ANC

CQ RADIO AMATEURS' JOURNAL

JANUARY 1954

The Double-Con 6

35c

a matched pair

for unmatched performance

The Collins 32V-3 and 75A-3 go together like fine matched luggage. Whether your operating taste runs to dx or rag chewing, you'll like the convenience of this pair of proven performers. The 32V-3 packs an accurately calibrated vfo, one-knob band changing, and gang-tuning, into a receiver-size cabinet. It is an ideal companion for the 75A-3 — *the only amateur receiver with built-in mechanical filter.*

With this accurately calibrated pair on your operating table you don't even have to zero-beat! Want to answer that station on his own frequency? Just set the 32V-3 to the frequency indicated on the 75A-3 — that's all there is to it!!!

Write your Collins distributor today for additional information on the unmatched performance you'll get from this matched pair.

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

COLLINS

11 W. 42nd St.
NEW YORK 36

1930 Hi-Line Drive
DALLAS 2

2700 W. Olive Ave.
BURBANK

CQ RADIO AMATEURS' JOURNAL

Vol. 10, No. 1
JANUARY, 1954

CQ—(title Reg. U.S. Post Office)—is published monthly by Cowan Publishing Corp. Executive and Editorial offices, 67 West 44th Street, New York 36, N. Y. Phone MUrray Hill 7-2080. Reentered as Second Class Matter February 6, 1951 at the Post Office New York, N. Y. under the Act of March 3, 1879. Subscription rates in U.S.A. Possessions, APO & FPO, 1 year $3.00; 2 years $5.00; 3 years $7.00. Elsewhere add $1.00 per year for postage. Single copies 35 cents. Printed in U.S.A.

POSTMASTER: SEND FORM 3579 to CQ 67 WEST 44th ST., NEW YORK 36, N. Y.

FEATURE ARTICLES

Departments

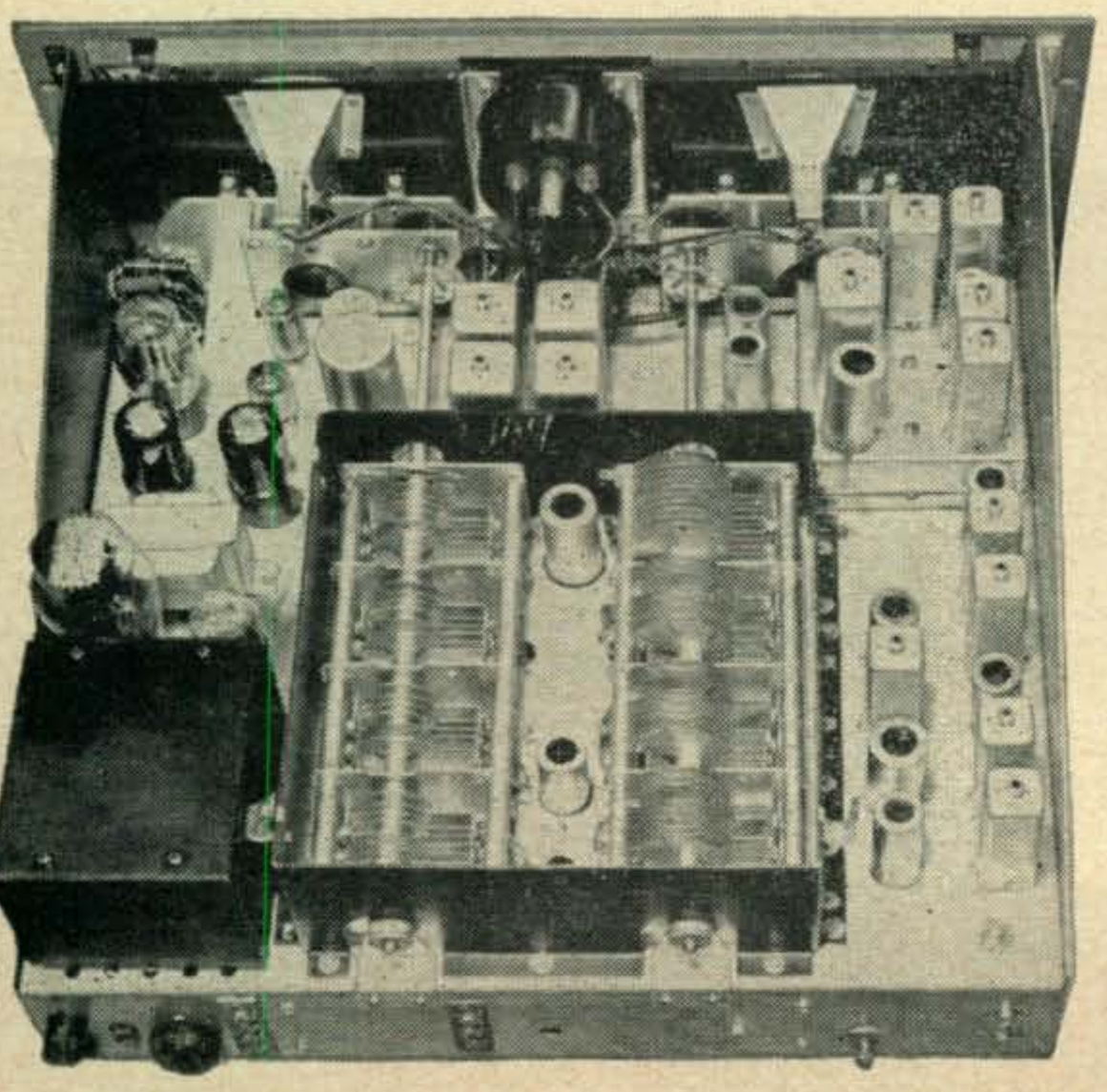
Miscellaneous

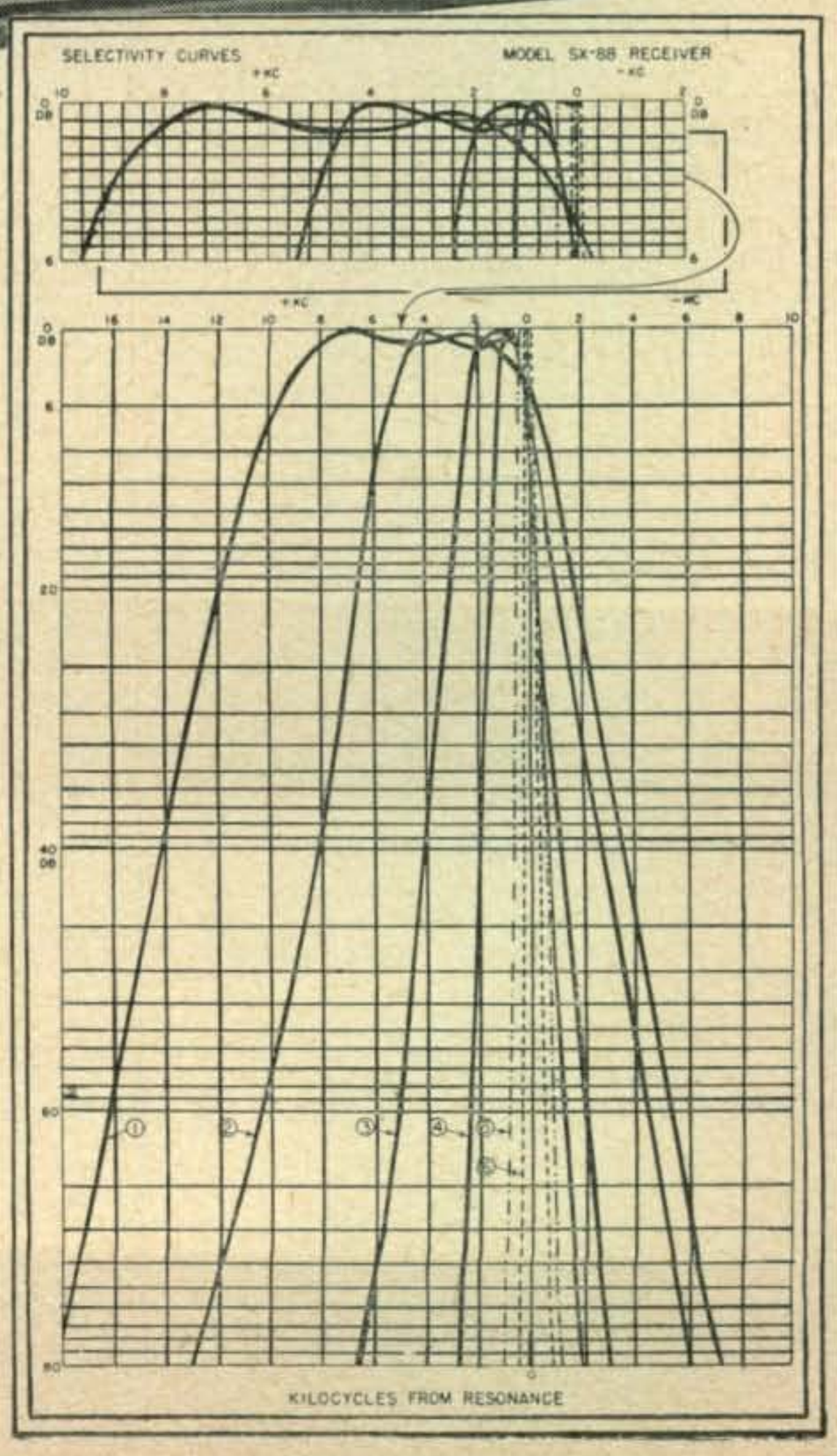
Here are

31 REASONS WHY THE...

is the hottest

SELECTIVITY—For the first time, selectivity from 10 kc to 250 cycles in six steps. Compare with ANY other receiver!





hallicrafters SX-88

ham news in years!

1. Heavy gauge steel welded chassis for mechanical stability.
2. Full precision gear drive for main and band spread tuning.
3. Six position Band Width Control (selectivity) from 250 cycles to 10 kc.
4. 10 watt inverse feed back and push-pull audio output.
5. Exhalted B. F. O. for tops in single side band reception.
6. Buffer amplifier in B. F. O. circuit.
7. Antenna trimmer.
8. Amplified and delayed A. V. C.
9. Built-in 100 kc calibration crystal.
10. Second conversion oscillators crystal controlled.
11. Inertia tuning (fly wheels both dials).
12. Full frequency coverage from 535 kc to 33 mc.
13. Calibrated electrical band spread 160, 80, 40, 20, 15, 11, and 10 meters.
14. Logging scales on each tuning shaft.
15. Dial locks on each tuning shaft.
16. Tuning dial indicators resettable from front panel for maximum calibration accuracy.
17. Auxiliary A.C. socket on rear of chassis.
18. Illuminated band-in-use indicator.
19. Illuminated S meter.
20. Dual S meter calibration S units and microvolts.
21. Auxiliary power socket plus .6 amps at 6.3 volts and 10 ma at 150 volts for accessories.
22. Standard 8¾" by 19" panel for rack mounting if desired.
23. 50 kc i.f. output jack via cathode follower for teletype converter, etc.
24. Five position response control (tone control).
25. Two r.f. stages (Bands II to VI).
26. 17 tubes plus voltage regulator, ballast tube and rectifier.
27. Automatic noise limiter circuit.
28. Phono Jack.
29. Audio output transformer for 3.2, 8, 500/600 ohm loads.
30. Fuse for overload protection.
31. Auxiliary sensitivity control permits monitoring of local transmissions in standby position.

hallicrafters

World's Leading Manufacturer of Communications and High Fidelity Equipment, Radio and Television

4401 West Fifth Avenue, Chicago 24, Illinois • Hallicrafters Ltd., 51 Camden Street, Toronto, Canada

Feenix, Ariz.

Deer Hon. Ed:

Oh boy and sumsuch other things, are I having fablus news for you. Gracious to goodness. Never in Hon. Million years are you buleeving its. Howsumever, I knowing you wanting to run speshul article on same so I rushing glad tidings to you posthasty.

First better givings you background. Resently I deciding my reseever not havings its youshewall sensitivity, so thinking it high time to pepping it up. I ripping out front end like madly, replacing cupple toobs, rewinding new coils with reel high cue, and even rebuilding bandchange switch.

Late one afternoon are finally gettings reseever all put back together, and having only cupple pieces left over, so turning it on. Toobs lite up, pilot lamp on OK, but amchoor bands seeming to be ded. Are just beginning to thinks I making mistakes in rewiring when suddenly coming across 1/c signal. Scratchi listening to see what's on, and Hokendoke!! my Hon. Hair are standing on end. Heering voices say: "Calling Jupiter, calling Plant Jupiter, this are Mars calling."

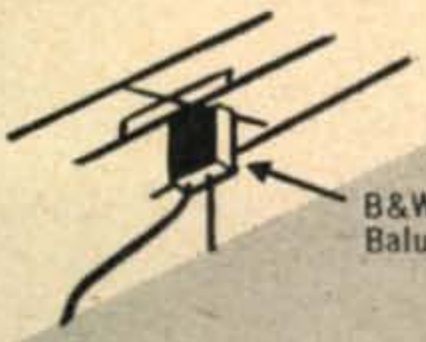
By the beard of my Sacred Aunt Fuji!! I glueing both ears to loudspeeker (for Scratchi this are easy with my ears) and heering Jupiter calling back to Mars. Then both stayshuns getting in long confab about rocket ship what not arriving at Mars on time. Wowiee!! do I keep listening!

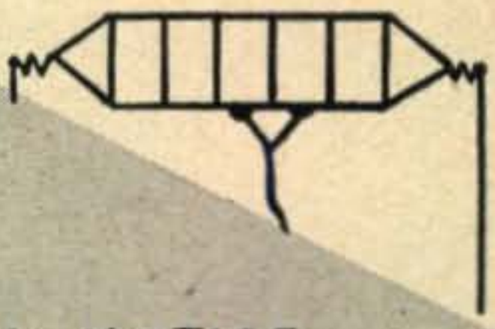
It seeming as how space-ship not arriving on acct. of bad kriminull named Black Pirate are being stowaway on ship, and he sneaking up and overpowering crew, tying them up like Xmas package, and taking over space-ship. The fellows what are so mad about this are sum peeples called Space Rangers, and the Space Rangers on Mars are telling Space Rangers on Jupiter to jumping in Patrol Ship and blasting off quicklike so can catching up with Black Pirate.

Evidentally one stayshun I heering are in Space Ranger school on Mars, and other stayshun are in same kindlike school on Jupiter. Both stayshuns must being in same freakquency because can't even telling when change stayshuns—even coming in same signal strength. Can you imagining, Hon. Ed? Scratchi are making reseever so sensitive it getting Mars and Jupiter. It not only a hot reseever, it a solar reseever!

Now, I suppose you thinking that sumthing are going to happen to my reseever so it not being able to get Mars. No indeedy. Not on your vacuum

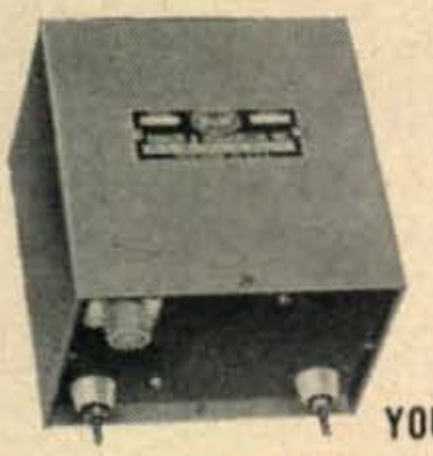
(Continued on page 8)





FOUND! *The Missing Link*

NEW B&W 1-KW BALUNS FILL THE GAP BETWEEN UNBALANCED FEED LINES AND BALANCED ANTENNA LOADS



YOU DON'T HAVE TO BE AN ENGINEER TO MATCH A COAX LINE TO YOUR ROTARY BEAM

Use these precision-built B&W 1-KW Baluns and take the guess work out of your *beam matching problems* for:

- MAXIMUM TRANSFER OF POWER
- LOW LINE RADIATION ON TRANSMISSION
- HIGH SIGNAL-TO-NOISE RATIO ON RECEPTION

Designed to match pi-network or other low impedance output of any transmitter with power ratings up to 1000 watts to beam type antennas, employing the popular "T" MATCHING SECTION.

Model 700 . . . . . for 10 meters
Model 701 . . . . . for 15 meters
Model 702 . . . . . for 20 meters

Housed in heavy gauge steel, weather-proofed cases fitted with coax input connectors and ceramic feed-thru output terminals.

Impedance—75 ohms unbalanced, to 100 ohms balanced.

Size—approx.—3½" x 3½" x 4".
Weight—less than 3 lbs.

$16.50

GET IMPROVED PERFORMANCE WITH FOLDED DIPOLE ANTENNAS

Use these precision-built B&W 1-KW *single band baluns* for:

- MAXIMUM TRANSFER OF POWER
- LOW LINE RADIATION ON TRANSMISSION
- HIGH SIGNAL-TO-NOISE RATIO ON RECEPTION

Designed to match pi-network or other low impedance output of any transmitter with power ratings up to 1000 watts into half wave folded dipoles using 300 ohm feed lines.

Model 710 for 10 meters
Model 711 for 15 meters
Model 712 for 20 meters
Model 713 for 40 meters
Model 714 for 80 meters

Housed in heavy gauge steel, weather-proofed cases fitted with coax input connectors and ceramic feed-thru output terminals.

Impedance—75 ohms unbalanced, to 300 ohms balanced.

Size—approx.—3½" x 3½" x 4".
Weight—less than 3 lbs.

$16.50

BARKER & WILLIAMSON, Inc.

B&W

237 Fairfield Ave., Upper Darby, Pa.

(from page 6)

condenser. That same evening I taking reseever chassis out of cabinet, taking many pictshures of changes made in front end, and even copying circuit diagram. I not taking any chances, not old geenyus Scratchi.

Next day I getting back to shack about same time as day before, turning on reseever, and, what you thinking? Ha! Ha! Hon. Ed., you ded wrong. Mars are still booming in like likkettyplus local. Only difference are that this time the Space Rangers are having run down this fellows Black Pirate and the stayshun I heering are in local jale-house. Black Pirate are confessing all and Mars stayshun are rebroadcasting news to Jupiter.

After confession are over, I heering another stayshun on same freakquency, this time from office of High Commissioner of Mars Space Rangers. He sending congratulayshuns to all Space Rangers for snappy work in bringing in this self-same Black Pirate.

Hon. Ed., this are lots more fun than DX, on acct. this are reel DX. Wowiee!! Just thinking, these stayshuns so far away they not even having call letters. Rite now I working like madly trying to get in two-way qso. Are having called the Plant Mars, but so far they not heering me. If I whomping up power to final and putting in maybes for kilowhats are having good chance. Hey! If I working them, will it counting towards WAZ, or are you starting WAP—Worked All Plants? Howsay? What will you accepting as proof, on acct. can't figure how to getting QSL from Mars or Jupiter?

Of course I also hard at work riting article for your Hon. Mag., so other amchoors can listening in on Mars and Jupiter. Scratchi's Solar Prober—that are name of article. Are thinking of calling it HAPPY (Heard All Plants Plenty Yesterday), but Scratchi's Solar Prober sounding more tecknical, you not thinking? You can looking for article soonly.

Hon. Ed., aren't it a strange thing. Here I heering peeples on Mars and Jupiter, and they speeking self-same languij like I am. Also, and this are reel coinsidense, they even having breakfast cereals like we do. Yes indeedy, every few minutes this stayshun are coming on, and some smart gentlefellows telling how good Crunchy-Wunchies are. You can even heering him pouring milk and cream on them. He even saying where they being made. It are in some town called Bafflecreeks, in Mars. Aren't it a small Universe?

Respectively yours,
Hashafisti Scratchi

Broad Band . . .

Editor, CQ:

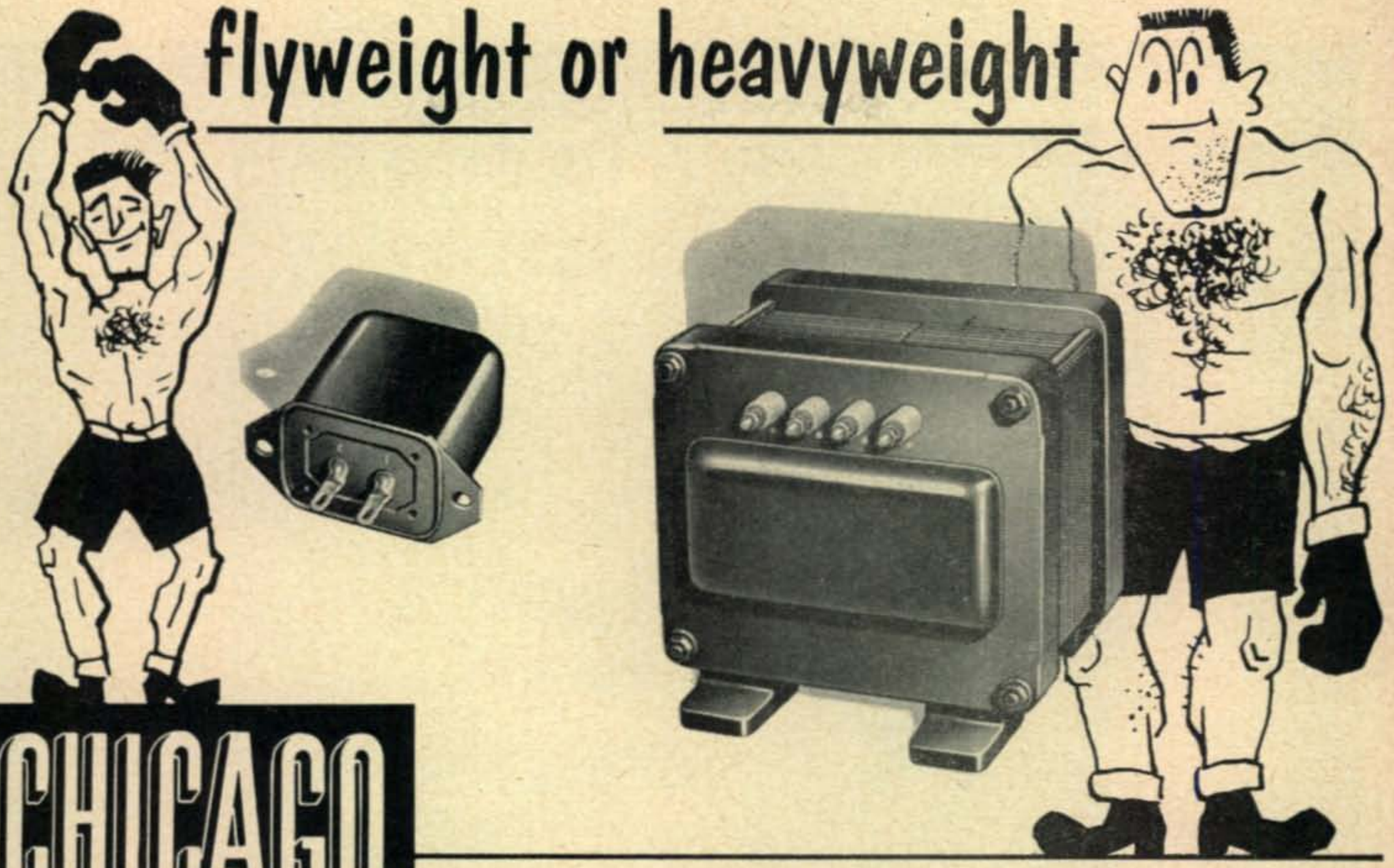
While I was overseas during World War II some 4000 QSL cards, all my log books, allied records, etc., were completely destroyed. These pertained to my amateur operation from 1931 through 1941 at which time my address was San Antonio or Kelly Field, Texas.

It would be sincerely appreciated if your readers would check to see if they had a QSO with me during that period. A duplicate QSL would enable me to regain some of these treasures.

