office operators. A long cord will enable freedom of movement. Once the correct position of the microphone has been set it then becomes in fact part of our contest wearing apparel and can be ignored from then on. One more source of thought, concern, and effort is thereby eliminated.

Every operator to his own bug. In the c.w. case there is very little to suggest save the obvious. The bug should be perfectly adjusted and then the setting locked. Prior experience will have established the most comfortable position on the table. If you have kept putting off the job of securing the bug solidly to the table, so that it does not slide, before the contest is the time to do it. A bare arm resting on a cold surface can result in a severe cramp. If your operating table is glass-topped better wear long sleeves.

It is possible that some rugged individualists will consider the above as a pantywaist study in self indulgence. Before these tough characters completely embrace that opinion they might well consider the work done, for instance, in aviation medicine where the care and feeding of such fragile gentry as jet fighter pilots is a subject of persistent and thorough research.

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SELL: Several Army Technical Manuals—all new, rare, cheap, on BC-312-342; BC-314-344; TG10 keyers; I-72 signal generators; I-56-E test set; PE-99-B; receiver AR-8506-B; $1.25 each plus postage. BC-221 manual, 162 pages, dope on all models, $1.50 plus postage. Frank Dunan, W3NB, 1717 Lang Place, N. E., Washington 2, D. C.

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WANTED: Echophone EC1A,SM7ZT, P.O. Box 132. Lennart Larsson, Reftele, Sweden.

FOR SALE: Pilot FM Tuner, like new, $20.00. W9ACU, Browning, Ill.

BEST OFFER takes Presto K11 recorder and model 55 Shure Unidyne multi-impedance cardioid microphone. All replies answered. Station W2QNB, 370 Convent Ave., New York 31, N. Y.

FOR SALE: Transmitters, receivers, parts, tubes, new, used and surplus. Write for list. Radio, Box 639, Winchester, Va.

TIME PAYMENTS available on all equipment, new or second-hand, at Evans Radio, Concord, N. H.

SPECIALIZED QSLs - SWLs! Samples! Ace Print, 2705 So. 7th, Council Bluffs, Iowa.

FOR SALE: Stancor ST-202-A. In good condition, with all tubes, coils. $80. Dan Hingtgen, WØWIG, 2846 Jackson Street, Dubuque, Iowa.

BARGAINS: New and reconditioned Collins, National, Hallicrafters, Hammarlund, RME, Millen, Meissner, Gonset, others. Reconditioned S38 $29.00, SX43 $119.00, SX42 $179.00, NC-57 $69.00, NC173 $139.00, NC 183 $199.00, HQ129X $129.00, DB22A $49.00, HF-10-20 $59.00, RME45 $89.00, BC211 $49.00, S40A, SX25, SX28, SX28A, SX62, S39, HT18, HT9, NC240D, HRO, VHF152A, BC610, Collins 32V, 75A, etc. Terms. Shipped on trial. List free. Henry Radio, Butler, Missouri.

FOR SALE. Several ART13 Collins autotune transmitters, used, unconverted, in excellent condition. Complete with tubes, xtal and calibration book, but less cable and dynamotor. $95. Several ARC4 Transmitter-Receiver 100-152 Mc. Used but excellent condition, complete with tubes and dynamotor. $20. Each item FOB W7EAI 535 Leslie Ave. Wm. H. Steele Helena, Montana.

QSLs? SWLs? Largest variety samples, 6c. Printer—Sackers, W8DED, Holland, Michigan.

AUTOMATIC ANTENNA MATCH—Any spacing line to any load! TV or "ham". Send dime for details. A. L. Munzig, (ex-W6BY), Hawthorne, Calif.

SELL OR SWAP: BC-342N, VHF-152A, LM and BC221B, Transvision 7", BC-522, GE YGS-3, approved A-460 TV FSM, DCSW-3, grid dipper, 72" Parmetal, chokes and condensers, 810, 813, 4E27, 100TH, 250TH, TB-35, PP100TH final and modulator, Make offer. W1JR, 23 Bennett Rd., Gardner, Mass.