Oliver D. Gassett, W5BVG

3005 Alexander
Waco, Texas

flyweight or heavyweight



CHICAGO

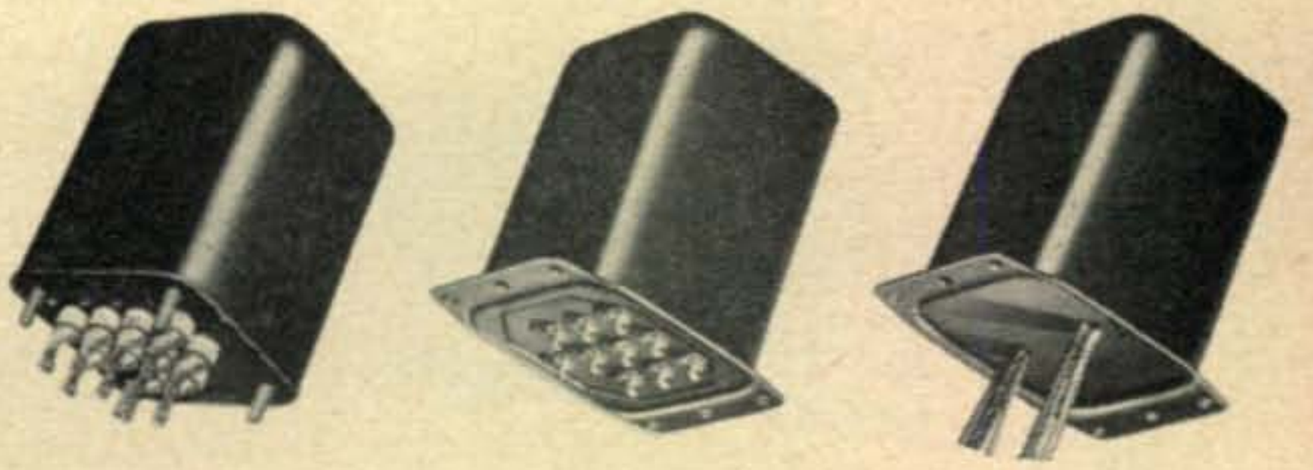
builds the world's TOUGHEST TRANSFORMERS

A Complete Range for Every Need: From "flyweight" Chokes to "heavyweight" Modulation bruisers, CHICAGO "Sealed-in-Steel" transformers are *really rugged*. Talk about "torture"—these units can "take it," and deliver full rating and continuous, dependable service under the toughest conditions. Your electronic parts distributor can supply the *complete* CHICAGO "Sealed-in-Steel" line for *every* circuit requirement: Power, Bias, Filament, Filter, Audio, MIL-T-27, Step-down, etc.

There's Nothing Tougher than the "Sealed-in-Steel" New Equipment Line

CHICAGO'S one-piece drawn-steel cases are the strongest, toughest, best-looking transformer construction available. The one-piece seamless design (in a choice of 3 mountings) enclosing an electronically perfect unit, provides the best possible electrostatic and magnetic shielding, with *complete* protection against adverse atmospheric conditions. Whether your transformers must pass the most rigid MIL-T-27 specs, or are intended simply for average applications—*play safe*—choose CHICAGO "Sealed-in-Steel" transformers.

Free CHICAGO Catalog—You'll want the full details on CHICAGO'S *New Equipment Line*, covering the complete range of "Sealed-in-Steel" transformers for every modern circuit requirement. Write for your Free copy of Catalog CT-153 today, or get it from your electronic parts distributor.



AVAILABLE IN 3 VERSATILE CONSTRUCTIONS

H-TYPE

Hermetic sealing meets all MIL-T-27 specs. Steel base cover is deep-seal soldered into case. Terminals hermetically sealed. Ceramic bushings. Stud-mounted unit.

S-TYPE

Steel base cover fitted with phenolic terminal board and pressed into base. Convenient numbered solder lug terminals. Flange-mounted unit.

C-TYPE

With 10" color-coded leads brought out through fibre coard base cover. Lead ends are stripped and tinned for easy soldering. Flange-mounted unit.

CHICAGO STANDARD TRANSFORMER CORP.

3501 ADDISON STREET • CHICAGO 18, ILLINOIS

TYPICAL OPERATION (Frequencies below 120 mc.)	
Radio Frequency Power Amplifier and Oscillator Class C Telegraphy or FM telephony (key down conditions, one tube)	2500 volts
D-C Plate Voltage	350 volts
D-C Screen Voltage	-150 volts
D-C Grid Voltage	200 ma.
D-C Plate Current	3.8 watts
Driving Power	500 watts
Plate Power Input	125 watts
Plate Dissipation	375 watts
Plate Power Output	

Write our Amateurs' Service Bureau for a free copy of the information filled 28 page booklet, "Care and Feeding of Power Tetrodes".

Quality screen-grid tubes became popular eight years ago when Eimac introduced the 4-125A radial-beam power tetrode to the electronic industry. Since that time thousands of engineers and amateur radio operators have used the Eimac 4-125A in a wide variety of applications and have consistently received outstanding, dependable performance. This versatile tetrode contains the *pyrovac** plate, controlled emission grid wire, low inductance leads, thoriated tungsten filament, and input-output shielding. All of these advanced features are found only in Eimac tubes. Add to this, high power output with low driving requirements, simple circuit design that minimizes TVI, low grid-plate capacitances, and ability to withstand heavy momentary overloads, and you have the Eimac 4-125A — quality tetrode in the 125 watt field.

**An Eimac trade name*

EITEL-McCULLOUGH, INC.
San Bruno, California
Export Agents: Frazar & Hansen, 301 Clay St., San Francisco, California

Eimac TUBES

Zero Bias . . .

"Radio Hams Facing Check for Security"

"Congress May Tighten Regulations on 800,000 Amateur Radio Operators"

In mid-November literally millions of newspaper readers were glancing over the above headlines and wondering if a new threat to the peace and welfare of this nation was being recognized. The story was attributed to Senator Wiley (R) of Wisconsin who serves as Chairman of the Foreign Relations Committee. Senator Wiley indicated that Congress would be asked to restrict the use of the Ham bands, in particular the ship-to-shore stations. The interpretation of this move is to preclude possible security risks.

Further examination of the remarks made by Senator Wiley leave considerable doubt as to whether he was referring to Hams specifically or whether he was lumping together all grades of FCC licensed operators and calling them all a potential threat. Obviously, this poor analysis of the problem precipitated a very wide range of confused opinions and comments. Ham operators represent only one in eight of the total number of licensed operators, but they are, nevertheless, the only large body of radio operators who could guarantee a certain degree of long-range communication.

If Senator Wiley is referring specifically to radio amateurs, then the question is whether or not Hams constitute a significant security risk. In this respect, Senator Wiley is reported to have stated that they represent about the only persons who operate radio transmitters as a hobby and could open the way during an atomic attack for a disloyal operator to guide a Soviet plane to its target. This aspect of the security problem has been given considerable study by key federal agencies. Their thoughts must necessarily revolve around what advantages are to be gained from greater restrictions and what price must be paid for these advantages.

Regardless of the philosophy expressed in some quarters, the security risk problem is one where the individual is assumed to be guilty until proven innocent. It would be possible, under this questionable and precarious philosophy, to check on the potential loyalty of each licensed radio operator. But this could only be done at a fantastic cost in time and money. Eventually, it would mean denying certain rights to a number of Hams, assuming that there were a few among us willing to utilize their facilities contrary to the best interests of the nation. Not too long after this "witch hunt" we might expect minute surveillance which would become so burdensome as to result in final curtailment of all Ham privileges.

What would the nation gain if this were to come about? Does the Senator from Wisconsin not realize that transmitting equipment can be built from electronic components available to every citizen? Is the Foreign Relations Committee aware that Hams maintain a wonderful monitoring network and actually, because of their overwhelming national loyalty, act as their own policing system? One wonders how long a clandestine station in the Ham bands could operate without being detected. Finally, isn't it about time that Senator Wiley be *re-informed* that Hams are the life-blood of the electronic industrial complex. Stifling our radio amateur life would soon decrease the number of available technicians and engineers. Our hobby can stand on its merits of providing the nation in peace and war with a solid backbone of capable electronic personnel.

This Editorial alone will not alleviate the impending threat to Ham privileges. Each radio amateur should consider this so-called "security risk" indictment a possible infringement on his basic rights. Rumors are persisting that strenuous efforts will be made this year to close this security gap. Whether or not the appropriate steps will be taken by individuals and groups to counter-balance this type of unfavorable and unfair publicity is something we are awaiting with bated breath.

Isn't the time to say something, *now?*

o. p. f.

The Double-Con 6

CLIFFORD C. JOHNSON, WØURQ

1258 Van Buren, St. Paul E-4, Minn.

A Truly Miniature Ham Receiver with Double Conversion on Six Bands Costing Less than $75 to Build

The old saying that good things come in small packages could easily be applied to this miniature Ham-band receiver. Although the cabinet measures only 8 x 12 inches, the performance of the receiver is comparable to that of its bigger brothers. The receiver covers six amateur bands with each band spread out over most of the 180 degrees of the six-inch dial—the largest component on the receiver. The coverage includes the 80, 40, 20, 15, 10 and 6-meter amateur bands.

The circuit and layout involves no tricky devices to obtain small size. Standard parts are used in a straightforward circuit employing the newest techniques in design for efficient operation. Although there is little waste space on the 7 x 9-inch chassis, all components are readily accessible and all the usual controls are conveniently located on the front panel. The dial drive is a simple drum and cord system that operates smoothly with a good vernier ratio that makes tuning easy. The circuit employs dual conversion to eliminate images with a low 2nd i-f channel for that selectivity so necessary on the Ham bands. The front end uses one remote cut-off r-f stage with both grid and plate circuits tuned for added selectivity and gain. The high frequency mixer-oscillator tube is a 6U8, chosen for its superior efficiency on the higher frequencies. The 6BE6 is the second conversion tube with a crystal in the low frequency oscillator section to change the 1959-kc. input i.f. to the single stage at 135 kc. A 6AL5 is a combined detector and noise limiter, a 12AT7 is used in the b.f.o. and first audio, and a 6AQ5 is the audio output stage.

Receiver Layout

While trying out this receiver, several good points turned up unexpectedly. For one thing the stability is unusually good both electrically and mechanically. Inasmuch as the chassis is small all leads are naturally very short and by the time all components were mounted their mutual bracing effect promoted excellent chassis solidity. There is no trace of oscillation or feedback between any of the circuits and the all-important high-frequency oscillator section has its coils and padders, so close to their respective connecting points, that practically no leads were required. The new *Centralab* small-sized bandswitch is the heart of the r-f section and permits the compact layout. The three-gang, ball bearing tuning condenser with wide plate spacing is a natural for this receiver. The b.f.o. is very stable due to the low frequency on which it operates. The low-frequency crystal oscillator precludes drift in that stage, although an ordinary cathode-tapped oscillator

Mounting Components

1 closed circuit phone jack.
1 dial drive.
1 2¼" dial drum.
18 r-f coils (see coil table).
5 7-pin shield base sockets, mica filled (Amphenol).
1 9-pin shield base socket, mica filled.
1 9-pin bakelite socket.
1 7 x 9 x 2-inch aluminum chassis.
1 8 x 12-inch cabinet with 8 x 10-inch panel (Par-Metal).
5 knobs.
9 8-lug terminal boards (surplus).
2 pilot lights and sockets.
1 a-c cord and plug.
Ground lugs, hookup wire, and pieces of light aluminum.
Tubes: 2-6BA6's, 1-6BE6, 1-6AL5, 1-6AQ5, 1-6U8, 1-2AT7.

coil could have been used with reasonably good results at this frequency.

The phone jack and noise limiter switch require the longest leads in the receiver since these leads must return to their respective tubes at the rear of the chassis. Shielded wire was used to prevent trouble. The audio output transformer location could have been a source of feedback, but gave no trouble after being properly oriented with respect to the power transformer to cancel out a slight bit of hum pickup.

A fellow likes to have his gear presentable, so the dial was placed in the center of the panel and the rest of the controls positioned around for a balanced layout. The arrangement of the parts on the chassis follows the circuit diagram closely, making the wiring simple and direct. Almost all of the resistors are grouped on terminal strips and mounted along the side of the chassis near their location in the circuit. This method leaves the chassis uncluttered and allows access to all tube socket connections for ease in wiring and checking. The i-f and audio sections of the receiver, as well as the power supply, are in a line around the outer one and a half inches of the chassis. This leaves the front side and most of the chassis itself for the band switching r-f section.

No Special Parts Needed

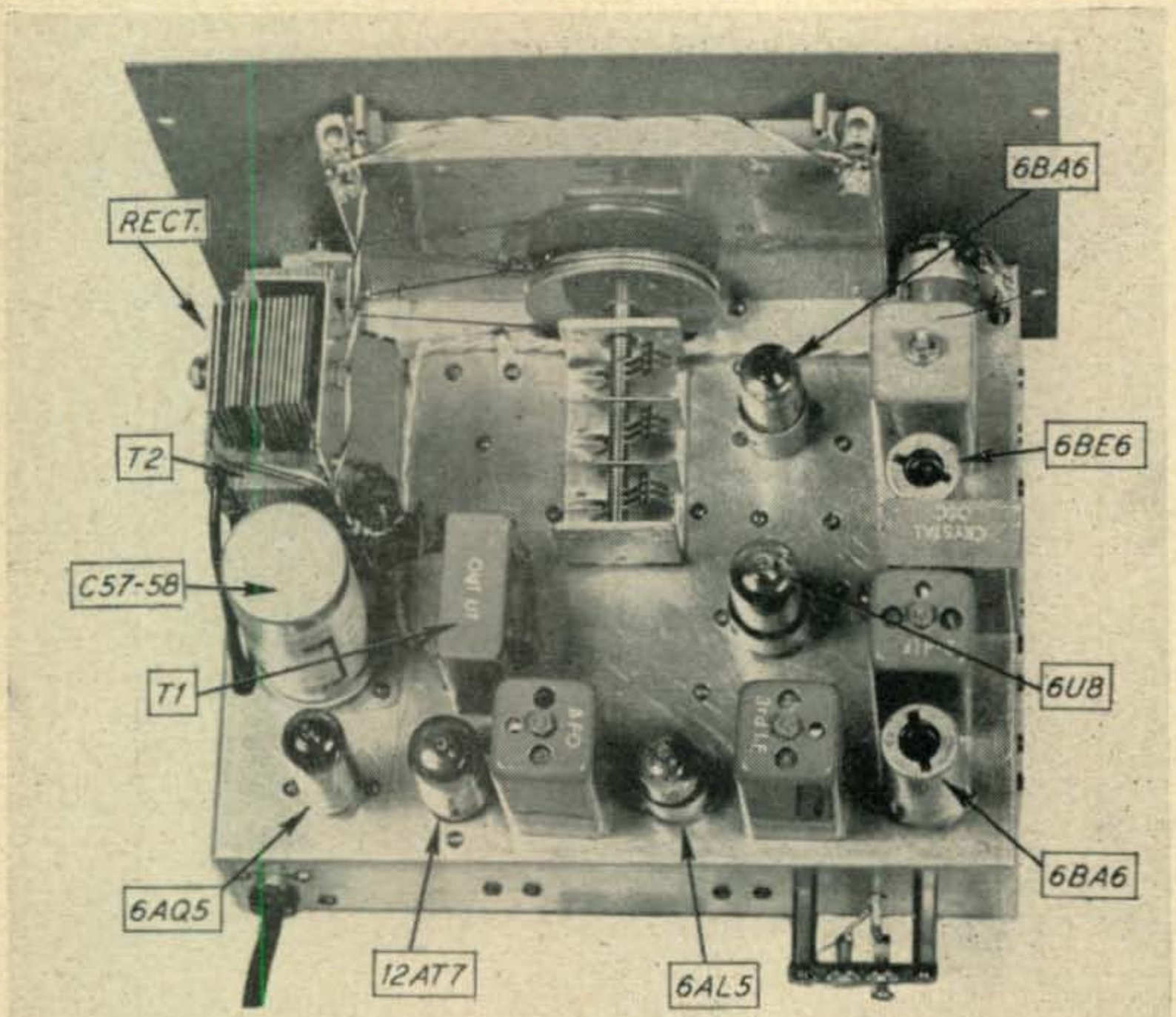
No special parts are required for this receiver that cannot be purchased or easily made up without an elaborate workshop. The chassis is a standard 7 x 9 x 2-inches, made of aluminum for easy working. The cabinet is a stock item carried by all purveyors of Ham gear. The tuning condenser is a 3-15 $\mu\mu$fd. model designed for use in FM receivers. The dial and its drive consists of a three-inch pulley drum on the condenser shaft and a dial cord running around the dial drive which terminates on a small spring on the drum, like many broadcast sets. A piece of cookie sheet aluminum was cut to make a back support 4 x 6-inches with ⅜-inch lips, and bent all around in the manner of a little chassis to enclose and serve as a mounting for the dial. The dial scale is a piece of glazed white cardboard. The back support, with a ¼-inch hole drilled through for the shaft of the condenser, is bolted to the chassis through the bottom lip. A couple of holes in the top lip make a place to mount the pilot lights. When the dial is calibrated, a piece of lucite sheet of the same size is fastened flat against the cardboard to hold it firmly in place and prevent warping in damp weather. Small bolts through the Lucite sheet and dial, tapped into the back support near each corner, will hold it nicely. The shaft extending from the tuning condenser protrudes slightly beyond the thickness of the cardboard and Lucite covering. A hole is drilled in the end of the condenser shaft and tapped for a *4-36* bolt to mount the pointer. The pointer was made from a ¼" wide strip of polystyrene with a line scratched down the center and filled with India ink. One of the small *National* or *Millen* dials could have been used but this simple hand-made dial has much more space for calibration.

Wiring Schematic and Parts List.

C1, C2, C3—3-15 $\mu\mu$fd., 3-gang variable (All Star or Bud LC-1846).
C4—100 $\mu\mu$fd. shaft type APC variable.
C5, C8, C9, C10, C23, C47—100 $\mu\mu$fd. ceramic.
C6, C7, C21, C22, C36, C37, C38, C39, C43, C50, C52, C54—0.01 μfd. disc ceramic (Erie 821-01).
C11, C14—15 $\mu\mu$fd. ceramic.
C12, C13, C15, C17, C19, C20—8-50 $\mu\mu$fd. ceramic variable (Centralab).
C16, C18—170 $\mu\mu$fd. ceramic.
C24—50 $\mu\mu$fd. silver mica.
C25, C27, C29, C31, C33, C35—5-25 $\mu\mu$fd. NPO ceramic variable (CRL).
C26—30 $\mu\mu$fd. silver mica.
C28—130 $\mu\mu$fd. silver mica.
C30—260 $\mu\mu$fd. silver mica.
C32—200 $\mu\mu$fd. silver mica.
C34—20 $\mu\mu$fd. silver mica.
C40—150 $\mu\mu$fd. silver mica.
C41, C42, C45, C46—0.02 disc ceramic (Erie 817-02).
C44—0.1 μfd., 200v. paper.
C48—0.05 μfd., 200v. paper.
C49—250 $\mu\mu$fd. ceramic.
C51, C55—25 μfd., 50v. electrolytic.
C53—100 $\mu\mu$fd. silver mica.
C56, C57, C58—40-40-10 μfd., 450v. electrolytic.
R1, R7, R10, R23, R24, R25—1 megohm, ½w.
R2, R17—100 ohms, ½w.
R3—10,000 ohms, variable. Midget.
R4, R19—47,000 ohms, 1w.
R5, R12, R16, R18, R30—100,000 ohms, ½w.
R6, R15, R20, R27—2,000 ohms, ½w.
R8, R13—22,000 ohms, ½w.
R9, R14, R29—27,000 ohms, 1w.
R11—150,000 ohms, ½w.
R21, R22, R31—270,000 ohms, ½w.
R26—500,000 ohm volume control with switch.
R28—50,000 ohms, ½w.
R32—500 ohms, 1w.
IFT-1—2000-kc. i.f., tuned to 1959 kc. J. W. Miller 112-W2).
IFT-2, IFT-3—135-kc. i.f. (from surplus marker beacon receivers, or J. W. Miller 012-M2).
BFO—135-kc. i.f., Modified as per text. (Same as IFT-2).
T1—output transformer, 6AQ5 to voice coil.
T2—power transformer (Merit P-3045).
Ch1—65 ma. filter choke (Merit C-2990).
Rect.—dual selenium, 100 ma., 160v. (Federal 1008A).
Xtal—2094 kc. (surplus).
Sw1, 2, 3, 4, 5, 6—single pole, six position wafers (CRL 2500 series)
Sw7-7A—d.p.s.t. toggle
Sw8—on volume control
Sw9, 10—s.p.s.t. toggle

Note:
If J. W. Miller transformer #112-W1 is used for IFT-1, the first i.f. will lie between 1400-1600 kc. The frequency of the conversion crystal will then be the i.f. chosen plus 135 kc., and will be in the range 1535-1735 kc.

6BA6
ANT
GND
SW1
SW2
SW3
SW4
SW5
SW6
C2 15 µµfd
C5 100 µµfd
C1 15 µµfd
C4 100 µµfd
R1 1Meg
R2 100Ω
R3 10K
C6 .01 µfd
R5 100K
C21 .01 µfd
R4 47K
C7 .01 µfd
L1
L2
L3
L4
L5
L6
C8 100 µµfd
C9 100 µµfd
C10 100 µµfd
C11 15 µµfd
L7
L8
L9
L10
L11
L12
C12 8-50 µµfd
C13 8-50 µµfd
C14 15 µµfd
C15 8-50 µµfd
C16 170 µµfd
C17 8-50 µµfd
C18 170 µµfd
C19 8-50 µµfd
C20 8-50 µµfd
C23 100 µµfd
R7 1Meg
R6 2K
C22 .01 µfd
6U8
C37 .01 µfd
SEE TEXT
R10 1Meg
+200V
AVC
RF GAIN
A
B
C
D
R9 27K
C24 50 µµfd
C3 15 µµfd
R8 22K
C36 .01 µfd
L13
L14
L15
L16
L17
L18
C25 5-25 µµfd
C26 30 µµfd
C27 5-25 µµfd
C28 130 µµfd
C29 5-25 µµfd
C30 250 µµfd
C31 5-25 µµfd
C32 200 µµfd
C33 5-25 µµfd
C34 20 µµfd
C35 5-25 µµfd
T2
SW8 ON VOL CONTROL
SW10 STANDBY
DUAL SEL. RECT.
CH1 65Ma
110V AC
C56 40µfd
C57 40 µfd
C58 40 µfd
6.3V TO ALL FILAMENTS
6BE6
6BA6
6AL5
12AT7
6AQ5
IFT-1
IFT-2
IFT-3
XTAL
L19
C40 150 µµfd
R13 22K
C38 .01 µfd
C39 .01 µfd
R11 150K
R12 100K
C41 .02 µfd
R14 27K
C42 .02 µfd
R15 2K
C44 .1 µfd
C43 .01 µfd
R16 100K
R17 100Ω
R18 100K
C45 .02 µfd
R19 47K
R20 2K
C46 .02 µfd
R23 1Meg
R21 270K
R22 270K
C47 100 µµfd
R24 1Meg
R25 1Meg
C48 .05 µfd
SW9 NOISE LIMITER
C49 250 µµfd
SW7 AVC
C50 .01µfd
R26 500K
R27 2K
C51 25 µfd
C52 .01 µfd
C53 100 µµfd
R28 50K
BFO
C59 3 µµfd
R29 27K
SW7A BFO
C54 .01µfd
PHONES
R30 100K
R31 270K
C55 25 µfd
R32 500Ω
T1 OUTPUT



The above-chassis view of the receiver shows the extremely clean appearance of the "Double-Con 6."

Although the i-f transformers used in this receiver are surplus items, standard midget transformers of similar frequencies may be used with equally good results. There is a lot of leeway in choosing the intermediate frequency, as well as the conversion oscillator frequency.

The one important thing is to prevent the harmonics of the conversion oscillator from falling right in the lower Ham bands. In a large receiver these harmonics can be minimized or eliminated entirely by isolation, shielding and the use of a separate oscillator tube. This elaborate construction can be disregarded in a Ham band receiver if the intermediate frequency is selected with a little forethought.

The 2094-kc. crystal used in this receiver was a matter of using what was readily available and although one harmonic falls on 29,316 kc., there are none in any of the lower frequency bands. A crystal is not absolutely necessary. A cathode tapped coil with a stable silver mica condenser across it can be set for the desired frequency and will be adequately stable. The midget 1500-kc. transformers currently available for converter use are ideally suited for this application. If they won't tune high enough as they come, a few turns can be removed from the coils. The lower the second i.f. the better the selectivity and gain.

The beat oscillator transformer consists of a slight modification of one coil of an i-f transformer. A couple dozen turns were removed from the coil, the wire brought out for a cathode tap and the turns then scramble wound back on the coil. The pitch of the b.f.o. is adjusted by means of the trimmer on the i-f can. Coupling to the detector is by means of a 3-$\mu\mu$fd. ceramic condenser from the cathode of the b-f-o tube to the detector diode.

The detector is a conventional diode and the noise limiter is a series type with a cut-out switch on the panel. It is a very effective limiter and causes very little audio distortion. The audio system leaves nothing to be desired for even a large Ham shack. The phone jack is between the audio stages and cuts off the output from the speaker when the headphones are plugged in.

The selenium-type power supply is simple and eliminates one tube while requiring only a small transformer. Isolation from the 110-volt line was felt desirable. The selenium rectifier is a 100-ma. 160-volt dual type and the filter condensers are 40/40-μfd., 450-volt units plus a 10-μfd. section, all in one can. The actual voltage developed under the 65 ma. drain measured about 200 volts out of the voltage doubler, and the power supply ran only slightly warm even after hours of continuous operation. The plate supply could have been anything from 150 to 250 volts. The selenium rectifier was mounted on a bracket on top of the power transformer to provide ventilation. The filter choke was mounted below the chassis beneath the power transformer.

The AVC System

Full a.v.c is applied to the r-f stage, the second mixer and the i-f amplifier. The r-f gain control is in the cathodes of the two 6BA6's. For an all-round receiver good a.v.c. action is desirable to prevent overloading, cross modulation or blocking with very strong signals. A remote cut-off tube in the r-f stages gives good performance in this respect. The screen voltage for the two tubes on the r-f gain control circuit is obtained through individual bleeder networks, instead of a dropping resistor, to prevent that annoying change in pitch of the beat note when the r-f gain is varied.

It was at first intended to include an *S*-meter on the receiver, but dial space requirements

precluded this. To dress up the appearance of the receiver, all the i-f cans and hand-made parts were painted with grey automobile enamel before chassis assembly, giving a durable finish that masks little dents and scratches, doesn't show dust and adds the elusive professional touch to the finished product.

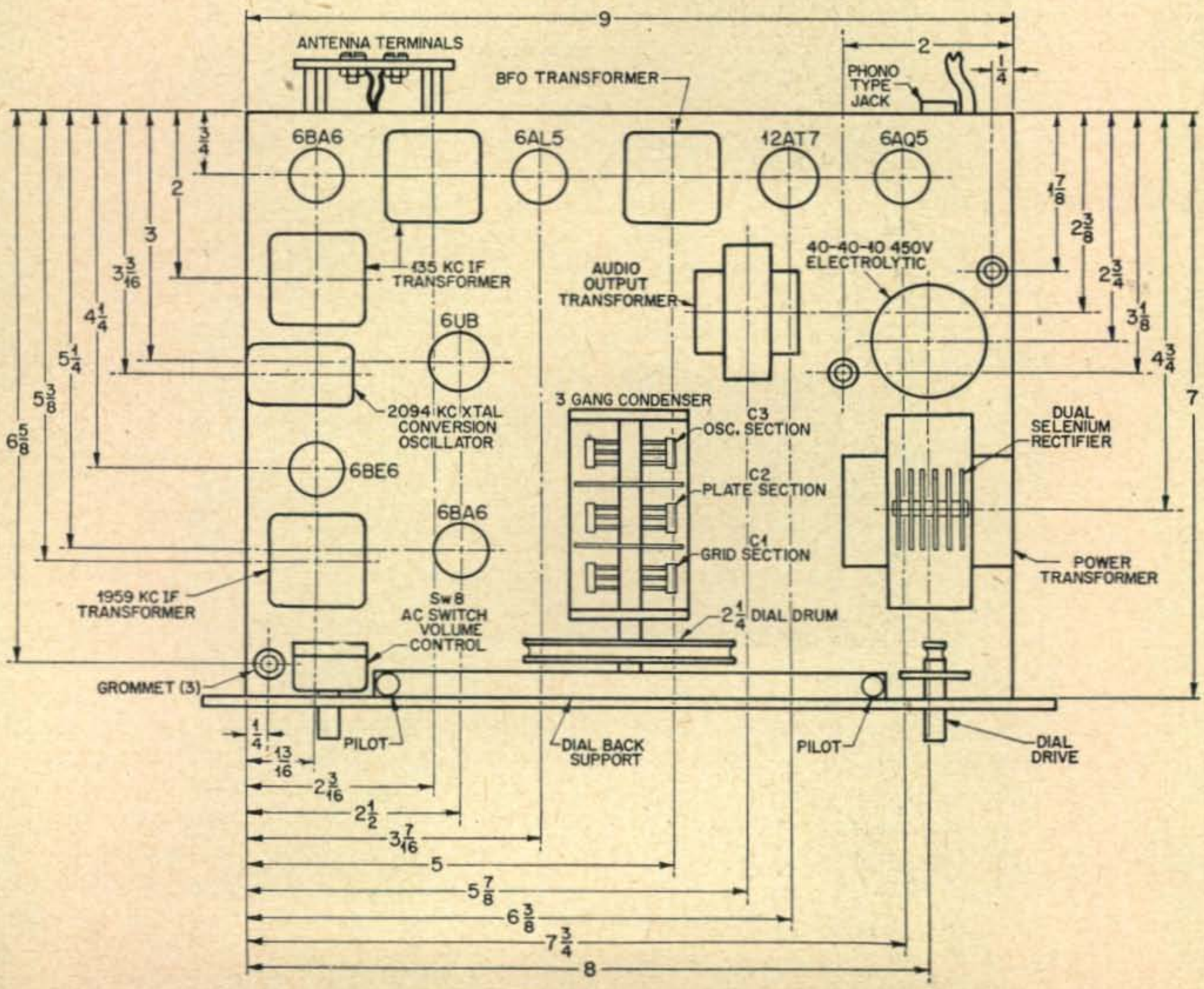
Parts Assembly

The layout of the parts is apparent from the photographs. At the front of the chassis to the left is the volume control, mounted directly on the panel; behind it is the 1959 kc. i-f transformer, then the 6BE6 and the shield can over the crystal. Next in line is the first low channel i-f transformer with the 6BA6 on the corner and the second i-f transformer to the right, then the 6AL5, the b-f-o transformer and 12AT7, and in the far right corner is the 6AQ5 output tube. The large can behind the power transformer is the filter condenser. The output transformer is between the filter can and the tuning condenser. Mounting holes were determined by putting each part in its approximate location and marking directly on the chassis with a pencil. After drilling the holes, the parts above the chassis were mounted. The location of the mounting holes for the front panel controls was determined by actually fitting the parts, starting with the band switch, in the center of the front edge of the chassis. The dial drive was placed to the right of the dial back support on a small angle bracket above the chassis. The b-f-o switch and the stand-by switch were put in line directly below it. At the left, the limiter switch and phone jack are in a line below the volume control with the r-f gain control and antenna trimmer equal distances either side of the band switch.

The tuning condenser was mounted right on the chassis with *4-36* bolts tapped into the convenient holes already in the condenser frame. The dial cord drum protrudes slightly below the top level of the chassis so a slot was cut in the chassis just large enough to allow clearance. Several 3/8-inch holes were drilled in the chassis under the ceramic buttons on the tuning condenser to let the soldering lugs come through to the under side where the connections are made. The antenna terminals were mounted on 1-inch stand-offs at the rear of the chassis so they would be easy to get at when the receiver was put in the cabinet. A phono-type jack was mounted on the rear apron of the chassis, near the 6AQ5 for the voice coil leads to the external speaker. The a-c line cord goes through a grommeted hole below the phono jack.

Wiring

Before working on the r-f section, wiring was done on the i-f and audio components already



This top chassis view shows the principal layout dimensions.

Coil Table

BAND	COIL TUNING RANGE	NO TURNS	WIRE SIZE	TAP	COIL DIA	TRIMMER (μμfd)	FIXED CAP (μμfd)
80	L1 ANT	12	32				
	L1 GRID 3500-4000	75	32		1/2		
	L7 PLATE 3500-4000	75	32		1/2	8-50	NONE
	L13 OSC. 5500-6000	37	26	8	1/2	5-25 NPO	30
40	L2 ANT	8	30				
	L2 GRID 7000-7300	25	22		1/2		100
	L8 PLATE 7000-7300	25	22		1/2	8-50	50
	L14 OSC. 9000-9300	15	22	5	1/2	5-25 NPO	130
20	L3 ANT	5	30				
	L3 GRID 14000-14350	8	20		1/2		100
	L9 PLATE 14000-14350	7	20		1/2	8-50	170
	L15 OSC. 16000-16350	6	20	2 1/2	1/2	5-25 NPO	260
15	L4 ANT	4	30				
	L4 GRID 21000-21500	5	20		1/2		100
	L10 PLATE 21000-21500	5	20		1/2	8-50	170
	L16 OSC. 19000-19500	5	20	2	1/2	5-25 NPO	200
10	L5 ANT	5	30				
	L5 GRID 26900-30000	9	20		3/8		15
	L11 PLATE 26900-30000	9	20		3/8	8-50	NONE
	L17 OSC. 28900-32000	8	20	3	3/8	5-25 NPO	20
6	L6 ANT	4	30				
	L6 GRID 49000-54000	5	20		3/8		NONE
	L12 PLATE 49000-54000	4	20		3/8	8-50	NONE
	L18 OSC. 51000-56000	4	20	1 1/2	3/8	5-25 NPO	NONE

All coils wound on 1¼" lengths of ⅜ or ½" dia. polystyrene rod in a winding space of ¾". The coil forms are drilled and tapped on the bottom for a 4-36 screw which fastens the form to the chassis. All wire is plain enam. in the sizes indicated. Small holes drilled through the forms ¾" apart hold the ends of the wire. Duco cement secures the finished coils.

Note 1: All antenna windings on the same form and at the bottom of the grid coils. All oscillator fixed capacitors are silver mica—others any type ceramic.
Note 2: The conversion oscillator coil is one pie of a 2.5 mh. choke with about 2/3 of the winding removed (check with grid-dip meter. Shunt the winding with the 150-μμfd. silver mica condenser) and tapped 1/3 of remaining turns for cathode tap. Crystal, coil and capacitor mounted in shield can above chassis.

---

mounted. Shielded wire was run along the inside edge of the chassis between the phone jack and the noise limiter switch to their connections at the rear of the chassis. Small resistors that could be mounted out of the way on the socket terminals were soldered right to their connecting points, but the majority were pre-assembled in groups of four on resistor strips, which were salvaged from surplus Command receivers, near their position in the circuit. The disc ceramic condensers used in the audio circuits and as a-v-c by-pass were also mounted on strips along the sides of the chassis. The remaining plate, screen, and cathode by-pass condensers were mounted right at the socket terminals and grounded to lugs near each tube socket. Only two paper condensers were used in the whole receiver, one an 0.05 μfd. in the noise limiter circuit, and the other a 0.1 μfd. in the cathode of the i-f tube. These were miniature types left over from a previous building project.

Still without doing anything about the r-f section, the tubes were put in their sockets, the a-c line plugged in and voltage applied to align the completed i-f part of the receiver. Voltages were measured at screen and plate connections to check for wiring errors. I-f transformers are pretty much pretuned as they come from the manufacturer so some signal usually gets through to start with. Not all signal generators go down to 135 kc. but the low frequency channel can be aligned indirectly. The first thing checked was the frequency of the conversion oscillator. With a crystal there is no problem except to be sure that it oscillates and that it can be heard plainly when tuned in on a regular receiver. A variable frequency conversion oscillator can be similarly adjusted by beating it against a broadcast station in the high end of the band. A 2000-kc. signal was applied to the grid of the 6U8 and all i-f trimmers peaked for maximum signal by ear. The final tuning up was left to be done when the front end of the receiver was finished.

The R-F Section

The r-f section of any receiver is very important in many respects, and a look inside most communications receivers at the array of coils, trimmers, switches and shielded partitions is enough to dismay many a potential builder of his own equipment. However, in a Ham band receiver the r-f section can be simplified with the added advantages of higher *Q* in the coils for each band, no absorption losses from unused coils, and shorter overall leads to keep the inductance confined to the coils. Since all tuning is band spread, the frequency calibrations can be made almost linear for all bands throughout their total range. The result is a better signal-to-noise ratio, greater r-f selectivity, more gain and much better operation on the higher frequency bands.

The band switch is made up from six wafers of *Centralab's* new miniature switch, each wafer having one pole and six positions. The two wafers for the oscillator section are ceramic, but the ordinary phenolic type wafer was used for the other four sections. One wafer is bolted on to the switch index and mounted on the front edge of the chassis for the antenna circuit. A ½ inch length of the shaft was left protruding beyond the wafer to take a coupling for the extension shaft that runs through the rest of the bandswitching assembly. Two strips of aluminum were cut 5-½ inches long and 2-¼ inches wide to make the partitions between the coil sections as well as mountings for the switch wafers. Only the antenna wafer is mounted in place by the index assembly; all other wafers mount to the partitions with ½ inch metal spacers. A ¼ inch lip was bent all around each strip for mounting the ceramic trimmer condensers and fastening the partitions to the chassis. The partitions then measure 5 by 1-¾ inches, allowing clearance for the trimmers so that they don't extend beyond chassis depth.

The mounting position for the wafers on the partitions was found by sliding a partition up against the front of the chassis on the inside and marking it from the mounting hole for the switch index. The distance from the front of

the chassis to the first partition is 2 inches and it is located so that it comes across the center of the r-f tube socket to act as a shield between the input and output sections of the tube. A cutout was made in the partition to clear the tube socket. This 2 x 5 inch space is for all the grid coils and the grid tuning condenser which is a shaft type *APC* mounted on the front wall of the chassis. This is labelled "Antenna Tuning." The r-f gain control is also mounted on the front wall of the chassis on the opposite side of the band switch. The second partition is 1-¾ inches behind the first one—this space being used for the plate coils of the r-f tube. A cutout was made in the bottom of this partition to clear the mixer tube socket and allow for wiring to the socket terminals.

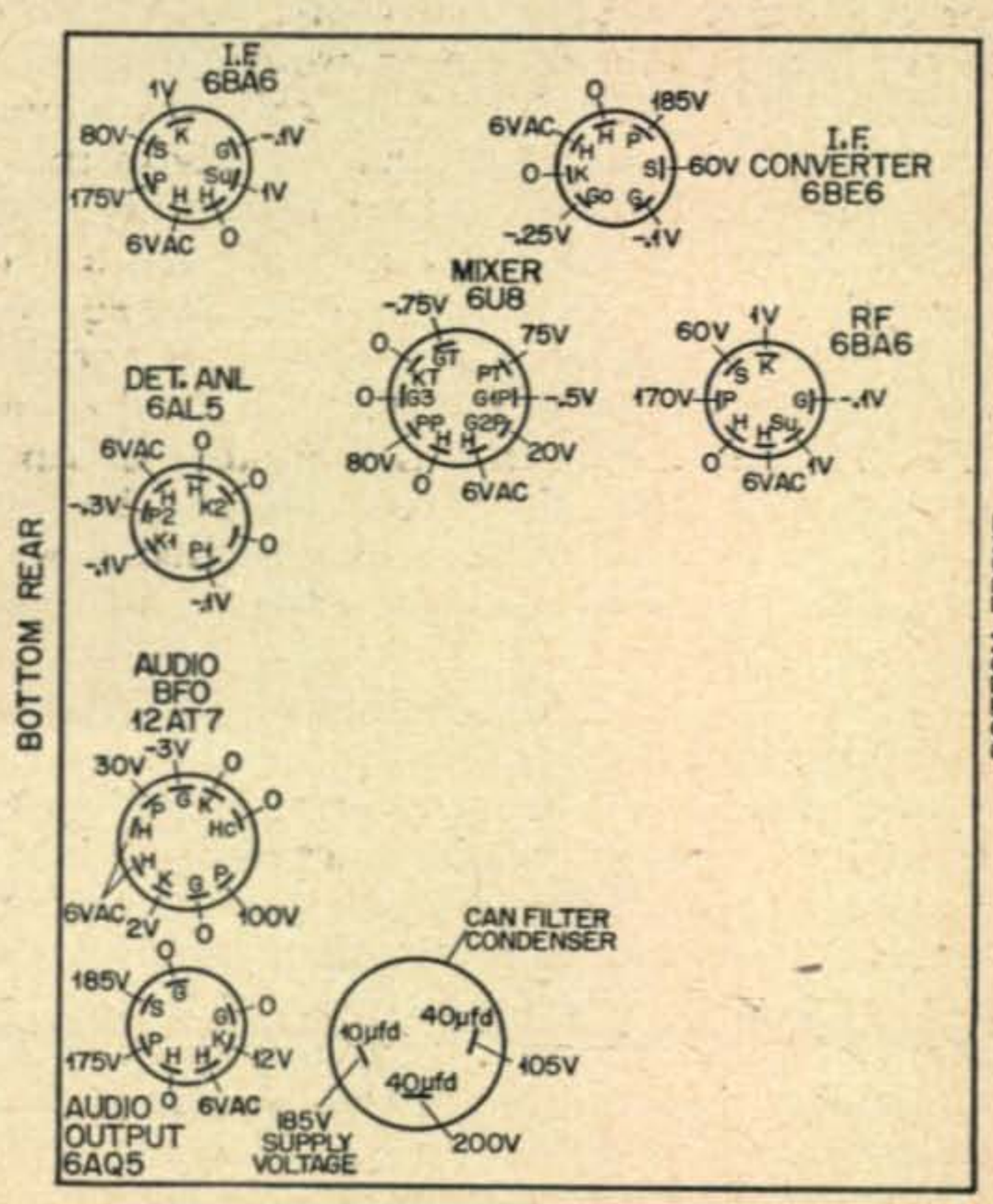
The wafers were mounted on the partitions with bolts and spacers, the same bolts going through both wafers on the front and back of each partition. The oscillator section has two wafers. All the wafers were mounted so that the terminals were accessible for wiring. The ceramic trimmer condensers were mounted on the lip of each partition by means of *4-36* bolts tapped into the lip, each condenser mounting directly in front of its respective coil. Two aluminum strips bolted to the sides of the partitions hold them 1-¾ inches apart and make the assembly rigid. The switch assembly was made up separately and then installed as a unit. The bottom lips of the partitions were firmly secured by *4-36* bolts coming through the chassis. All the r-f tube wiring was done prior to wiring the r-f and mixer leads, and short leads were soldered on to the lugs of the tuning condenser to connect to the bandswitch when it was mounted.

Coil Placement

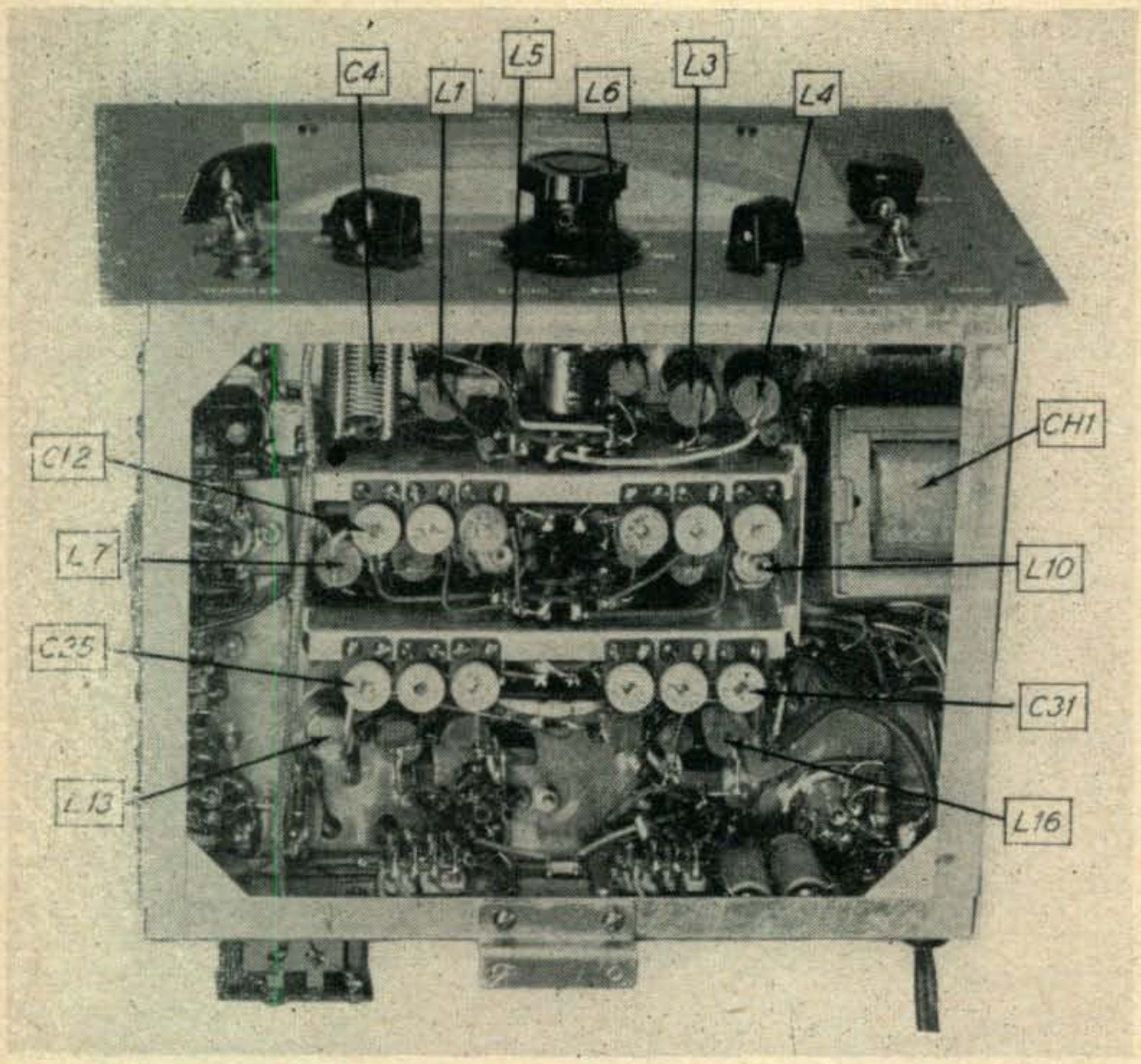
The extension shaft to operate all the switches was made from a piece of bakelite rod ¼ inch in diameter filed flat on two sides to fit the holes in the rotating arms of the switches. It was made just long enough to go through all the switches and extend into the ¼ inch coupling on the index assembly. Use of a bakelite rod for this purpose was a precautionary measure to preclude undesired coupling between grid and plate circuits of the r-f section. Before mounting the switch assembly in place, one end of each plate trimmer condenser was wired to its respective switch contact. One side of the oscillator trimmers was connected to a common heavy wire for their ground connection. The assembly was then mounted on the chassis and the position of the coils determined. The highest frequency coils were placed closest to the bandswitch for short leads. This resulted in the 15-meter coils at the left, then the 10-meter coils and the 6-meter coils right next to the left of the switch. The coils to the right of the switch are for 20 meters, then 40 meters and finally the 80-meter coils at the far right of each section (except for the grid coils where the 40-meter coil was placed towards the front of the chassis because the antenna trimmer condenser occupied the remaining space). In the oscillator section a thin copper strip was placed along the chassis the length of the coil compartment under all the coils with tabs bent up near each coil for a ground connection. It was securely fastened under the mixer socket ground lug and a ¼ inch wide strap of the same material brought up to the common ground lead on the trimmer condensers.

The R-F Coils

Blank coil forms were put in place to locate the mounting position of each coil, and holes drilled in the chassis below the center point of each coil for the coil mounting bolt. All coil forms were made from polystyrene rod for several reasons. Slug tuned coils are very nice to work with when it comes to tracking the tuning range, and they eliminate a lot of cut and try, but they also have their disadvantages. The biggest drawback is the price of a set of 18 coils. At current costs that many coils would run into several dollars, whereas 50 cents will buy more than enough rod for all the coils needed. The use of slugs in oscillator coils for the high frequencies is debatable. Unless they are securely glued in place after adjustment there is the chance of vibration causing a slight movement of the slug (they are not all precision-made) with resultant wobble on the received signals or a shift in frequency. Slug forms require room for the mounting nut above the chassis which makes space a limiting factor.



Under chassis voltage check points,



This under-chassis photograph should be compared with the drawing below to check the positions of outstanding components.