BARGAINS: NEW AND USED TRANSMITTERS — RECEIVERS PARTS: Globe King $299.00; HT9 $225.00; Temco 75GA $250.00; Collins 75A1 $295.00; new 150 watt phone $199.00; SX42 $189.00; NC-173, HQ129X $139.00; SX43 $129.00 ART-13 $119.00; RME45 $99.00; SX25 $89.00; HT6 $85.00; Meck T-60 $85.00; RME69 $69.50; VHF 152A $69.00; NC-100 $59.00; Globe Trotter $57.50; New Bud VFO $39.50; New Meissner Signal Calibrators $24.95; S-38 $29.95; 90800 Exciter $29.50; 3-30 or 10-11 converters $25.00; S41G 22.50; XE-10 $19.95; and many others. Large stock trade-ins. Free trial. Terms financed by Leo, WØGFQ. Write for catalog and best deal to World Radio Labs, Council Bluffs, Iowa.

WANTED: "S" meter for Hallicrafters S-40 with or without case. Ray Westcott, Ontario, Orgeon. W7NOM

WANTED: SSR-1-G receiver. State condition and price. W6CLV, 122 43rd Street, Sacramento 16, Calif.

SALE BC-610 modulation transformer $20; Stancor P-8032 plate transformer 2000 vdc at 375 ma. $30; Turner 22D hi-impedance mike $10; Astatic D-104 mike $7; six 8 mfd 2000 vdc filter condensers $3 each; four 810's $5 each; two 813's $5 each; several large Johnson variable condensers, single and double section, 0.2 inch spacing. All good gear excess to my own needs. FOB Charleston. Want Super-Pro BC-779, BC-794, or BC-1004. Paul H. Lee, W4RXO, Isle of Palms, S. C.

SELL untanked distribution transformers, 1.5 KVA, 7200 VCT—120/240 volts. $15.00 each f.o.b. Power Electric Co., Box 267, Jackson, Mississippi.

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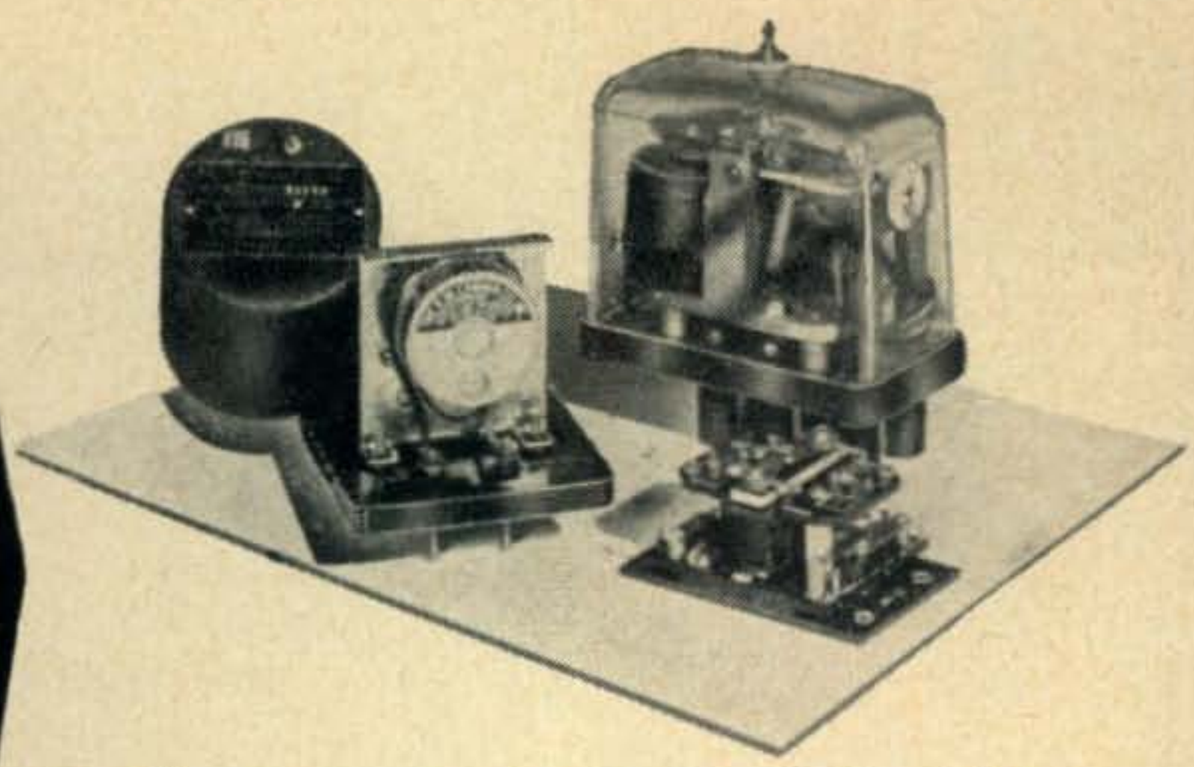