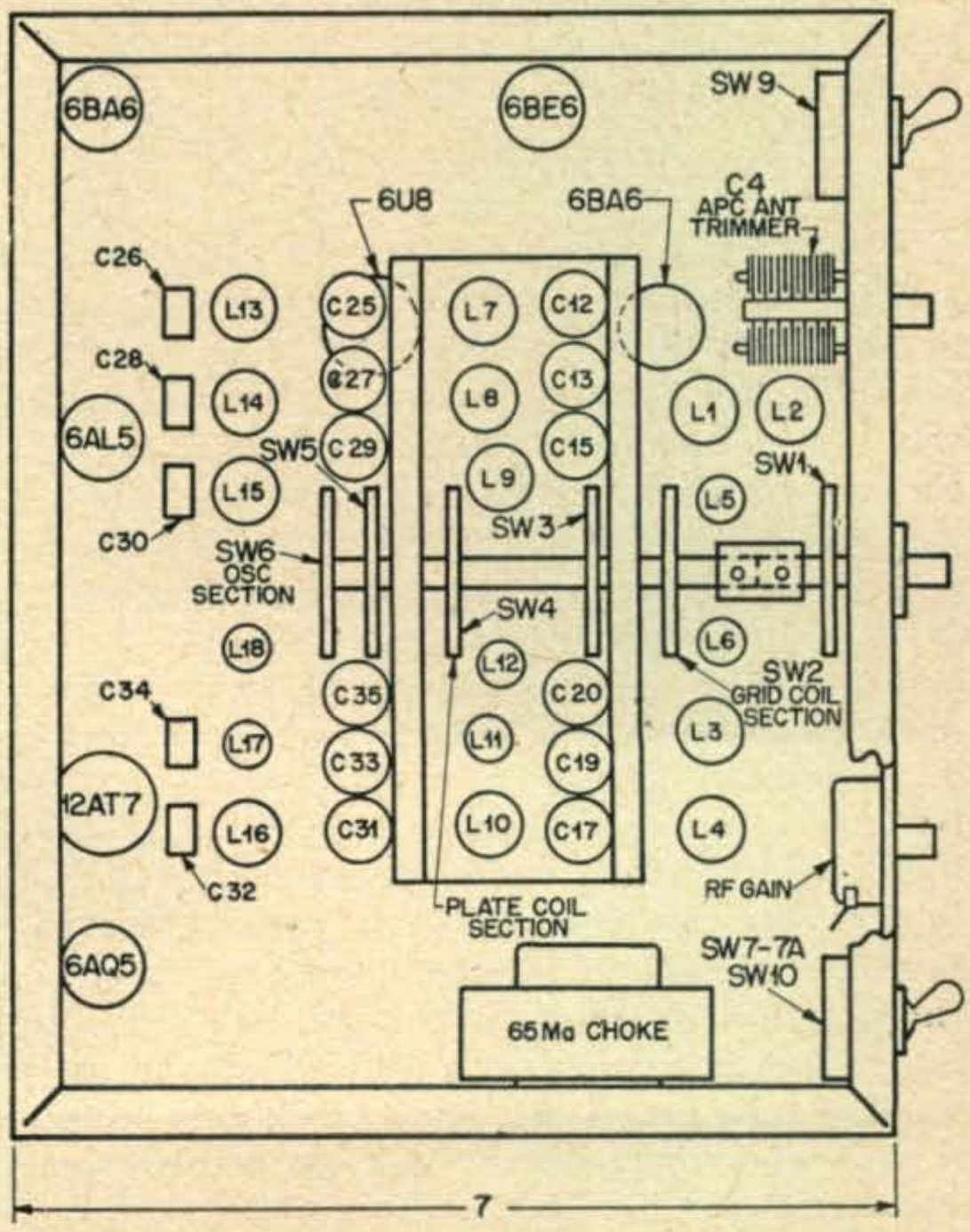
Coils are wound tight on solid rod with holes drilled through it to fasten the ends of the wire, and then coated with cement. They are rigid and stay put.

The coils for the 6-meter band were made first, starting with the oscillator coil so the tuning range could be set. The oscillator operates on the high side of the signal so adding the intermediate frequency gives the range to be covered. The tuning range was made from 49 Mc. to 54 Mc. in order to be able to listen for the commercial stations just below the 6-meter band. The oscillator would then tune from 51 Mc. to 56 Mc. The coil was wound up and wired into place and a grid-dip meter used to set the range. Since the tuning condenser is very small, only a small amount of parallel capacity across the coils is required to spread the band over 180 degrees of the dial and this method of bandspread was used on all coils. It is apparent that the number of turns on the grid and plate coils should be just slightly more than those on the oscillator with somewhat less fixed padding capacity to cover the tuning range.

Circuit Tracking

The tracking was accomplished following the method explained in the various handbooks. After the coils were put in place and the bandswitch set to the 6-meter band, the tuning condenser was turned to minimum capacity. The plate and grid coils were tuned to 54 Mc. by means of their trimmers using a grid-dip meter for rough indication. Then a signal was tuned in and the trimmers peaked up. With a few feet of wire for an antenna the harmonics from a 1000-kc. oscillator were used as check points. Next the tuning condenser was rotated to maximum capacity—the low end of the 6-meter band—and the trimmers adjusted again for maximum signal strength. If the capacity of the trimmers has to be increased, it means that the inductance of the coils is *low* and the turns will have to be squeezed together slightly. If the trimmers need to be decreased, the inductance is *high* and the turns will have to be spread apart. This tracking process is repeated until the signal is uniform in strength at both ends of the band without any further adjustment of the trimmers. The coil wires were then cemented to their forms and the coils for the next lower band put in place and the process repeated, starting again with the oscillator coil.

(Continued on page 44)



Under chassis placement schematic.

Gathered by DICK SPENCELEY, KV4AA

Box 403, St. Thomas, Virgin Islands, U.S.A.

Our heartiest congratulations to the following station upon his entry to the WAZ lists:

No. 290 ON4QF Mick Meunier 40-200

Our welcome is also extended to the following newcomers to the HONOR ROLL

W2IMU	**39-192**
W6CUL	**39-154**
GM3EST	**38-204**

At Time Of Writing

RIO DE ORO, EA9DD (EA4BH) : One of the few "Ham" countries, hitherto unrepresented, was heard from on October 20th when Luis, EA9DD, came on the air. His ten days at this QTH resulted in 2246 contacts covering 132 countries on 3.5, 7 and 14 Mc. EA9DD was on the air some 18 hours each day, quite an accomplishment for a single operator station.

Luis reports that his 14-Mc. band operating difficulties were brutal. These stemmed from a high motor QRN from a nearby factory, poor conditions and the faulty operation of his receiver on this band. It was with the utmost difficulty that he was able to decipher any of the hundreds of calls coming at him. With a properly operating receiver he feels sure his total would have exceeded 3000 QSO's. The 7-Mc. band proved much better for DX especially between 2200 and 0600 GMT, and many contacts were made with W's, VK's, ZL's and the Pacific Islands. One of his high points on 7 Mc. was a contact with Formosa at 0210 GMT. Considerable DX was also worked on 3.5 Mc. around 0000 GMT when W's, South Americans and South Africans came through. His best on this band was a QSO with Argentine Antarctica. A *Collins* transmitter was used and a vertical antenna. Some 97 per cent of the contacts were on CW. Luis wishes to assure one and all that QSL's will be forthcoming for all contacts and, no doubt, you will have received yours by the time this is read. EA9DD wishes to thank all the OM's for their kind comments on his expedition and states that he is planning another trip to Rio De Oro in the near future in order to give those who have missed him another chance.

The following early QSO's were noted with EA9DD: KV4BB, KP4KD, KV4AQ, G3BTA, FF8JC, W2GLM (1st W2), W2BUV, PAØLY, W2BUY, VP9TT, FA8DA, VO3X, W2GFW, SVØWE, W1ZL, W2HUQ, E7SHP, W4LQN, W1HX, W4CEN, W1FH, W9DUY, CN8BJ, G8KP, W3OIV, W2MJ, W5MPG, W2LV, W2SUC, W6CUQ, W6EFV, W5DQV, W6GFE, W5KUJ, DL7AP, HB9AO, W4DGF, W3EVW, and W2TXB. On 3.5 Mc.: EA6AF, W3BVN, W1CWX and W3EEB.

For these efforts, Luis, we extend our "MUCHISIMO GRACIAS AMIGO!!"

• • •

RIO DE ORO, EA2CA: Reports have it that EA2CA was due on the air from "RIO" on November 16. Accent will be on 'phone operation.

• • •

COCOS ISLAND, T19UXX: We have indications that Evan showed up at this QTH on the night of Nov. 13th and the morning of Nov 14th. KP4CC reports a QSO with him at 1055 GMT 14th. 7 Mc.

• • •

WEST INDIES, G2RO: Bob has mailed us his itinerary covering the period from November 16 to February 9 as follows: Nov. 16/24, Bahamas; Nov. 24/30, Jamaica; Nov. 30/Dec. 14, British Honduras; Dec. 14/18, Jamaica; Dec. 18/19, St. Kitts, Leeward Is.; Dec. 19/23, Antigua, Leeward Is., Dec. 23/30, Barbados; Dec. 30/Jan. 9, Grenada, Windward Is.; Jan. 9/15, Trinidad; Jan. 15/Feb. 2, British Guiana; Feb. 5/8, Jamaica; Feb. 9, sails for England. Bob will try to be on from each one of these spots with his 15-watt rig.

• • •

DX Notes in General

News of ST2UU's non-arrival in Gambia comes via a letter to KV4BB. Jim states that he got as far as Bilma, French Sahara, and no gas was waiting for him as promised. As a result he was forced to fly back to ST land where he arrived with just about enough gas to fill his Zippo! Jim expresses a desire to visit VQ7 a few more times and also make a "Stateside" visit in the very near future. He may be found at the old stand, 096, with new xtals . . . Via John, F9QU, ex-FM7WD, we learn that FY7YB is now in France and will return to French Guiana next August with a 100-watt phone rig. Marcel, 3A2AM, will be QRV from Monaco from Dec. 23 to Jan. 4 on 14125/150. XW8AA, Laos, is QRV Sats. and Suns. 054 or 074 xtal. FD8AB is now an FF8 in French Nigeria . . . W6CUF, now DL1QX, is tentatively planning to visit LX for one week-end of the ARRL contest. Jim is also eying 3A2, HE, M1 and HV QTH's and will do what he can to set up shop in these places. See QTH's . . . VR4AE may be found on 14010 at 1100 GMT, Sundays . . . VK9WZ, 060, is located on Manus Island in the Admiralty group. He counts same as New Guinea . . . Doc, W4VE, got that KR6AA call

and is now active from that QTH . . . OK1MB reports a QSO with **G3HS/Perim Island,** 7006 kc. This QTH is in the Red Sea just off Aden. Beda also reports **YA1B** active on 7005.

ZL2AAB is now in Apia, British Samoa, and should be heard with a **ZM6** call . . . **VK9OK** is now active on Norfolk Island (a separate one) he is ex-VK2AOK . . . **ZK2AA** closed shop on Nov. 7. Bill sails for New Zealand on Dec. 2 where he will be for three months as ZL1BA. After that a ZM6, or other, prefix is possible. See QTH's . . . KV4AA nabbed **C3PM,** Harry, 017 1145 GMT. VS6AE says the only legit C3 is **C3BF!** . . . **HR1AT** is on each day between 1900 and 2000 GMT on 14015 . . . **TA3AA** will make an effort to put Crete on the air . . . **HH2LD** was found on 7008, 2245 GMT . . . **VK1RL,** Russ, returns to Australia in January and QSL's will begin to flow . . . **KC6AF** has been active on 7 Mc. from Yap . . . **W5MET** is now at sea again and hopes to get permission to get on the air as **W5MET/HL1** when at Pusan. Dick also will visit Yokohama, Kobe, Cebu and Manila before returning to east coast via KH6

FLASH!

A license has been issued to a well known W for operation on Clipperton Island. This is the last which will be issued to a native of a country that does not have a reciprocal licensing agreement. To avoid being besieged with unnecessary correspondence this W has asked that his call be withheld for the time being. When his plans are completed we hope to give this all the publicity it deserves.

and KZ5 . . . As of Oct. 23 Laos is a free and independent nation within the French Union (XW8AA) . . . 9S4AX was scheduled to be on from **LX1AS** during the Contest Day of Oct. 31 . . . From VS2CP we hear that **ZC5VR** is putting up a 3-element beam and will be heard on 121, A3 . . . **VQ3EO** has been quite active on 14 Mc. See QTH's . . . **4S7XG,** Pete, states that he has not heard a CR8 station in over a year . . . **ZS8MK** returns to Basutoland in November ('53). After a few weeks' stay he will go to VQ3 . . . **VS9AP** is now back in England where he may be heard as **G2AVP.** See QTH's. Notes from F9RS: Joseph Klein, operator at FB8ZZ during 1951/1952 is on his way to Kerguelen Island where he will operate **FB8XX** in 1954 . . . **FF8CG** is active in Ivory Coast, FWA . . . From French Sudan the only activity comes from **FF8AZ** who runs 60 watts . . . **FN8AA** had local electric troubles and made only one QSO. He is now back in Saigon . . . **FO8AD** is again active from Rapa Island . . . From W5KUC and the West Gulf Bulletin we hear that **VQ4NZK/VQ1NZK** plans a trip to VQ9 and VQ7 around February 6 . . . George, VK3ADZ, was due to leave for Heard Island in December. The call will be **VK1DY,** QRG 14100 kc. . . . **MP4BTF** is active in Trucial Oman, 030 . . . W6QL

Here are a few scattered, claimed, scores from the recent **International DX Club Contest:**

TA3AA 288,214 (Phone)	**PAØUN 183,000**
W4KFC 340,400	**YU1AD 150,000**
W3GRF 328,700	**W6FSJ 130,785**
W8JIN 304,325	**KV4AA 117,720**
W2WZ 243,500	**W6BUD 54,000**
SP3AN 242,300	**W6VUP 50,000**
W6AM 235,000	**HR1AT 30,628**
OK1MB 200,000	**W6ILP 28,560**
W6RW 185,339	**W6FOZ 24,000**

hears **JA6AA,** 090, 0030 GMT, **LZ1KDP,** 060, 0330 GMT and **ET2PA,** 050, 0300 GMT . . . **News from LZ-land: ZA2B, ZA2FM** and **ZA4KAA** were on but thought to be pirates . . . **9B3AA** now operates with different call . . . The UA stations don't QSO outsiders . . . Very active are YO3RF (QSL Mgr), YO3RD, YO5LC, YO4CR and YO6VG. The Sofia Hams at LZ1KAB, LZ1KDP and LZ1KSA have chosen 7010, 14020, 21030 and 28040 as the "LZ" frequency. LZ's may be heard there from 0500/2200 GMT. The 500 watt CW/Phone transmitter at LZ1KAB will be ready soon. Other LZ club stations are: LZ1KSI, Sofia; LZ1KNB, Sofia; LZ1AA, Sofia; LZ1KPZ, Pazapdjik; LZ1KSP, Plovdiv; LZ2KAC, Tirnovo; LZ2KSK, Kolarovgrad; LZ2KPP, Gabrovo. All QSL's to Box 830, Sofia. Letters may go to: Central Radio Club, Rakovsky 155, Sofia, Bulgaria.

Exploits

EA9DD eased these stations up one notch as follows: **W2AGW** to 241, **W6GDJ** to 230, **W4RBQ** to 193, **W2WZ** to 230, **W6AM** to 243, **W1RAN** to 147, **4X4RE** to 226, **W6MX** to 238, **W2GVZ** to 177, **W1ZL** to 204 and **CE3DZ** to 213 . . . **W6ATO** upped to 167 with 5A3TZ and CR6AI . . . Bob, W6ONZ, resumed his DX'ing this year and comes up to date with 13 new ones which include VP5BH, VP8AJ, VP7NS and LB8YB for 152 . . . **G6ZO** soars to 249 with VR4AE and LB8YB . . . **W6VE** adds JZØKF for No. 221 . . . **W6NTR** goes to 186 with ZC4IP, MP4BBD, CEØAA, PZ1WZ and JZØKF while Horace, **W6TI,** hits 218 with LB8YB . . . Andy, **W6ENV,** ups to 248 with EA9DD and CEØAA . . . **W6ID** reaches 146 with VP4LZ, HH3D and VP8AW while Howy, **W2QHH,** goes to 222 with LZ1RF/ZA and EA9DD . . . **W9NZZ** added OD5AB, CP1BX, ZP5AY, CR6CZ, ZD9AA and SU1RS to hit 157 while **W6GPB** rested on 183 with SU1SS, EA9DD, EAØAB and ZD4BJ.

Ev, **KP4KD,** keyed with EA9DD and VQ1NZK to reach 206 while **KV4AA** went to 227 with EA9DD and C3PM . . . **W5ASG** is way up there with 238 having added EA9DD and CEØAA. Bill also added SP2KAC for 171 on A3 . . . Roy, **W6LW,** pulled up at 194 with EA9DD and SVØWG . . . **W2BXA** nabbed ZD9AA for 201 on A3 while Willard, **W1NWO,** added CEØAA on A3 for No. 203 . . . **W1KFV** upped to 177 with 9S4AX, CEØAA, I5LV, EA9AP, and HR1AT . . . Carl, **W1BFT,** snagged VS9AP, DU1FC and EA9DD to reach 166 . . . Sam, **W3AXT,** continues up the line to 148 with I5LV, CR5AC, MP4BBD, ZS8D and EA9DD . . . **ZL3CP** goes to 121 with HR1AA, KAØIJ, AP2R and CT3AV . . . Miles, **W6ZZ,** A3'd with CR6BX and ZS9G on 21 to reach 132 . . . Tom, **TI2TG,** went to 213 with VR4AE while Gus, **W2HMJ,** hit 205 with CEØAA and FB8BE . . . **W2SHZ** nabbed CEØAA, ZD4BU, LZ1KPZ and ST2HK to reach 179 . . . **W2OST** added six and came up to date with 169 . . . **W4EPA** is on 151 with EA9DD and VQ5CL while Bill, **W1HA,** went to 198 with such as ET2US, EA9DD, KS6AB, VQ8AY, CEØAA, OD5XX and YI2AM . . . Ernie, **W6KQY** brought his phone standing up to 168 with VQ1NZK, MP4KAC, YI2AM, ZP5CF, VP1AB and KV4BD.

W2ESO, Gene, added four with VQ3, FQ8, ZE3 and EA6 . . . **LU5AB** nabbed EA9DD, VR2BZ, FK8AO, VR4AE, C3BF and VK9WZ . . . EA9DD made **KV4BB** 165 on CW and 145 on phone. Bill also got credit for W9SMA/KP6, Fanning Islands . . . **W3AS** received WAA Certif No. 106 and WAPY No. 124 . . . Frank, **W8HMI,** put up a wide spaced beam and went up to 70 with such as VQ3, OQ5, CR6 and 5A1 . . . **W3AXT** went to 57 on 3.5 Mc. with SP3AN and EA8BF. Sam now holds DUF-2, WBE, KZ5-25 . . . Phil, **W7SGN,** A3'ed with DU7SV, KAØIJ, KH6ACK/KX6, KJ6BA, KW6BB and KX6BB . . . **W2SUC** is glad to be DX'ing from the home QTH again after stays at SVØAB, KL7ANR and DL4CM. Aaron nabbed such as OQ5CU, CS3AC, FQ8AF, PJ2CA, 3V8AN, VQ4RF, CR6AI, KT1LU, EA9DD, ZD9AA and FF8JC giving him an even 100 . . . **G3AAM** nabbed VU5AB again on 14140 A3 . . . Bob, **W4TYE,** goes strong on 7 Mc. with such contacts as HH2OT, YU3FT, TA3AA, VK3GX, ZS5DN, I1GBK and ZL3KN. 14 Mc. accounted for HZ1TB and FQ8AK . . . **SM5AQW** is up to 62 on 3.5 with 5A3TL, VQ3KIF, ZB1BJ, CT2BO, VS9AP, YV5DE, LU1EP, OQ5GU, FP8AK, LU4ZD, KP4KD, VP4LZ and 4S7XG . . . Dick, **W2LYO,** had a WAC on 3.5 in two hours and thirty-nine minutes with ZS2A, 4X4RE, VP4LZ, DL1BR, KV4AA and ZL1BY. He also added LZ1KPZ and 3V8AN on 14 Mc . . . **W6EFV** added EA9DD, LB8YB, ZP5AY and SP3AN . . . **TI2TG** worked FE8BS on 7008, 0200 GMT, the name is Phil who says QSL to Box 147, Doula (He spells Douala wrong!!) . . . **KV4AA** nabbed YK1AH, 015, 1200 GMT. Fadel is on each day. See QTH's . . . Mirko, **YU1AD,** got EA9DD for No. 201.

REMINDER

The 160 meter trans-Atlantic tests will be held from 0500 to 0800 GMT on January 3, 17 and 31.

21 Megacycles

Conditions on this band have been extremely spotty and generally poor. Favorable predictions based on the excellent openings of October 10 have not been forthcoming. The band must be watched, however, as openings do occur when you least expect them. Persistent operating here usually pays off.

Jim, **G6ZO,** complains of the lack of CW activity from those rare spots and is stuck at 89 A1 only . . . **G2PL**

(Continued on page 68)

These two lads, F9JD/FC and F9QV/FC, have added Corsica to the lists of many. (Photo courtesy of W6LW.)

CT1ST, of Lisbon, was Portugal's high scorer in CQ's 1952 contest.

Operating position at EA9DD, Rio De Oro, with Luis Vigueras, EA4BH. (Luis does not identify his companion but he looks like he has the makings of a rabid DX'er!!)

The well known signals of W3IL, Harry Strang, Washington, D.C., emanate from this neat set-up.

These will be coming through!!

One of the leading DX'ers in the London area is G4ZU. Dick has worked over 200 countries with 150 watts into an 813 and is well known as the designer of the "G4ZU" two-element beam. (Photo courtesy of G3FNN.)

Test Equipment..... ... in the Ham Shack

HOWARD BURGESS, W5WGF

925 Adams St., S.E., Albuquerque, New Mexico.

Audio Signal Generators— Part II of a Series

Some pieces of test equipment are acquired out of sheer necessity while others have an appeal above that of utility. Many Hams will place a good audio signal generator in this latter class. From the beginning of radio, sources of test audio have been required. Many things, including the XYL, clocks and the family cat, have been pressed into service to fill the need for wide range audio signals.

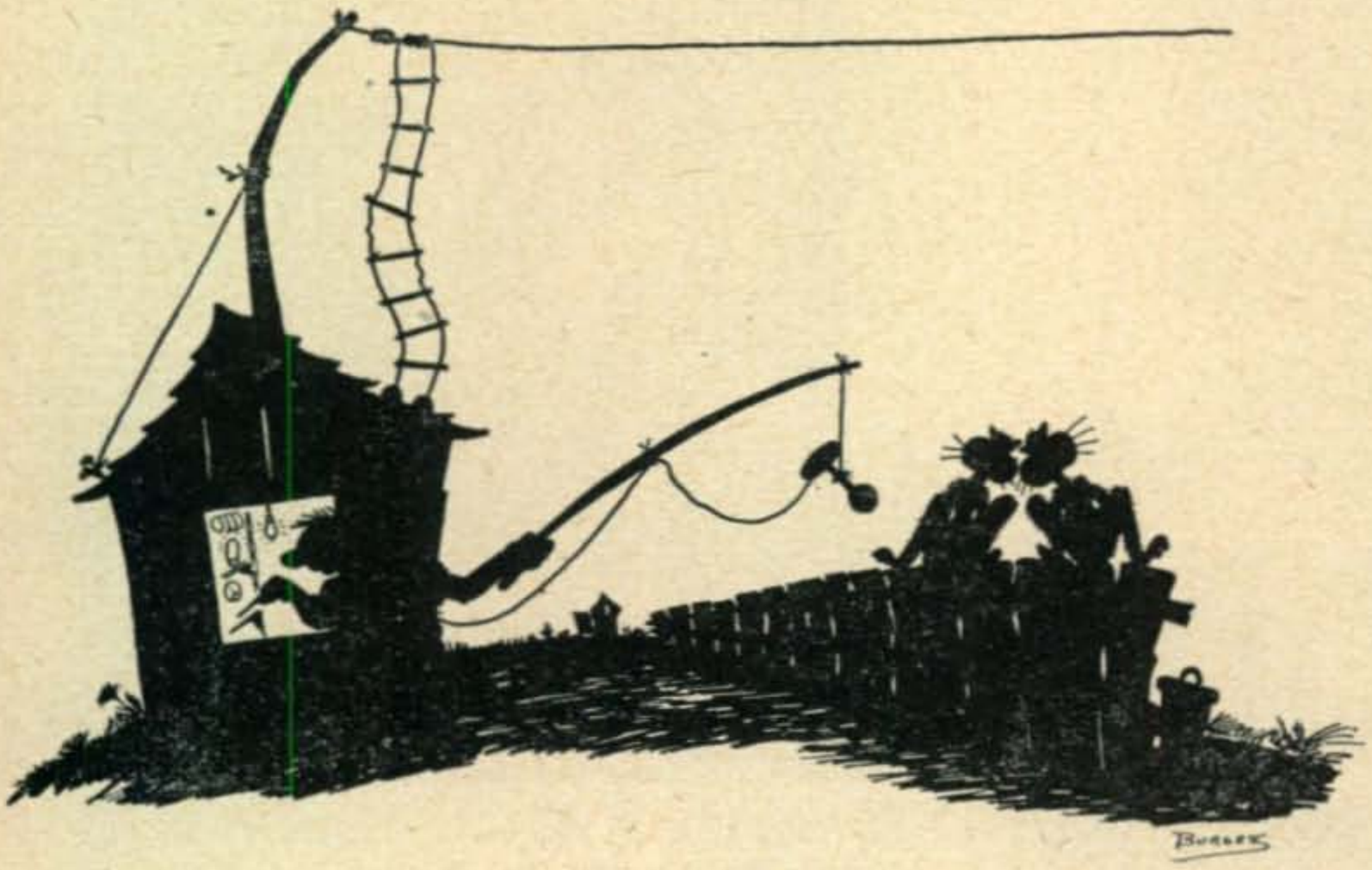
Until recent years nearly all audio oscillators were designed around an L/C circuit. Because of their C requirements such circuits were often quite limited in frequency range except for the more complicated designs. With the development of the R/C type of oscillator, precision, wide range equipment became available for those interested in the audio and supersonic frequencies.

Although a multitude of circuits have been published the majority of them are based on the principle that a resistance coupled amplifier will oscillate if a portion of the output is fed back to the input in the proper phase relationship. This can be accomplished in a very simple manner by using a resistance capacity network. In some forms this network has the dual purpose of inverting the phase of the signal as well as selecting the desired frequency, while in others it merely selects the frequency of oscillation.

The basic circuits of three of the more common types of such R/C oscillators are shown in *Fig. 1*. In each case the frequency determining network is shown in the dashed outline. Of the three, *B* and *C* have been favored more in general usage. The circuit of *B* can be operated as high as 10 megacycles or more with care, exceeding that usually obtained with circuit *C*. However, because of certain construction advantages circuit *C* is favored except where high frequencies are a requirement.

The Wein Bridge Oscillator

The diagram of *Fig. 1c*, sometimes known as the Wein bridge oscillator (there are many who will disagree on this designation), is shown in more detail in *Fig. 2*. Operation may be traced as follows. In dashed outline *1* is a conventional two-stage resistance coupled amplifier. Enclosed in outline *2* is a variable resistance connecting points *A* and *F*. This will give con-



"Many things . . . including the family cat . . . have been pressed into service to fill the need for wide range audio . . ."

trollable negative feedback at all frequencies to reduce the gain of the circuit and oppose oscillation. Point *A* is also connected to *E* through the network in outline *3*. Feed through *ABCD* to *E* is positive, but at only one frequency will the phase shift be such that point *E* is in phase with point *A*. At this one point, then, the positive feed back exceeds the negative feedback and the circuit will oscillate. Frequency of oscillation can be varied by changing either *R1-R2* or *C1-C2*.

The lamp in the cathode of *V1* is a 110-volt 3-watt type and serves as a cathode bias resistor. Because of the temperature coefficient of the lamp its resistance will increase with current and gives a form of automatic level control. With this form of stabilizing the level will remain nearly constant at all usable frequencies.

For greater stability this circuit should be followed by an amplifier stage to isolate the load. Capacitors *C1-C2* may be ganged variables and *R1-R2* may be tapped in steps to give a series of overlapping ranges.

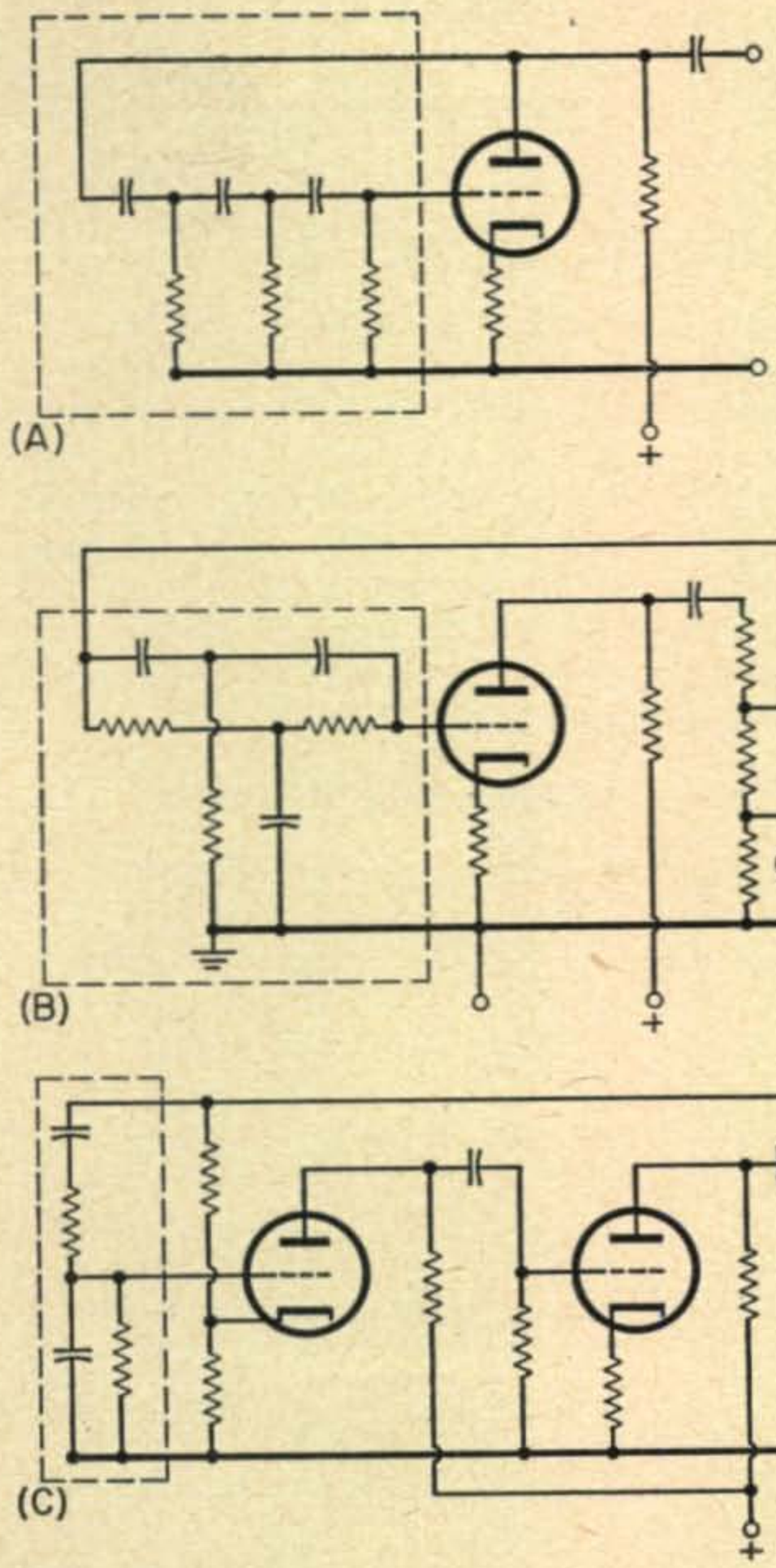


Fig. 1. Three of the most common types of RC oscillators: (A) The phase-shift, (B) the parallel-T and (C) the Wein Bridge.

Checking for Audio Resonance

Amateurs will have little difficulty in finding a multitude of uses for such a generator, but a few precautions should be observed if measurements are to be correct. Checking the resonant points of *L/C* combinations, voice filters and transformers is easily accomplished as shown in *Fig. 3*. The meter *M* is an a-c voltmeter with good audio response and should have a high ohms-per-volt rating. A VTVM is best but a dry disc rectifier type will do. The resistance of *R* should be the highest possible which will still give a reading on the meter. *R* should never be omitted. As the generator is tuned, *M* will follow the impedance of the circuit under test rising to a peak at the resonant point. If a series circuit is connected the resonant frequency will be indicated by a dip.

One of the more common uses for such a generator is to check the frequency response of amplifiers, audio transmission lines and transmitters. In many cases a setup such as *Fig. 4A* is used, the generator is tuned across the audio spectrum while meter *M1* is held constant. The variations in frequency response are then read and plotted from meter *M2* which is across the load. If a response curve is plotted using this method it will in most cases be in error.

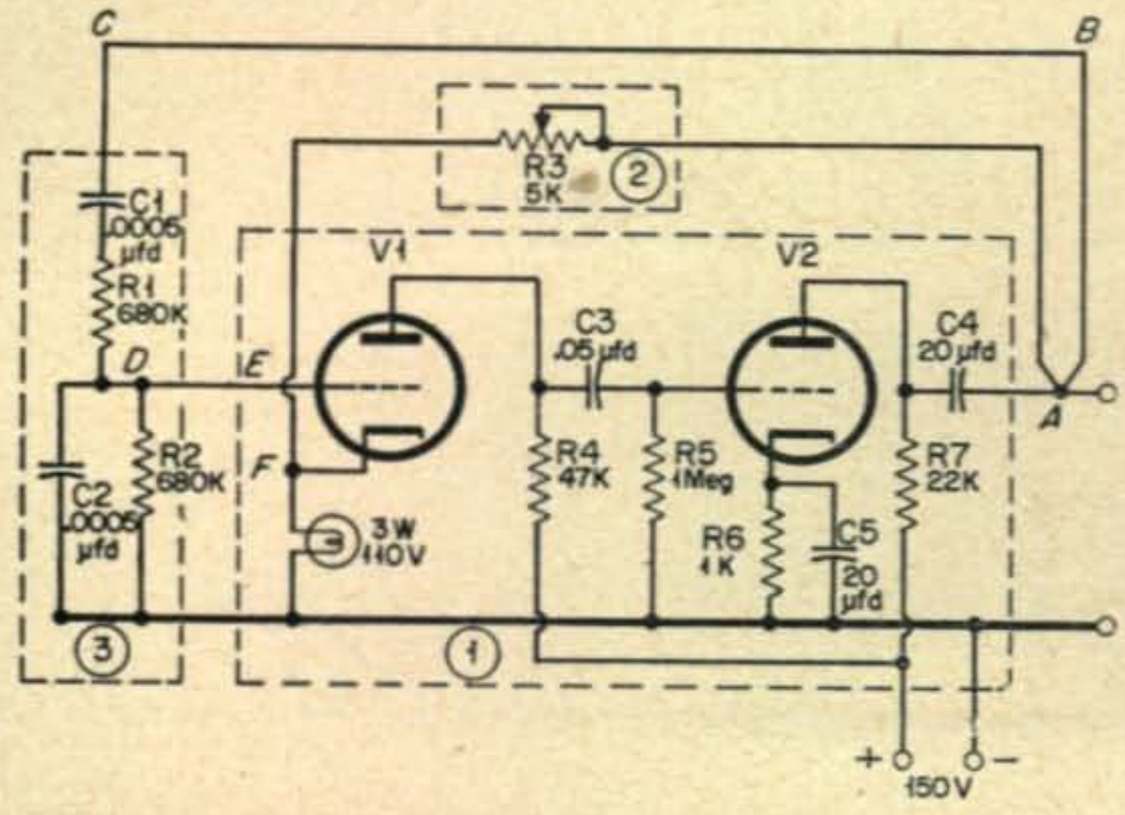


Fig. 2. Wiring schematic of a typical Wein Bridge RC oscillator for audio signal generation.

For a more accurate response measurement the circuit in *Fig. 4B* or *4C* should be used. *Figure 4B* is used for unbalanced inputs and *4C* for balanced inputs. Resistor *R1* which is used in unbalanced circuits should be equal to the impedance of the device which will be driving the amplifier in operation. Example: If in operation the amplifier is to be driven from a 600-ohm line, *R1* should be 600 ohms.

The same rule will hold true for balanced inputs but the value of the driving impedance will be divided between *R2* and *R3*. Example: If the amplifier is to be used with a balanced 600-ohm input, *R2* and *R3* will each be 300 ohms.

The reason for the addition of the resistors is simple. When the output of a signal generator is held constant at all frequencies it will

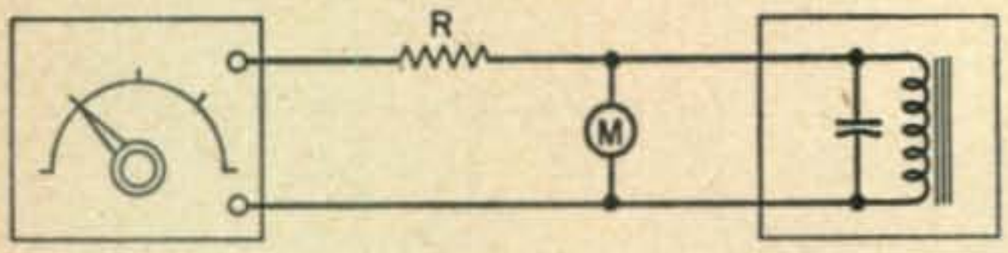


Fig. 3. This circuit may be used to check for resonant peaks within the audio range.

theoretically have the equivalent of a zero output impedance. If this zero impedance is used to drive an amplifier with, say, a 600-ohm input, the frequency response will be in error. When the resistor equallying the input impedance of the amplifier is placed in series with the zero impedance of the signal source, the amplifier will be matched with the driver. When this method is used the actual output impedance of the signal generator can be disregarded.

Plotting the Frequency Response

To make a frequency run on an amplifier using this hookup the signal generator is set at 1000 cycles and the output adjusted to give a reading in the usable portion of the scale of *M1*. With the amplifier gain control near the normal operating position, a reading is taken on *M2*. This will be our zero reference point. Without changing the gain of the amplifier being tested, the audio signal generator is tuned from a low frequency such as 20 cycles, up to the point where the output falls too low to be read on *M2*.

During this tuning process the reading on *M1* must be kept constant by adjusting the output of the generator. The readings of *M2* are logged at spot frequencies such as 20, 50, 100, 200, 400, 600, 1000 and so on cycles through the audio range. At points where the *M2* reading is less than the zero reference value, the unit under test has poor response. Peaks in the output will be indicated by values greater than the reference level.

A single meter with suitable switching arrangement can be used for both *M1* and *M2*, but if this meter is of low resistance such as the 1000 ohm-per-volt variety, a resistor equal to that of the meter should be substituted whenever the meter is removed from the circuit. This will keep loading constant at all times on both the generator and the amplifier.

After the readings are all taken they can be converted to decibels and plotted as gain or loss against the 1000-cycle reference point and frequency. If this is not done, do not be misled by small changes in the reading of *M2*. This is voltage and the power varies as the square of

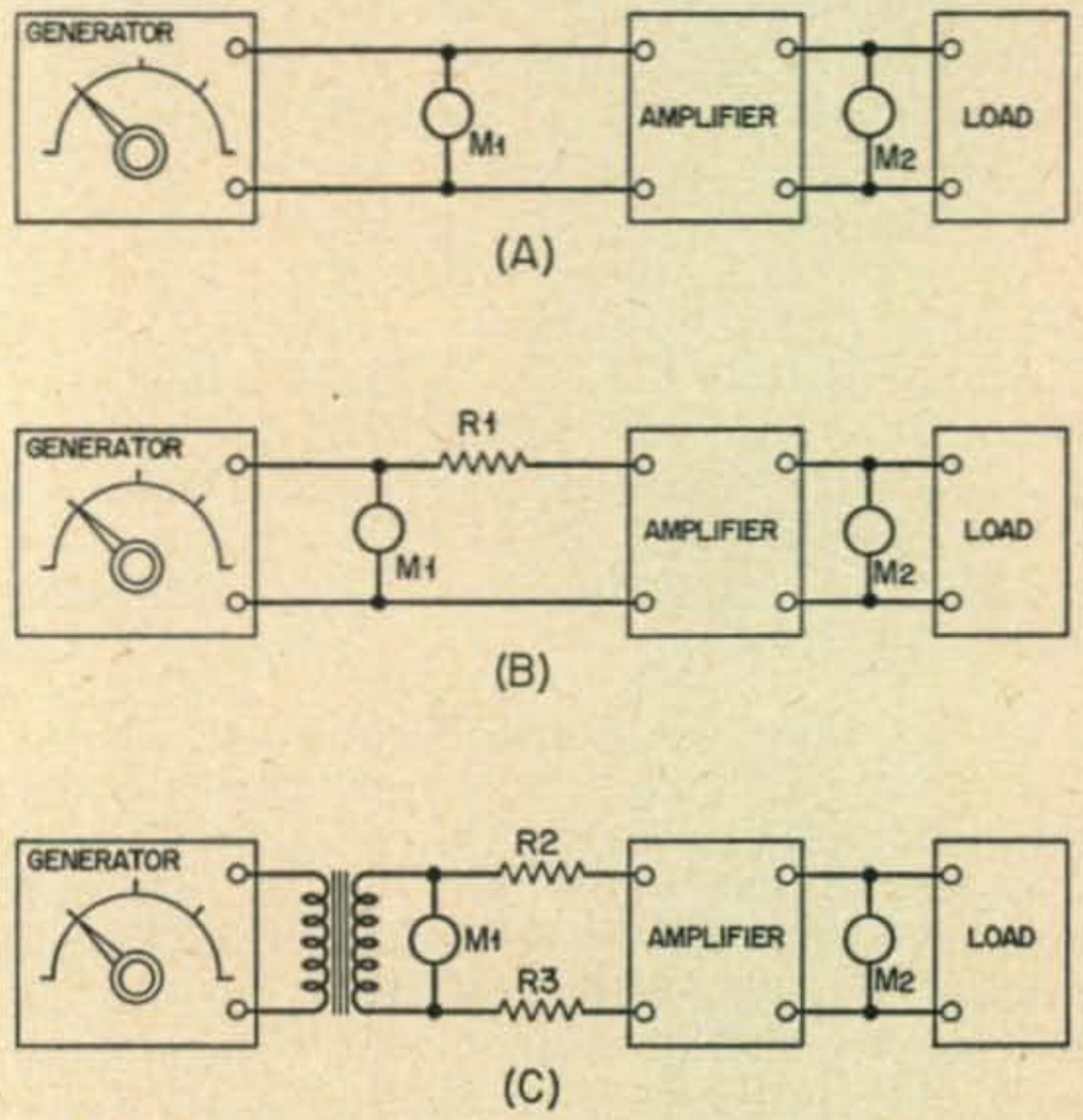


Fig. 4. Three methods for measuring the frequency response of audio amplifiers. The circuit shown as (A) is not recommended although it is mistakenly used by many operators. Circuit (B) is utilized with unbalanced inputs and (C) with balanced input arrangements.

this reading. However if *M2* drops off just half at some frequency, three-fourths of your power has disappeared.

If a high gain amplifier is checked as shown in *Fig. 4B* it may be overloaded if too much voltage is applied to give a reading on *M2*. To avoid this. a voltage divider is required.

The Heathkit Model AG-8 Audio signal generator in use by the author.

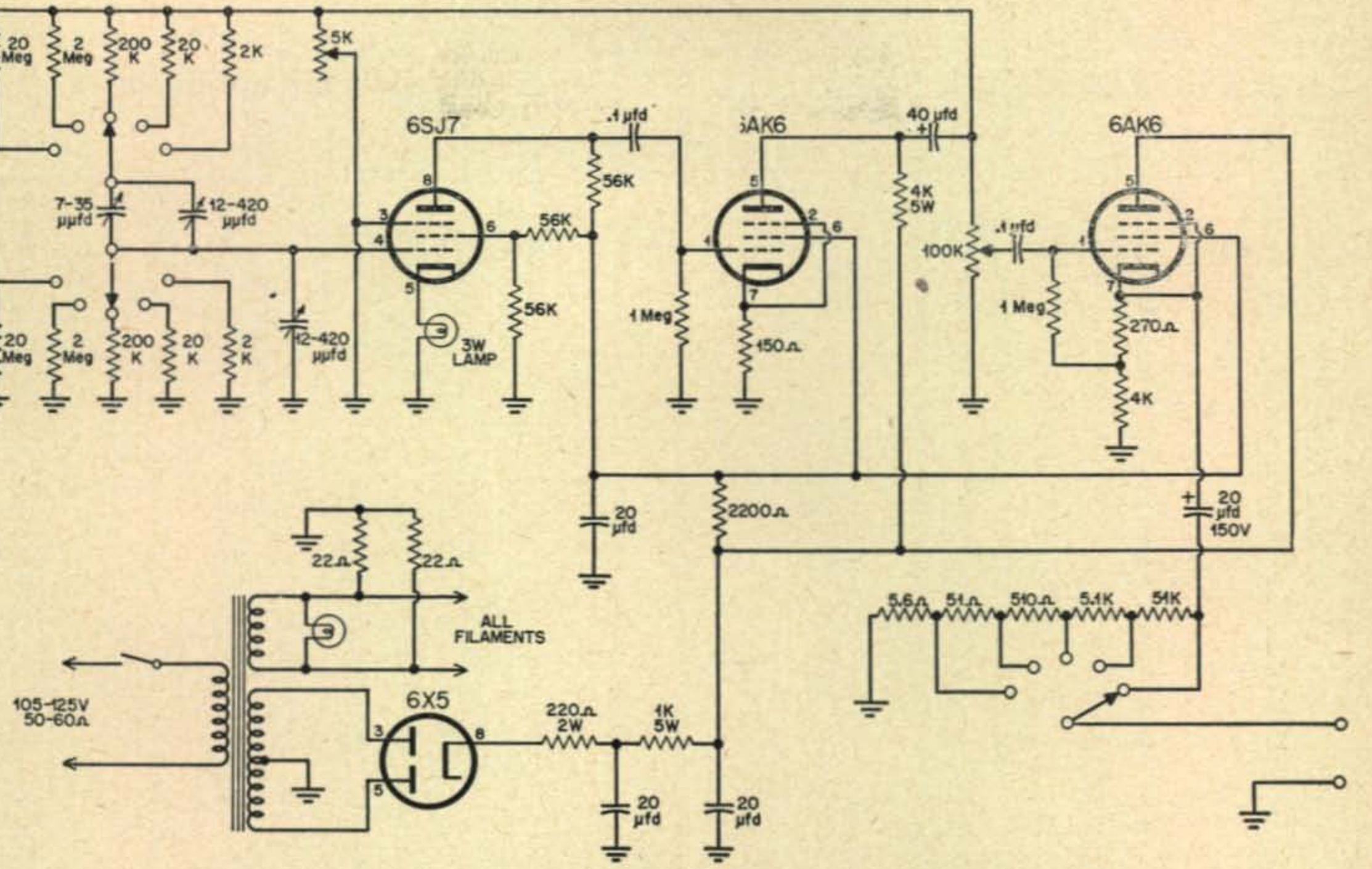


Fig. 6. Wiring schematic of the Heathkit AG-8 audio signal generator.

Such an arrangement as that shown in *Fig. 5* can be used. This can be made up of standard values of resistors and when used to feed a high impedance input will give results with an accuracy adequate for amateur needs. If this is used to make a response curve on an amplifier which is to be used for a crystal mike or pickup, *R1* should be omitted and a .005 µfd. mica capacitor used in its place. The reason for this is most crystal devices are capacitive rather than resistive and will average about .0015 µfd. in value.

Harmonic Generation

Sometimes it is very useful to have harmonics in the short wave region of frequencies which lie in the range from 20 kc. to 500 kc. If a germanium diode and r-f choke are used as shown in *Fig. 7* useful harmonics can be found on a receiver as high as 120 Mc. or more. If for example the generator is tuned to 50 kc., the crystal will generate marker points each 50 kc. through most of the Ham bands. Varying the size of the r-f choke will effect the strength of the harmonics.