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| STOCK NO. | VOLTAGE | OHMAGE | CONTACTS |
|---|---|---|---|
| R-503 | 12/32 VDC. | 100 | 3A, 2C |
| R-749 | 600 VDC. | ... | Max. 28 Amps. |
| R-804 | 550 VAC. | ... | 1B/38 Amps. |
| R-250 | 115 VAC. | ... | Adj. Cir. Breaker .04-.16A |
| R-579 | 220 VAC. | ... | 1B |
| R-294 | 27.5 VDC. | 200 | 1B |
| R-686 | 115 VAC. | ... | 2C |
| R-246 | 115 VAC. | ... | 1B |
| R-246A | 115 VAC. | ... | 1A |
| R-611 | 24 VAC. | ... | 1A/30 Amps. |
| R-283 | 12 VDC. | 125 | AC/10 Amps. |
| R-614 | 18/24 VDC. | 60 | 1A/15 Amps. |
| R-262 | ..... | 200 | 1C |
| R-245 | 12 VDC. | 25 | 4 In. Micalex Lever |
| R-527 | 6/12 VDC. | 50/50 | In Series |
| R-544 | 12/24 VDC. | 60/60 | 1C |
| R-255 | ..... | ... | 1A |
| R-669 | 75 VAC. | 400 CYC. | 1B, 1A |
| R-660 | 6 VDC. | ... | ⅜" Stroke |
| R-651 | 24 VDC. | 100 | Solenoid Valve |
| R-295 | 12 VDC. | 275 | Annuncitar Drop |
| R-230 | 5/8 VDC. | 2 | 2A, 1C |
| R-813 | 12 VDC. | 12 | Wafer |
| R-275 | 12 VDC. | 750 | 1A, 1B, 1C |
| R-716 | 24 VDC. | 70 | 2A/5 Amps. |
| R-620 | 6/12 VDC. | 35 | 2C, 1A |
| R-629 | 9/14 VDC. | 40 | 1C/10 Amps. |
| R-778 | 8 VDC. | 4500 | 1C/5 Amps. |
| R-720 | 24 VDC. | 50 | 2C, Ceramic |
| R-500 | 12 VDC. | 10/10 | 2C/6 Amps. |
| R-816 | 12 VDC. | 10/15 | 2C/6 Amps. |
| R-811 | 48 VDC. | 8000 | 1C |
| R-524 | 24 VAC/DC. | ... | ..... |
| R-838 | 90/120 VDC. | 925 | 2A |
| R-839 | 100/125 VDC. | 1200 | 3A |
| R-840 | 115 VDC. | 1200 | 2A |
| R-841 | 115 VDC. | 1200 | 4A |
| R-842 | 115 VDC. | 925 | 3A |
| R-843 | 115 VDC. | 1200 | 3A |
| R-844 | 115 VDC. | 1200 | 3A, 1B |
| R-845 | 220 VAC. | Intermit | 3A |
| R-831 | 7.5/29 VDC. | 6.5 | 1A/250A, 1000A Surge |
| R-837 | 110 VAC. | ... | 2A/30 Amps. |
| R-835 | 24 VDC. | 2800 | 1A Dble. Brk./10 Amps. |
| R-836 | 220 VAC. | ... | 2A Ddle. Brk./10 Amps. |
| R-566 | 115 VAC. | 150-Ohms. | (Coil only. Not a complete relay) |
| R-710 | ..... | | |