The primary purpose of these articles is to encourage the use of test equipment rather than to present a complete "how to build it" feature.

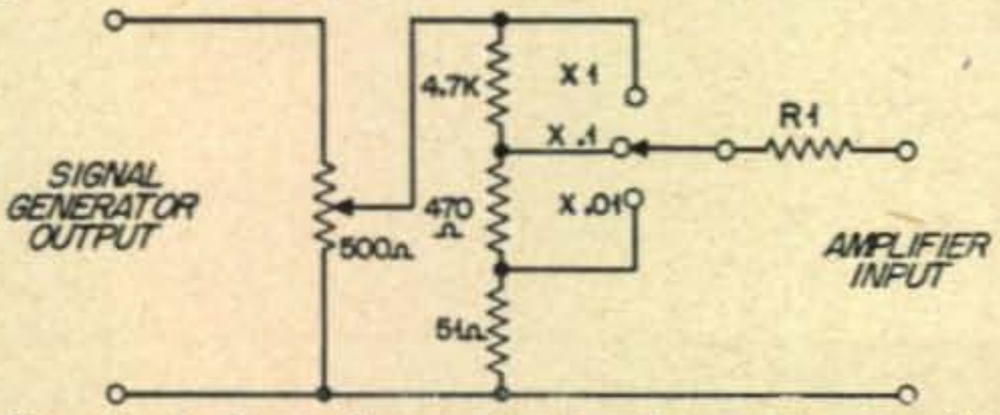


Fig. 5. Audio voltage divider for audio amplifiers having a high input impedance and a very high gain.

However, enough information will usually be included to enable the amateur designer to whip up one of his own.

For those who prefer the easy way our suggested kit this month which we have built and tested is the *Heathkit Audio Generator Model AG-8*. This is a four-tube unit which covers the range from 20 cycles to 1 Mc. and can be assembled in one evening. A Novice should be able to put one of these into operation with no difficulty as assembly instructions are more than sufficient.

We found this unit to be a-c (not AC-DC) operated and the output signal has very low distortion with a level of 10 volts r.m.s. on all

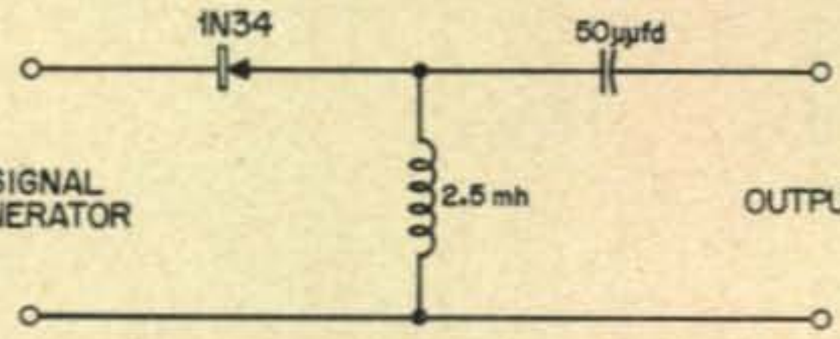


Fig. 7. The addition of this non-linear element in the output of the audio generator will enrich the harmonic output. The unit may then be used as a "marker" generator.

but the high band. The high band which covers from 200 kc. to 1 Mc. has slightly more distortion and less output than the lower bands. But as the average Wein bridge oscillator does not go much above 200 kc., anything above this can be considered as a bonus band.

One precaution should be mentioned for those who have never constructed an audio generator. An oscillator of this type will have a tendency to beat or even lock in when tuned

(Continued on page 64)

ALL TIMES IN E S T

EASTERN USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
Western Europe	0900-1200 (1)	0700-1300 (3-4) 1300-1430 (1-2)	1530-2100 (3-4) 2100-0530 (2)	1700-2030 (2-3) 2030-0400 (3-4)
Central Europe & Balkans	0800-1200 (1)	0700-1200 (3) 1200-1400 (1-2)	1600-2100 (3) 2100-0400 (2)	1730-0230 (3)
South Europe & North Africa	0800-1300 (2)	0700-1400 (4) 1400-1600 (2)	1630-2000 (3-4) 2000-0500 (3)	1730-2030 (3) 2030-0400 (3-4)
Near & Middle East	0800-1100 (1)	0700-1100 (1-2) 1100-1230 (2-3)	1630-0000 (2)	1830-2300 (1-2)
Central & South Africa	0700-1130 (1-2) 1130-1430 (3)	0630-1230 (1) 1230-1700 (3)	1730-0000 (2)	1830-2230 (1-2)
South America	1300-1500 (0-1)* 0800-1500 (2-3) 1500-1700 (3-4)	0700-1530 (3) 1530-1700 (4-5) 1700-1900 (2) 2300-0400 (2)	1800-0400 (3-4) 0400-0700 (2-3)	1900-0400 (2-3)
South East Asia	Nil	Nil	0300-0800 (0-1)	Nil
Australasia	1600-1800 (1)	0830-1130 (2) 1130-2000 (0-1)	0100-0800 (1-2)	0200-0700 (2)
Guam & Pacific	1600-1800 (0-1)	1600-1900 (1)	0000-0700 (2)	0100-0600 (1-2)
Japan & Far East	Nil	1700-2000 (0-1)	0300-0800 (1)	0400-0700 (0-1)
West Coast, USA	1200-1600 (1)	1100-1600 (3) 1600-1730 (4)	1900-0800 (3)	2000-0700 (3-4)

ALL TIMES IN C S T

CENTRAL USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
Western & Central Europe	0830-1100 (0-1)	0730-1130 (3) 1130-1230 (1)	1600-1800 (3) 1800-0200 (1-2)	1800-0100 (2-3)
Southern Europe & North Africa	0800-1200 (2)	1730-1300 (3-4) 1300-1430 (1-2)	1700-0100 (2-3)	1830-0200 (2-3)
Central & South Africa	0700-1100 (1-2) 1100-1400 (3)	0700-1200 (1) 1200-1600 (3)	1700-0000 (2)	1900-2200 (1-2)
Central America & Northern South America	1000-1400 (1)* 0800-1500 (4-5) 1500-1630 (1-2)	0700-0900 (3-4) 0900-1430 (2) 1430-1800 (4) 0300-0400 (2-3)	1800-0500 (4)	1900-0400 (3)
South America	1000-1400 (1)* 0700-1430 (3) 1430-1600 (4)	0600-0800 (3) 0800-1500 (2) 1500-1800 (4) 2300-0100 (2-3)	1800-0600 (3)	1900-0500 (2)
Japan & Far East	1700-1800 (0-1)	1500-1930 (2-3)	0200-0800 (2)	0300-0700 (2)

ALL TIMES IN C S T

CENTRAL USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
South East Asia	Nil	1730-1900 (0-1)	0200-0730 (1)	Nil
Hawaii	1130-1700 (2-3)	1000-1930 (2-3)	2100-0830 (3-4)	2200-0700 (3-4)
Australasia	1600-1900 (1-2)	0830-1100 (3) 1100-2000 (0-1)	0200-0700 (2-3)	0300-0600 (2)

ALL TIMES IN P S T

WESTERN USA TO:	15 Meters	20 Meters	40 Meters	80 Meters
Europe & North Africa	Nil	0700-1000 (1)	1630-0000 (0-1)	1800-2300 (1)
Central & South Africa	0900-1230 (1-2) 1230-1400 (2-3)	0600-1400 (0-1) 1400-1800 (2-3)	1630-2200 (2-3)	1830-2100 (1)
South America	0900-1400 (1)* 0800-1330 (3) 1330-1530 (4)	0600-1400 (2-3) 1400-1630 (4) 1630-1800 (2) 2200-0200 (2)	1800-0330 (3)	1900-0230 (2)
Guam & Mariana Islands	1300-1600 (1)* 1300-1800 (3-4)	1300-1800 (1) 1800-2030 (2-3)	0000-0800 (3)	0100-0700 (2)
Okinawa	1430-1730 (2-3)	1400-1730 (2) 1730-2030 (3)	2330-1000 (3)	0030-0900 (2)
Australasia	1300-1730 (2)	1000-1130 (2) 1130-1730 (1) 1730-2000 (2)	2300-0500 (2-3) 0700-0800 (2)	0100-0700 (1-2)
Japan & Far East	1400-1800 (2-3)	1330-1700 (3) 1700-1830 (3-4)	2200-0800 (3-4)	2300-0700 (3)
Philippine Islands & East Indies	1500-1800 (2)	1400-2000 (1-2)	0200-0700 (1)	0400-0600 (0-1)
Malaya & South West Asia	1600-1800 (0-1)	1500-1900 (1-2)	0300-0700 (1)	0430-0600 (0-1)
Hong Kong, Macao & Formosa	1500-1730 (2)	1500-1700 (2) 1700-1900 (3)	0000-0700 (3)	0100-0600 (2)

Symbols For Expected Percentage Of Days Of Month Path Open:

(0) None (1) 10% (2) 25% (3) 50% (4) 70% (5) 85% or more.

* Indicates time of possible ten-meter opening.

Ionospheric Propagation Conditions

Forecasts by
GEORGE JACOBS, W2PAJ
144-40 72nd Ave.,
Flushing, Long Island, N.Y.

General Propagation Conditions

10 METERS—DX generally poor, with erratic daylight openings possible on some North-South circuits during periods of good propagation.

15 METERS—DX openings decreasing on general East-West paths, but still fair to good during daytime hours on most North-South paths.

20 METERS—Conditions quite similar to December; DX fair to good during day light hours with exceptionally strong signals at times on East-West paths.

40 METERS—Fair night-time world-wide DX continues, especially during early evening hours. Band quiet and signals strong.

80 METERS—Generally fair to rather good night-time DX to many areas. Band quiet and DX signals quite strong at times. This band will generally remain open to many areas after 40 meters has dropped out.

160 METERS—Conditions quite similar to December. Seasonal low absorption and atmospheric noise levels (in the Northern Hemisphere) should permit fairly strong night-time signals on many DX paths. This band should open during approximately the same hours as 80-meter openings, but on fewer occasions and with weaker signals than observed for similar paths on 80 meters.

This overall picture of band conditions is intended to indicate qualitative changes in each band from month to month. For specific times of band openings for any particular circuit, refer, as usual to the *Propagation Charts* on the opposite page.

This month's *Propagation Charts* are based upon a predicted smoothed Zurich sunspot number of 14 centered on January, 1954.

These CQ *Propagation Charts* are centered on Washington, D.C., St. Louis, Missouri, and Sacramento, California. These three particular locations have been selected because they are each located at about 38 degrees North Latitude, which represents the approximate center latitude of the United States. In general, the accuracy of these predictions will not usually vary significantly at distances less than 500 miles from the location used as a center for the calculations. Therefore, the predictions are usable throughout most of the United States. For areas within the USA, but outside the range of these predictions, path openings can usually be determined by averaging the readings of the two nearest centers.

The charts are based upon the following parameters:

a) CW power input to antenna of 150 watts.
b) Gain of transmitting antenna is unity with maximum radiation at angles less than 30 degrees (a horizontal dipole at least a half wavelength above ground).
c) Propagation is skywave, considering F2 reflection only.
d) Assuming a realistic service gain of 6 DB between amateur type radio-telephone circuits and a reference CW circuit, these *Charts* apply for a phone power of 600 watts into the reference antenna.
e) For a system gain of less than 6 db. (either in power or antenna gain), add or subtract one from the circuit reliability rating indicated next to time of opening. For example, if a rating of 3 is given in chart (opening expected 50% of the days of the month), and you are running 150 watts into an antenna that has a 6 DB gain over a horizontal dipole, then you may generally expect openings for 70% of the month, or a rating of 4, etc.

1954

The subject of the sun and its effects upon shortwave radio conditions has already been discussed in "DX And The Sun" appearing in the July and August issues of CQ. It is, however, noteworthy to repeat here that the year 1954 is expected to be a significant one as far as shortwave radio is concerned. Some time during 1954 (probably by summer or early fall) the minimum of the present sunspot cycle will be reached. This will mark the fifth such minimum in the history of shortwave radio and only the third since the correlation between shortwave radio and the cycle was discovered. It is expected that ionospheric researchers will collect much valuable data this year which may give us considerably more knowledge about the ionosphere and its effects upon Amateur Radio. Of possibly more importance to most Amateurs, 1954 will mark the last year (at least for some time) of deteriorating radio conditions, with conditions expected to pick up slowly during 1955 and more rapidly during 1956 and 1957.

Ionospheric conditions are expected to be disturbed during the period of Jan. 6-16 (8-10, severely). Good ionospheric conditions are expected during Jan. 1-5, and 24-31. The period during 17-23 is expected to be unstable.

Next month's column will be devoted to an Ionospheric Review of 1953.

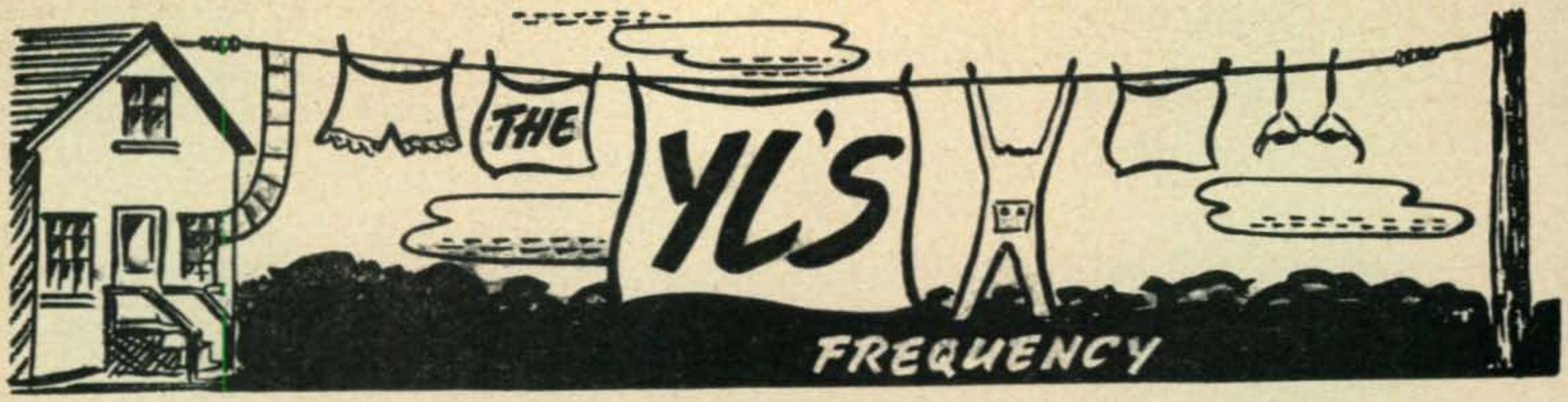
The Central Radio Propagation Laboratory

Each month I mention the fact that these predictions would not be possible if it were not for the basic ionospheric information supplied by the Central Radio Propagation Laboratory (CRPL) of the National Bureau of Standards. This month this column pays special tribute to the CRPL.

We all are quite familiar with the fact that the propagation of radio waves over long distances depends on their reflection from the ionosphere, the electrically conducting layers in the earth's upper atmosphere. Readers of this column are quite aware by now that the characteristics of these layers are continuously changing. For regular and reliable communication, it is, therefore, necessary to collect and analyze ionospheric data from stations all over the world in order that predictions of usable frequencies between any two places at any hour can be made. During the last war it was extremely urgent that information of this type be available so that important world-wide military communications could be successfully maintained between the Allies. Early during the war, therefore, the Inter-Service Radio Propagation Laboratory was set up at the National Bureau of Standards in Washington, D.C., to centralize ionospheric work and predictions for all the Armed Forces of the United States.

On May 1, 1946, this activity returned to peacetime status as the CRPL of the National Bureau of Standards. Designed to act as a permanent centralizing agency for propagation predictions and studies, analogous in the field of radio to the reports of the Weather Bureau in the field of meteorology, the CRPL was estab-

(Continued on page 68)



Monitored by LOUISA B. SANDO, W5RZJ

959-C 24th St., Los Alamos, New Mexico

Seems like we've always QSO'd more YLs in person than on the air—and it still holds true. After visiting the W6 YLs last month we've made a flying trip East to W1-land and have met more YLs along the way. The OM went to Nevada to work for a few weeks so on the spur of the moment we packed up the two jr. ops and took off for New England, for none of our family had ever seen the little harmonics.

When we dragged into Chicago, W9SJR (see write-up in Oct. CQ) was waiting for us. What a welcome sight! It just happened to be Bernice's day off (she works for the phone company) so she whisked us to her apartment. It also happened that her OM was at home, and he kindly took over the jr. ops while Bernice, who is president of the YL club, LARK, took us to lunch with the other YLs who found they could make it on such short notice. We were happy to meet W9LOY, Cris, former president of LARK; W9MYC, Gladys, vice president of LARK, and W9YWH, Evelyn, LARK's membership secretary.

The LARKs recently held their installation of officers, at which YLRL president W1BCU, Peg Wells, was a guest of honor. The LARKS now number twenty-five licensed YLs. One of their objectives is to help other would-be YLs to get licenses. They invite prospective Hams to club meetings and if a girl shows definite interest, the club member living nearest to her helps the girl learn code and get started for her ticket.

After the luncheon we returned to W9SJR's QTH where we met newly licensed W9CBA. Helen, who is the LARK's new publicity chairman, is sightless and gets around with a handsome master-eye dog she calls Troll.

Once back in Massachusetts, of course, we had to look up W1QON—you know, Eleanor is YL contributor for the "other" Ham magazine—hi! With both jr. ops in tow, we made a fast trip up to Walpole, where Eleanor had a delicious dinner for us. We managed to get in a good bit of ragchewing; we could sympathize with each other in the problems—as well as the fun—of keeping a column going. We appreciated the opportunity to meet the YLRI Prexy, Peg, W1BCU and her OM, who had come over from Foxboro. Eleanor and her OM ultimately put us on the train, and after arriving at Concord, we spent several days with W1FTJ and W1BFT.

What a gay time that was—their three jr. ops and our two making merry, playing with Dot's beautiful Cocker Spaniels, and our thrill of operating W1FTJ,

(Continued on page 64)

Among the thirteen YLs enjoying the LARK's first installation-of-officers dinner were, left to right: W9LOY, outgoing president of the LARK; W1BCU, president of YLRL; W9SJR, Editor of Harmonics and president of LARK; W9IKS, LARK secretary-treasurer.

YLs gathered at Montreal for the Eastern Canada ARRL Convention on Sept. 19th. L. to r.: VE2RK, VE2AOB, VE2CA, VE2NJ, W1ZCS, K2DRY, K2CBS, VE2AKK, VE2HI. Photo: R. E. Fleischman.

Conducted by HERB BRIER, W9EGQ

385 Johnson St., Gary 3, Indiana

Every month, the *Novice Shack* prints many letters from Novices telling how well they get out. Among these letters are a sprinkling of letters from others with equally good equipment who have great difficulty in making contacts. Naturally, the latter want

Bob Weggel and his attractive Novice Station, WN9ZZJ at Rhinelander, Wisc. Bob makes no special claims, but admits that he is pretty proud of his equipment. And he has a right to be.

to know what they are doing wrong; so that they can improve their results.

Very possibly, they are doing nothing wrong and are getting as good results as they could reasonably expect, considering their equipment, location, and available operating time. On the other hand, the results obtained from any amateur station are largely determined by the skill with which it is operated. Some authorities claim results are determined ten per cent by the equipment available and ninety per cent by the operator. This may be an unbalanced estimate, but there is little question that many amateurs (and not only Novices) would have much better results if they improved their operating techniques.

Becoming A Better Operator

The first step in becoming a better operator is to admit that there is room for improvement. The next is to analyze what makes a good operator.

A good operator is one who knows what he is doing at all times. He has studied the procedures recommended in operating manuals and by experienced operators until he knows why they, and not some others, are recommended. Then he practices until he does the right thing automatically. However, he never lets his operation become so automatic that it becomes sloppy and careless. Most of all, he realizes that he, himself, is the greatest beneficiary of his own good operating.

Probably the first mark of a good operator is the quality of his sending. He realizes that with every letter he sends he is putting his "fist" on the line to be judged. He knows that if his sending is difficult to read, other stations will hesitate to work him, and he will naturally make fewer contacts.

Anybody who has obtained a license knows the requirements for good sending;* therefore it is unnecessary to stress them here. The important thing is to apply them.

Just as important as sending well is sending at the proper speed. For example, the average Novice can copy somewhat over five words per minute, but not as fast as thirteen words per minute; otherwise he would probably have a General Class License. Therefore, a reasonable sending speed in the Novice bands would seem to be around eight words per minute unless requested to send slower (QRS) or faster (QRQ).

Deliberately sending faster than the other fellow can copy to impress him works extremely well. It

Elvis, WN5ZNQ, is located at Fort Worth, Texas. A thirty-five year old, he reports not meeting many Novices in that age group.

immediately impresses your call letters on his mind as belonging to a show off. It is just as effective as sending faster than you can receive yourself.

(Continued on page 46)

---

* Dashes three times as long as dots. Spacing between parts of a letter equal in length to a dot. Spacing between letters equal in length to a dash. Spacing between words equal to seven dots.

Commentaries

A Department of Constructive Suggestions

The Co-ax Coaxial

In view of the present trend of 10-meter openings for skip DX it is not too surprising to see the band being used principally for mobile and CD work. Beams are gradually being discarded and the emphasis is now on vertically polarized radiators.

Our commercial counterparts have used a variety of vertical radiators above these frequencies for at least fifteen years. Of them all, I feel that the coaxial is the most efficient when properly tuned up. It is essentially a quarter-wave radiator extending vertically above a quarter-wave "skirt." The latter acts as the remaining half of a dipole and at the same time does an excellent job of preventing radiation from the coaxial feedline. It is also well-known as a low-angle radiator.

Constructing a Simple Coaxial Vertical

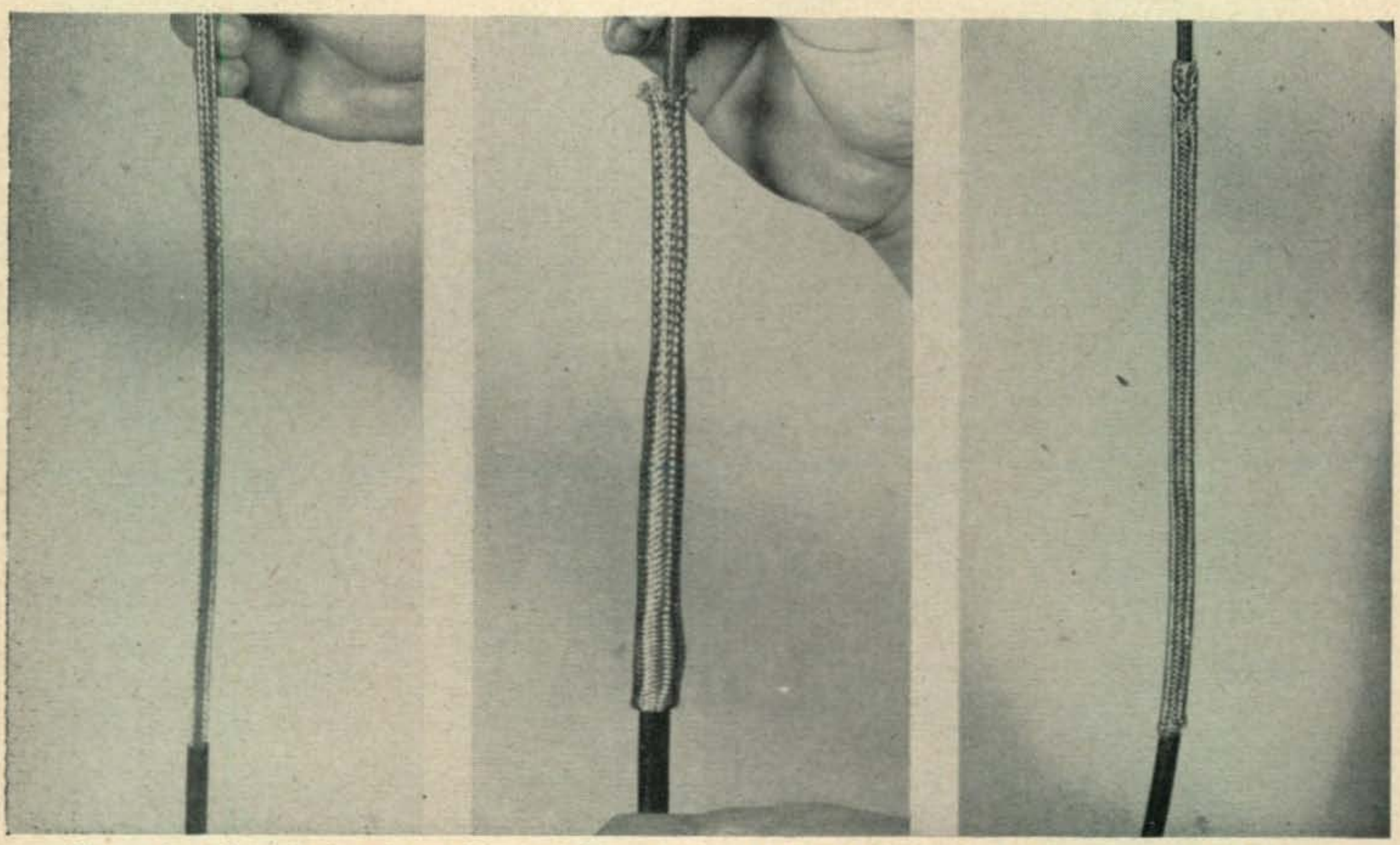
Although most coaxial verticals require considerable machine work I was inclined to think that the same radiation efficiency could be obtained from a simple variation of the main idea. I used enough RG-8/U cable to make up both the transmission line and the radiating element.

To construct an antenna of this type, begin by measuring from one end a length equal to ¼-wave at the operating frequency. This will be used as the radiator. Strip the black covering off the cable and then double the shield back over the co-ax line to make the "skirt." Push the shield back on the cable while holding on to the end of the center insulation. This will free the shield and it may then be doubled back over the black external jacket. Equalize the length of the "skirt" and the radiating element.*

The photographs show the various steps in the preparation of the antenna. Note that some

(Continued on page 58)

* The constructor will probably find it necessary to slightly juggle the length of the shield (or skirt) to secure optimum loading. This may be done on the ground with the pole supporting the coaxial in a vertical position. The length of the skirt will influence the SWR. Do not try to load over 150 watts into this particular type of antenna as the cable may not be able to take it—Tech. Adv. Ed.



Three steps in stripping down the coaxial braid to make the radiator and skirt elements. In the left hand photograph the outer covering has been stripped off. In the center photograph the braid has been pushed down to free it from the center insulator. In the right hand photograph the braid has been doubled and pulled down over the black outer covering to make the skirt.

Problems in Automatic Antenna Tuner Design

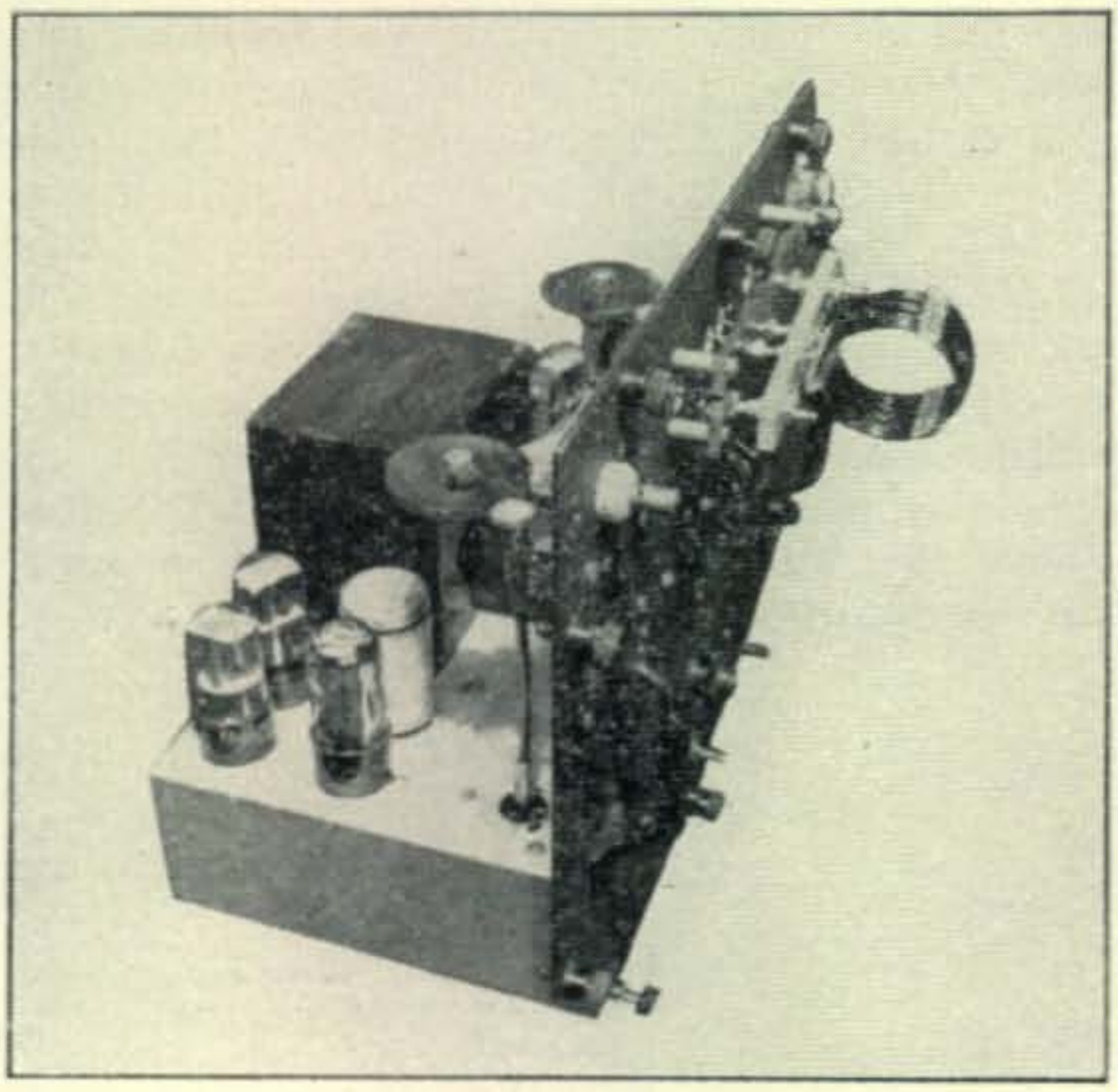
CAPT. R. R. HAY, USN, W4LW

414 New Hampshire Ave., Norfolk 8, Va.

This Article is Published in an Effort to Familiarize Our Readers with the Current Status of the Development of a Fully Automatic Antenna Tuner

Development of an automatic antenna-tuning unit by the Naval Research Laboratory inspired the writer to adapt such a device for amateur radio use. While an automatic antenna tuner is a convenience in any radio shack, it is particularly adaptable to situations where the antenna tuner must be located remotely from the operating position.

Before we proceed, it is only fair to say that this definitely is not a project for the Novice. The word "problems" was inserted in the title of this article because, in the words of Mortimer Snerd, "It ain't easy!" The many variables involved will require considerable adjustment of values and even modification of some of the circuits involved. Each amateur station has its own problems and the characteristics of the antenna tuner should be selected accordingly.

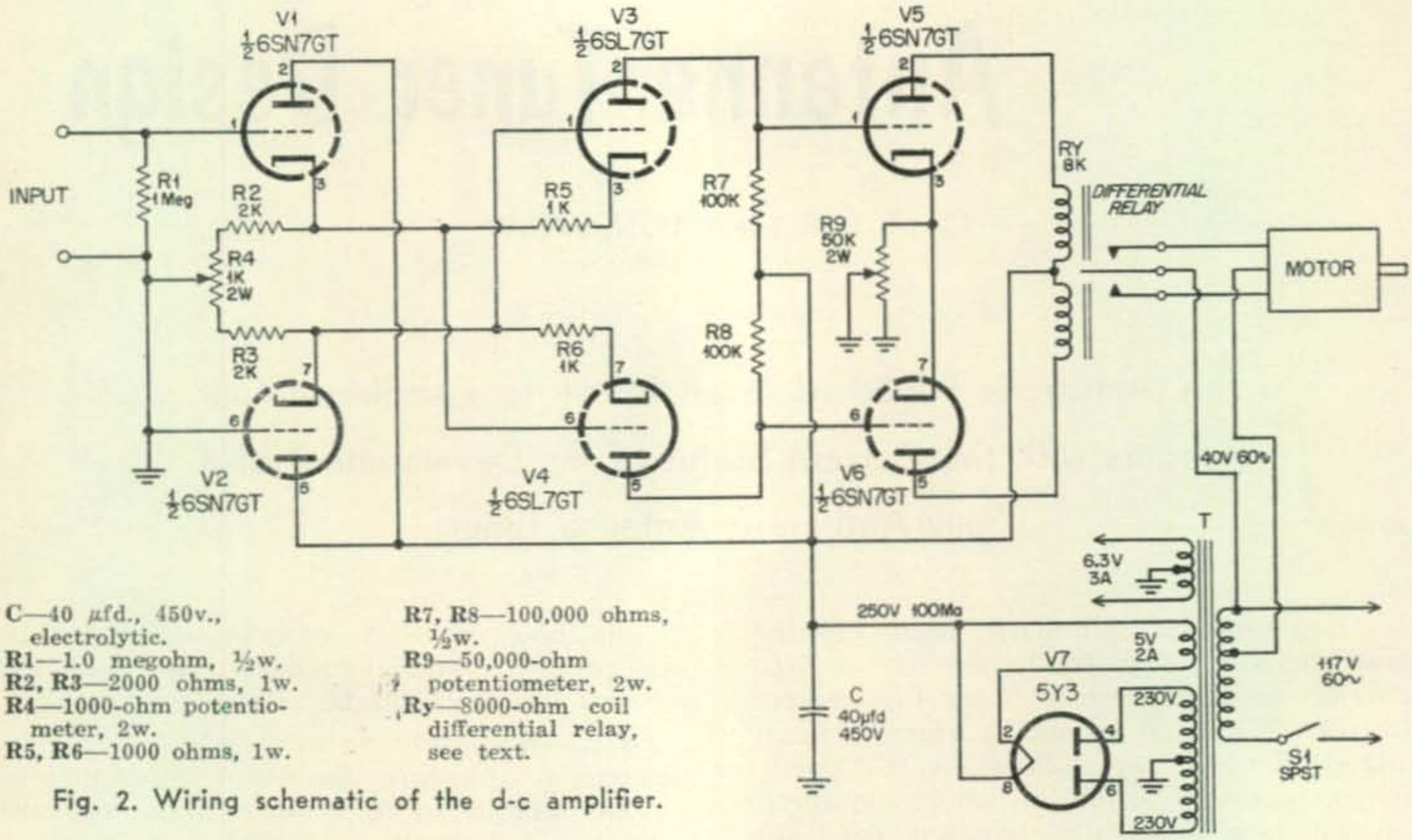


This is a side view of the automatic tuner constructed by the author. The drive control from the magnitude control motor and gearing for the magnitude control condenser, C2, is visible in the foreground. The 20-meter coil has been plugged in the jack bar on the front panel.

To match an antenna to a coaxial line, it is necessary to transform the input impedance of the antenna to an impedance whose resistive component is equal to the characteristic resistance of the transmission line, and to tune out the reactive component of the combined impedance of the antenna and antenna coupler. In order to determine when an impedance match has been obtained, and to produce control signals for adjustment of the antenna tuner, it is necessary to provide a sensing device consisting of an impedance magnitude detector and a phase angle detector. The "True-Matcher," described in the December 1952 issue of *CQ*, provides these sensing functions.

Figure 1 shows a block diagram of the essential elements of the impedance matching system. The outputs of the two detectors are fed to d-c amplifiers, which in turn control differential type relays. These relays control reversible motors which vary the tuning elements of the antenna tuner. The output of the magnitude detector determines the adjustment of the impedance magnitude element of the antenna coupler, while the output of the phase angle detector determines the adjustment of the phase element of the coupler.

The "True-Matcher" exhibits an appreciable amount of reactance. Therefore it should be located as close to either the transmitter or the antenna tuner as possible. In the former case, the reactance will form part of the output circuit of the transmitter; in the latter case it will be included in the tuning of the antenna coupler. If the "True-Matcher" is placed with the antenna tuner, the only connection to the transmitter will be the coaxial line. If the "True-Matcher" is placed at the transmitter,



C—40 µfd., 450v., electrolytic.
R1—1.0 megohm, ½w.
R2, R3—2000 ohms, 1w.
R4—1000-ohm potentiometer, 2w.
R5, R6—1000 ohms, 1w.
R7, R8—100,000 ohms, ½w.
R9—50,000-ohm potentiometer, 2w.
Ry—8000-ohm coil differential relay, see text.

Fig. 2. Wiring schematic of the d-c amplifier.

a three-wire control line must be run to the antenna coupler, but it will be convenient to monitor operation and to check the calibration of the detectors.

The two d-c amplifiers used at W4LW are identical and are of the cross-coupled type. The diagram is shown in *Fig. 2*. Both amplifiers and their common power supply are mounted on a 7x12x3-inch chassis, which also carries the reversible motors. Sensitivity of the relay operation is adjusted by varying *R9* in each amplifier. A value of about 45,000 ohms should be satisfactory for preliminary tests. The amplifiers are balanced, at zero input signal, by varying the center tap on *R4*. The correct position is that which leaves the relay in mid-position, i.e., with both sets of contacts open. Readjustment of *R4* may be required as the tubes age or are replaced. When *R4* and *R9* are properly adjusted, the relay will close one set of contacts when a positive input signal is applied and will close the other set of contacts for a negative input signal.

The differential relays are "surplus" items, similar to *Allied Control Company's* type *DS*.

A variety of motors are suitable for use. Those used were selected on the basis of price, size and availability. They are 28-volt d.c. 2-watt, series motors manufactured by the *John Oster Mfg. Co.* These motors have three lends and can be reversed with an s.p.d.t. switch or relay. They operated satisfactorily with about 40-volts, 60-cycle a.c. as power source. The motor shafts are coupled, by means of flexible shafts, to a pair of 2½ to 1 reduction gears. The reduction gears are, in turn, connected to worm drives on the tuning elements. This combination provides an over-all shaft speed of about 10 rpm. This speed proved to be ideal for operation on the 40-meter band, but a speed

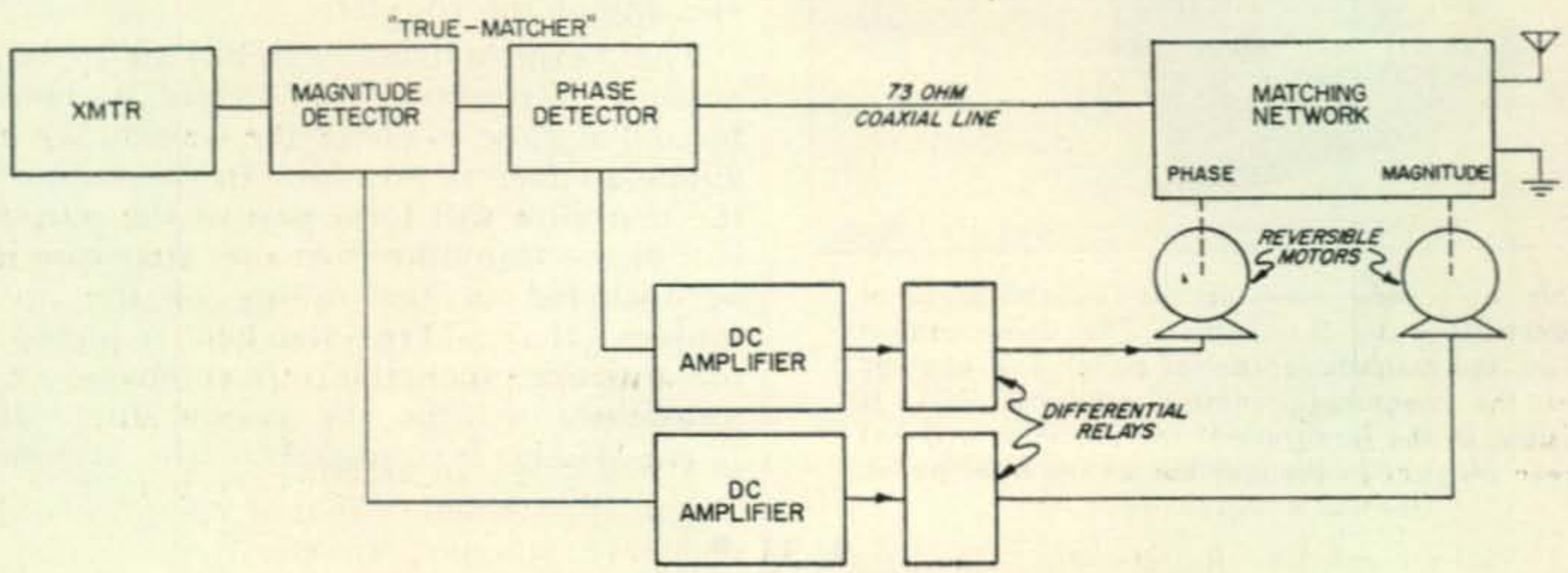


Fig. 1. Block diagram of the impedance matching system.

of about 5 rpm would have been more desirable for the 20-meter band.

The tuning elements (variable condensers or inductances) should either be capable of continuous rotation or have electrical limit stops. Otherwise there is danger of stalling the motors, with subsequent damage. We took the easy way by selecting variable condensers which could be rotated through 360 degrees. These came out of an ARC-5 transmitter and originally had mechanical limit stops, which we filed off. By having condensers capable of continuous rotation, we also eliminated the possibility of getting the motors connected for the wrong direction of rotation, since the direction of change of capacity reverses every 180 degrees.

The d-c amplifiers have a tendency to drift during the warm-up period. This causes the relays to close, even though there is no control signal. There are several solutions to this problem. One is to keep the amplifiers turned on continuously so that they are always warmed up and ready for operation. This may be a little hard on the electric bill, particularly if you don't operate the station daily. Another solution is to keep power off the drive motors during the warm-up period. This may be done either manually or with a time delay device. About ten minutes are required for the amplifiers to warm up to a point where they are stable.

A third, and simplest solution, is to let the motors run during the warm-up period. When the relays open, and the motors stop, you will know the control mechanism is ready for business. *Warning:* Check to see if your motors can run continuously.

Incidentally, the 6SN7GT tubes vary considerably in balance adjustment and warm-up requirements. It is a good idea to have a supply on hand so that several can be tested for performance.

The Antenna Tuner

The next item is the provision of an antenna tuner which will present the coaxial line with a load equal to its characteristic impedance. The transmission line selected for use at W4LW is 73-ohm coaxial cable, since the "True-Matcher" was designed for this cable. The antenna tuner must, therefore, be able to transform the impedance of the antenna to a non-reactive load of 73 ohms.

Before we can design a tuner to accomplish the desired transformation, we must determine the characteristics of the antenna. A thin, half-wave, antenna in space is considered to have an end resistance of several thousand ohms and to be non-reactive. When such an antenna is operated on harmonics of its natural frequency, its resistance may be expected to rise in value. However, when the antenna is mounted vertically and one end brought close to ground, several changes occur.

A study of measurements taken on 35-foot vertical antennas at the Naval Research Laboratory indicate that:

a. The maximum resistance to be expected of a half-wave antenna at the fundamental frequency is approximately 500 ohms. This drops to about 200 ohms for the second harmonic (full wave), and to about 100 ohms for higher harmonics.

b. While the reactance is at or near zero when the resistance is maximum, in the case of the fundamental frequency, the antenna may present a reactive load for harmonic operation.

c. The natural frequency is lower than would be expected, i.e. the antenna "looks" longer than it actually is. For example, a 35 ft. vertical antenna would be expected to have a natural frequency at ½ wavelength of about 13.5 Mc. but actual measurement showed this frequency to be about 9.5 Mc.

d. Both the resistance and reactance will vary considerably between similar antennas, depending upon ground conductivity, proximity of other objects etc., and the variation is greater in the case of harmonic operation.

Figure 3 shows the above data graphically. It must be emphasized that this figure is representative only, and that it will be difficult, if not impossible, to reproduce these characteristics in any particular antenna.

Based on the above information, it was decided to proceed on the following assumptions:

a. The antenna to be used would have enough of its length vertical to acquire some of the characteristics of a vertical antenna.

b. By selecting an antenna with physical length approximately that of a horizontal half-wave antenna, an electrical length of about 2/3 wavelength would result. As indicated in *Fig. 3,* the resulting re-

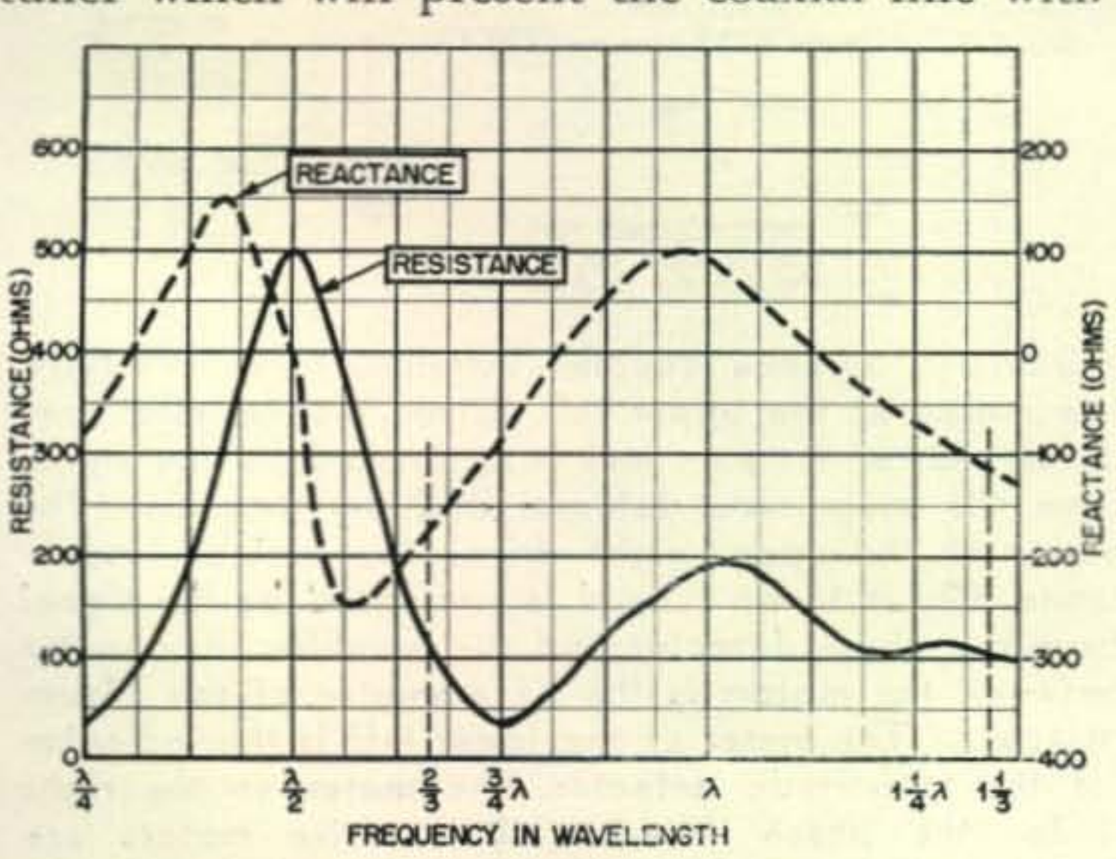


Fig. 3. Vertical antenna characteristics. Note: These curves are representative and probably will not apply to any other particular antenna.