| MANUFACTURER & NUMBER | PRICE |
|---|---|
| G.E. Ant. Keying 500W 2C6530-653AR1 | $ 2.25 |
| Allen Bradley 810 Dashpot | 5.95 |
| Culter Hammer C-261173A34 Contactor | 3.50 |
| Westinghouse MN Overload | 12.95 |
| Adlake 60 Sec. Thermo Delay | 6.95 |
| Edison 50 Sec. Thermo Delay | 4.25 |
| Leach 1157T-5/20 Sec. ADJ. Delay | 4.95 |
| Cramer 2 Min. Adj. Time Delay | 8.95 |
| Cramer 2 Min. Aqj. Time Delay | 8.95 |
| Durakool BF-63 | 4.25 |
| Onan Rev. Current 3H4512/R24 | 1.00 |
| Rev. Current Cutout 3H2339A/E1 | 3.50 |
| W. U. Tel. Co. 41C Single Current | 3.75 |
| ..... | .95 |
| 2Z7668 For Scr-274N | .95 |
| G.E. Push Button Remote Relay #CR2791-R-106C8 | 1.65 |
| G.E. Pressure Switch #2927B100-C2 | .95 |
| Clare 400 | .95 |
| Cannon Plunger Relay #13672 | .95 |
| ..... | 2.50 |
| ..... | 2.15 |
| Guardian Ratchet Relay | 2.15 |
| Ratchet Relay From Scr-522 | 4.25 |
| Guardian BK-10 | 2.75 |
| BK-13 | 1.45 |
| Guerdian BK-16 | 1.05 |
| Guardian BK-17A | 1.25 |
| Kurman BK-24 | 2.10 |
| 45A High Power | 1.35 |
| Str. Dunn. Latch & Reset | 2.85 |
| Guardian Latch & Reset | 2.85 |
| Sigma 4R | 1.65 |
| Edwards Alarm Bell | .95 |
| Allen Bradley-Bulletin #702 Motor Control | 4.50 |
| Allen Bradley-Bulletin #200E Motor Control | 4.50 |
| Allen Bradley-Bulletin #209 Size 1 Motor Control W/Type "N" Thermals | 5.50 |
| Allen Bradley-Bulletin #709 Size 2 Motor Control W/Type "N" Thermals | 25.00 |
| Allen Bradley-Bulletin #709 Motor Control W/Type "N" Thermals | 5.50 |
| Allen Bradley-Bulletin #200 Motor Control | 4.50 |
| Allen Bradley-Bulletin #202 Motor Control | 4.50 |
| Allen Bradley-Bulletin #704 Motor Control | 4.50 |
| Leach B-8 | 3.50 |
| Leach 6104 | 2.75 |
| Wheelock Signal, B1/39 | 1.95 |
| Wheelock Signal, A7/37 | 3.45 |
| Leach #6104 | .75 |
| Guardian #38187 | 50 |

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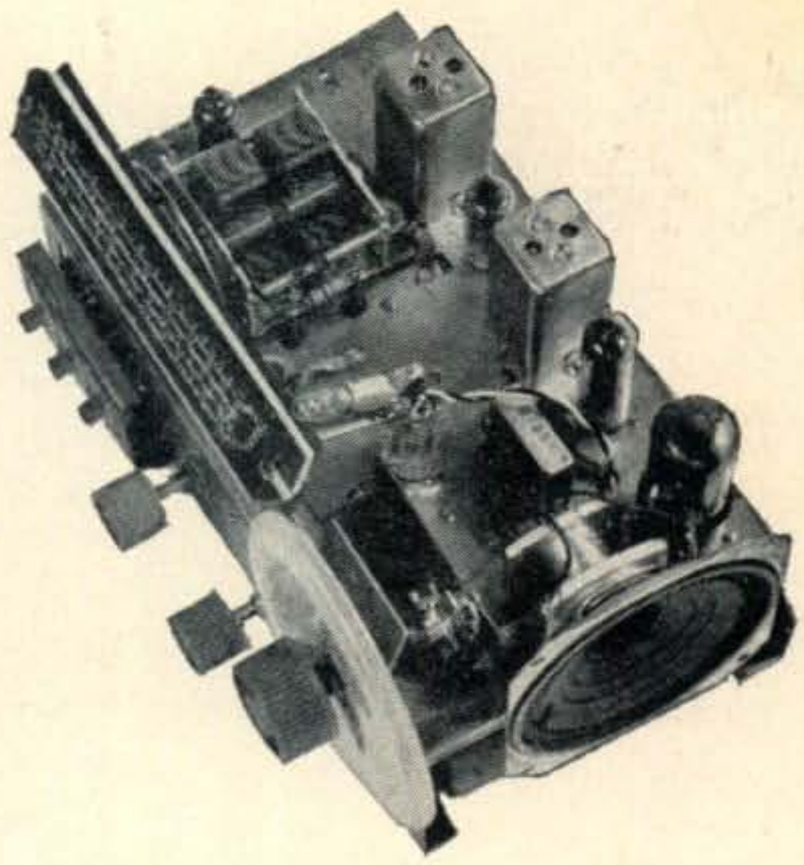
Prices slightly higher west of the Rockies.



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