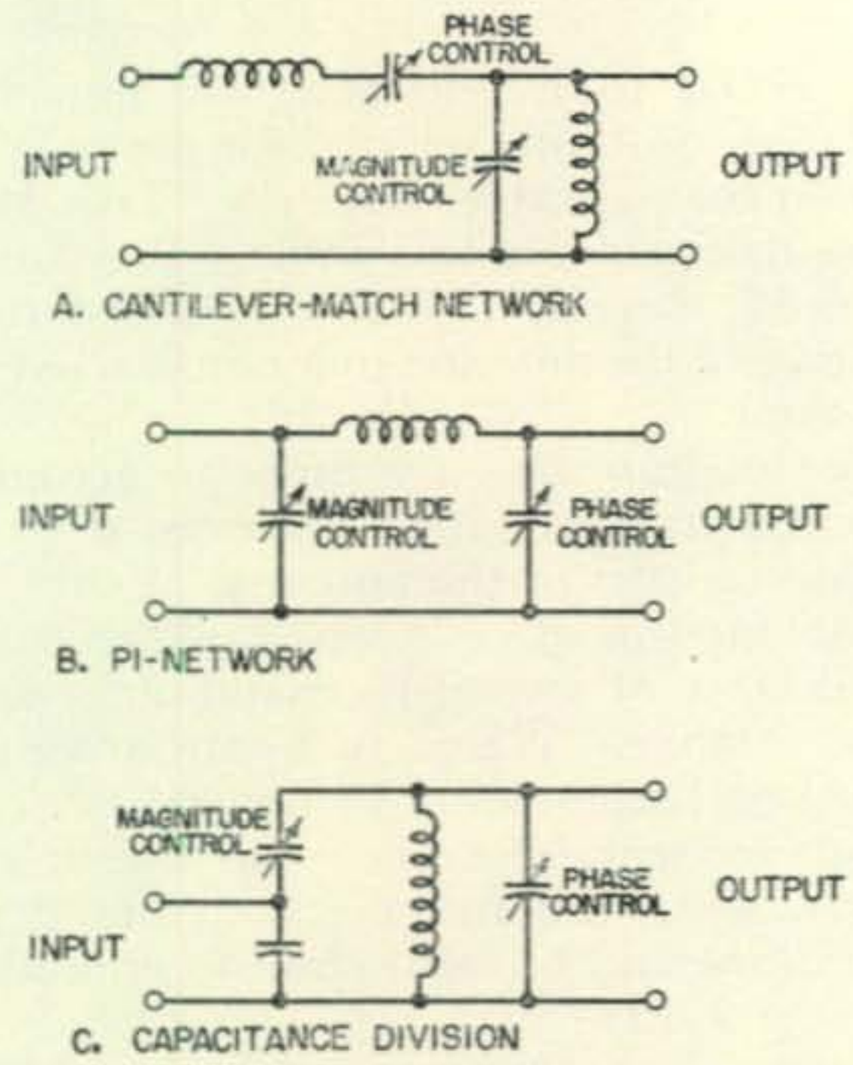


Fig. 4. These circuits may be used to vary the magnitude or phase angle of the impedance in the antenna feed system.

sistance should be about 100 ohms at both the fundamental and harmonic frequencies, and the reactance should be capacitive for all these frequencies.

It was decided to use a matching network with condensers as the variable elements, with plug-in coils. This type of tuner has several important advantages:

a. Changing the inductance by plug-in coils eliminates the losses which would result from using a variable inductance.

b. Variable condensers furnish a convenient, smooth operating, and low-loss method of varying phase angle and magnitude.

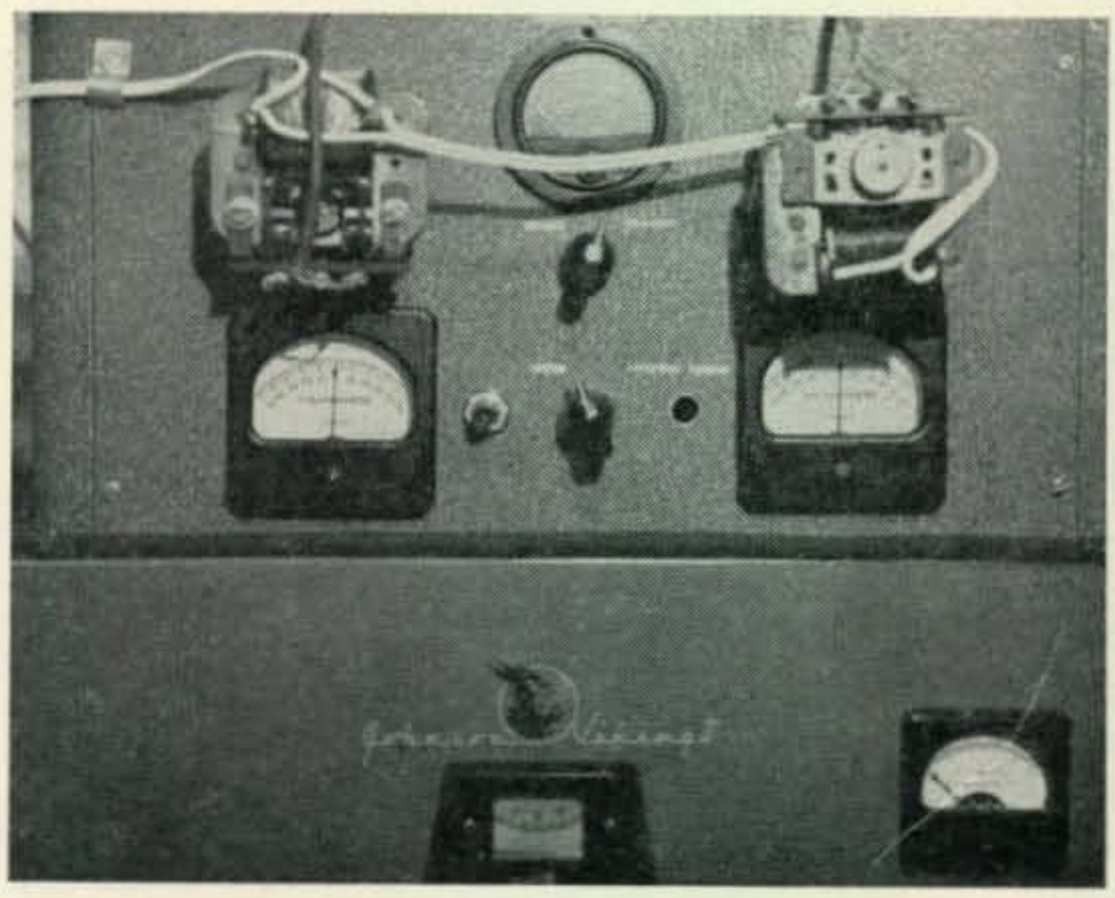
c. Changing coils reduces the possibility of "zeroing" on a harmonic of the desired frequency.

The most common type of antenna tuner used at amateur stations is one which employs link coupling to the co-ax line from the transmitter and a variable condenser for tuning a tank circuit. Automatic tuning may be applied to this type of antenna tuner by using the signal from the phase angle detector to control the variable condenser. The visual indication of the magnitude detector meter is used to select and adjust the link coil for magnitude match at mid-frequency for the band in use. Of course, some mismatch in magnitude will result for frequencies at the edges of the band. However, this mismatch will not be serious if a broad-band type of antenna (such as a folded dipole) is used. Even in the case of narrow-band antennas, if the co-ax line to the antenna tuner is comparatively short (ten feet or less) the mismatch will not prevent a satisfactory transfer of power, *provided the phase angle match is "on the nose."*

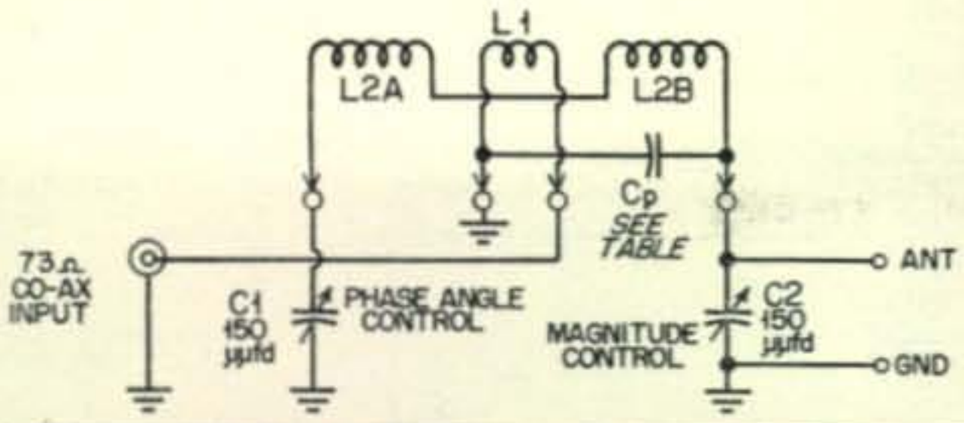
If you are satisfied with the above solution, you will need only the "True-Matcher," the phase angle control system, and a standard antenna tuner. If you want an exact impedance match in both phase angle and magnitude the problem becomes more difficult.

As suggested in the "True-Matcher" article (December, *CQ*), an *L*-network is adaptable to this use. Design data on *L*-networks may be obtained in the article "R.F. Coupling Circuits" on page 134, May 1952 issue of *ELECTRONICS* Magazine. This was the first type of tuner tested at W4LW, but was discarded because of mechanical difficulties with the variable inductance. If a satisfactory mechanical solution can be obtained, the *L*-network is well worth trying because it is simple and has low losses.

Other circuits which are adaptable to use for variation of both magnitude and phase angle of the impedance are shown in *Fig. 4*. These were tried and discarded at W4LW because of limitations of components available for use in the circuits. If you have suitable components, these circuits offer interesting possibilities. Design data may be obtained from the *ELECTRONICS* article mentioned above.



Automatic antenna coupler installation at W4UCN. The motor at the upper left drives the variable condenser, C, at 1 r.p.m. and is controlled by the signal from the magnitude detector and d-c amplifier. The motor at the upper right drives the variable inductance, L2, at 15 r.p.m. and is controlled by the signal from the phase detector and d-c amplifier. The meter between the motors is the r-f ammeter of the "True-Matcher." The meter at the lower left is the indicator for the magnitude detector. The meter on the right is for the phase detector. Both drive motors are Barber-Coleman units with shaded poles, 110-volt, 60-cycle, reversible.



COILS WOUND ON ARC-5 TYPE FORMS: L1 = 1" DIA, L2 = 1 5/8" DIA, 3/8" BETWEEN L2A & L2B	BAND	FIXED LINK COILS CONSTRUCTED FROM B & W INDUCTOR, 2" DIA 10 TURNS PER INCH.
L1 = 4 TURNS L2A = 24 TURNS, 1 1/8" LONG L2B = 10 TURNS, 3/8" LONG C_p = 0	80	SATISFACTORY SOLUTION NOT OBTAINED WITH FIXED LINK.
L1 = 4 TURNS L2A = 11 TURNS, 1" LONG L2B = 5 TURNS, 1/2" LONG C_p = 160 µµfd	40	L1 = 5 TURNS L2A = 8 TURNS L2B = 8 TURNS, 1 1/4" FROM L2A C_p = 80 µµfd
L1 = 2 TURNS L2A = 5 TURNS, 1" LONG L2B = 3 TURNS, 3/8" LONG C_p = 0	20	L1 = 3 TURNS L2A = 4 TURNS L2B = 3 TURNS, 3/8" FROM L2A C_p = 0

Fig. 5. Suggested antenna tuner for an unbalanced adaptation. Derived from a design by W2FTW (see Fig. 6b).

The characteristics which were desired for the system at W4LW are those which would permit the following operation:

a. On 80, 40, and 20-meter bands with a single antenna.
b. Transmitter to be loaded into a dummy antenna and then switched to the antenna tuner without appreciable change in loading.
c. Adjustment of the antenna tuner fully automatic within each amateur frequency band.
d. System in operation at all times to permit rapid frequency shift and to compensate for variations caused by wind and weather.
e. Maximum power handling capacity—150 watts.

An end fed, single wire antenna offers the simplest solution to operation on a series of harmonically related frequencies. Because this type of antenna has a tendency to radiate unwanted harmonics, it is necessary that the transmitter be as free from such harmonics as it is possible to make it. It is also highly desirable to place a low-pass filter in the transmission line to avoid TVI.

The circuit finally chosen is a combination of link coupling and *pi*-section network, and was inspired by W2FTW's article in the November, 1952 issue of *RCA Ham Tips*. The circuit diagram is shown in *Fig. 5*. This circuit provides the flexibility of a *pi*-section tuner without requiring the large values of capacitance required for the latter type. *C1* is controlled by the phase detector signal and *C2* is controlled by the magnitude detector signal.

First experiments were made with coils wound on forms taken from ARC-5 transmitters. Each of these forms is 1⅝ inches in diameter and has a rotor mounted inside, near one end. A link coil wound on this rotor has the facility of variation through 360 degrees. In addition to having the correct number of turns and the correct degree of coupling, the *polarity* of coupling must be correct. With a rotor such as provided in these ARC-5 coil forms, polarity may be reversed by turning the rotor 180 degrees.

It was planned to replace these ARC-5 coils with coils capable of handling higher power. Coils for 20 meters and 40 meters were constructed from *B & W Inductor #3707* (2" diam., 10 turns per inch), with fixed links. However, a satisfactory solution was not obtained for the 80-meter band because the correct link coupling was not achieved. Consequently, the original ARC-5 coil is still in use for this band pending procurement of a variable link coil assembly.

One adjustment in the antenna coupler should change more rapidly than the other in order to prevent the controls from "hunting." With both condensers of the same value, and driven at the same speed, this probably will occur naturally since phase angle will change faster than magnitude. If other condenser values are used, it may be necessary to change the gear ratio for one control or reduce the voltage on the drive motor in order to provide a difference in the rate of correction between phase and magnitude.

Preliminary adjustments are as indicated below:

a. Set the transmitter near the low frequency end of the 80-meter band and adjust it for maximum power into the dummy load in the "True-Matcher."
b. Disconnect the control line to the d-c amplifiers.

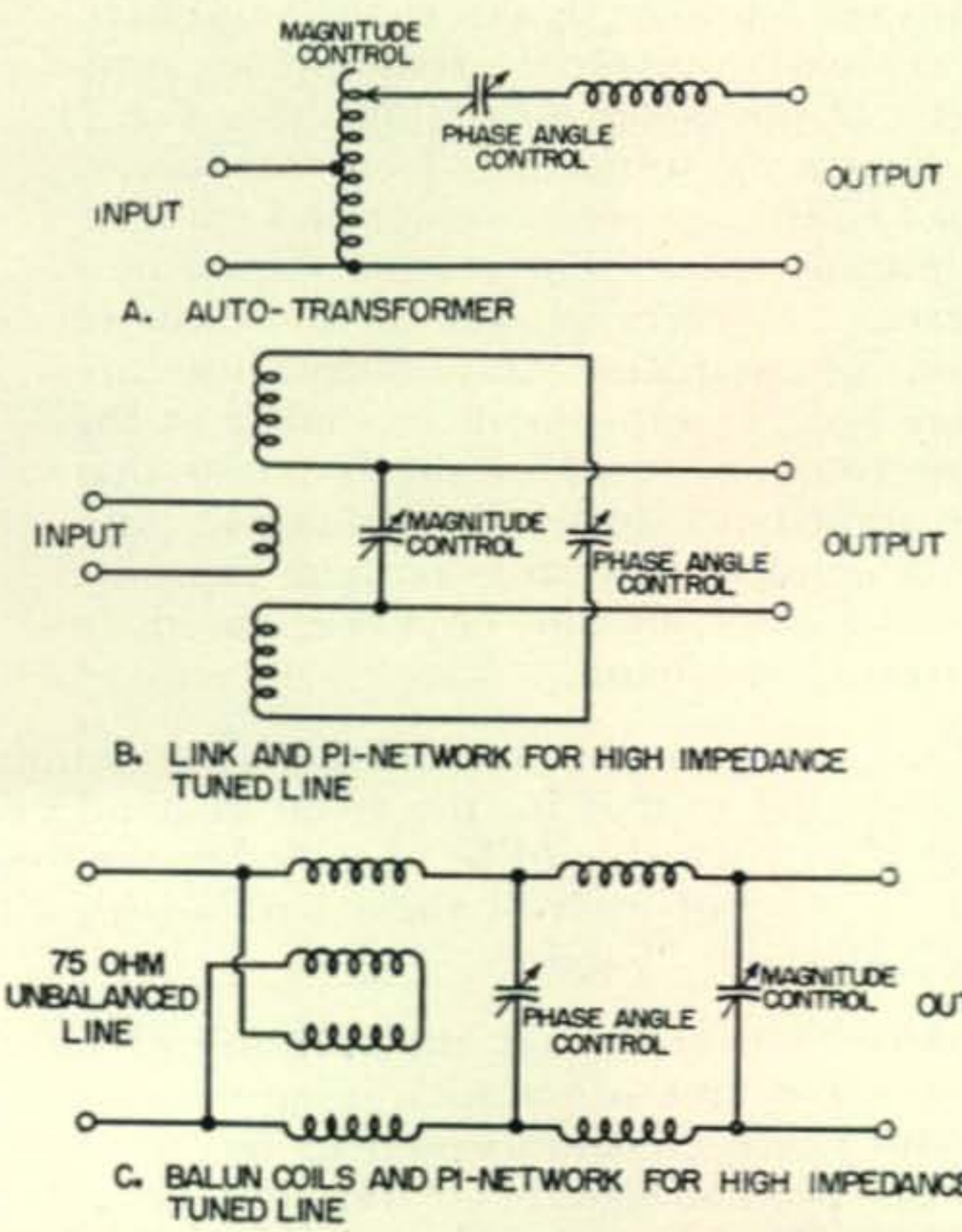


Fig. 6. Additional circuit suggestions for the experimenter. These might be used in certain installations to replace the circuit recommended by W4LW in Fig. 5.

c. Plug in the 80-meter coil, and set *C1* and *C2* near maximum capacity.
d. Switch the transmitter from the dummy load to the antenna tuner.
e. Manually adjust *C1* for phase angle match and *C2* for impedance magnitude match as indicated on the "True-Matcher" meters. If a match cannot be obtained, adjust the position of the variable link, or reverse the link connections if a fixed link is used, and try again. *This link coupling adjustment is very important.* Its effect can be observed on the meters of the "True-Matcher." If a phase match cannot be obtained, it may be necessary to add padding capacitance in parallel with *C1*. If a phase match can be obtained but not one in magnitude, it may be necessary to add padding.
f. When a satisfactory match has been obtained at the low frequency end of the band, shift the transmitter to the high frequency end of the band and readjust for maximum power into the dummy load. Energize the d-c amplifiers and "zero" them by adjusting *R4* so that relay contacts remain open when the transmitter is not energized.
g. Un-plug the meters from the "True-Matcher" and substitute the input connections to the d-c amplifiers. (If it is desired to retain the meters to monitor operation, it will be necessary to insert a resistance of at least 150,000 ohms in series with each meter in order to prevent reduction of signals to the amplifiers. This will, of course, reduce the sensitivity of the meter indications. (See *Fig. 7*)
h. Switch the transmitter from the dummy load to the antenna coupler and energize the transmitter. The motors should now drive condensers *C1* and *C2* and come to rest when phase and magnitude are matched. If adjustment was made at the low frequency end of the band so that an impedance match was obtained with both condensers near maximum capacity, no difficulty should be experienced in covering the band.

Adjustment for the 40 and 20-meter bands will be similar to that for the 80-meter band except that a match should be obtained at the low frequency end of each of these bands with *C1* and *C2* at about 75 $\mu\mu$fd.

It was discovered that the transmitter must be completely free of parasitic or spurious emission, since such emission would be out of phase with the normal signal. A transient parasitic, which appeared for a fraction of a second when the transmitter was keyed, gave us some trouble on 20 meters by causing the differential relays to close momentarily every time the key was closed. Excessive chirp or key click may be expected to produce a similar effect.

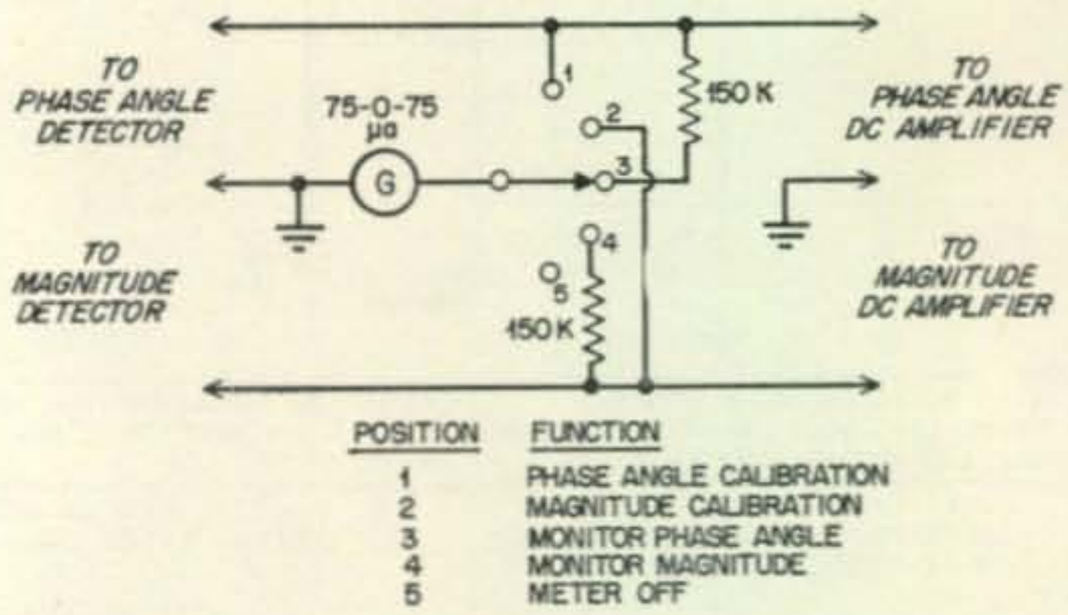


Fig. 7. Switching arrangement for use of a single meter with the "True-Matcher."

By this time you are probably wondering why anyone should go to all this trouble to build an automatic antenna tuner. Other than the obvious advantage of remote operation, there is another desirable feature of this device. It can produce an impedance match faster and more accurately than you can do it by hand. For example, a frequency shift from 7005 to 7295 kc. can be handled by the automatic tuner in less than 2 seconds. Ordinary frequency changes of 10 to 20 kc. require only a fraction of a second. Since the tuning of the transmitter itself is done with a dummy antenna, there is no unnecessary QRM during the tune-up. Changes in antenna characteristics because of weather, movement of the antenna or nearby objects, etc., result in automatic compensation by the antenna tuner.

The "True-Matcher" samples your outgoing signals continuously and controls the automatic tuner in order to provide optimum use of the transmitted power.

Additional Notes

Substitution of a 6SL7GT tube for the 6SN7GT in the final stage of the d-c amplifier was tried and found to be acceptable, although it reduced the sensitivity of the amplifier slightly. . . . 6SN7GT's and 6SL7GT's with matched sections may be selected by checking them on a tube tester. Both sections should give the same meter reading on the tester and the meter needle should come to rest in a few seconds. Erratic movement of the needle will indicate an unsatisfactory condition for use in the d-c amplifier. . . . If it is desired to use miniature tubes, substitute 12AU7's for the 6SN7GT's and 12AX7's or 12AT7's for the 6SL7GT's. . . . Initial tests may be simplified by the use of a grid dip meter. This can be used to determine if the tuner, with antenna and co-ax line attached, will tune to the lowest frequency for any particular band. . . . Suitable control equipment may be constructed from a *Zenith* remote control unit; it requires 75 watts of 110-volts, 60-cycle power. Will drive ¼" shaft at 4 rpm. Includes transformer, reversible motor, reduction gear train and reversing switch. Available from *Herbach and Rademan, Inc.*, 1204 Arch St., Philadelphia 7, Pa.

The Monitoring Post

On last July 2nd, the Naval Research Laboratory in Washington, D. C., celebrated its 30th anniversary. As a part of the celebration, amateurs employed by the NRL operated W3WV/3 on the various bands. W3WV is the call of Leo C. Young, who has been a research worker at the NRL since its founding. Hundreds of amateurs have worked Leo while he operated the Naval station NKF during propagation studies . . . An interesting sidelight of the day was a visit by Fred Schnell, W9UZ, who flew in from Chicago to talk over old times. Fred is especially remembered by the NRL for his work aboard the *USS Seattle* during its famous 1925 cruise to Australia that convinced everyone of the value of high-frequency radio waves for long distance communication.

• • •

Although over one-half of the various States have authorized the issuance of call-letter license plates the approach used on Governor George Craig of the State of Indiana may be proved to be most interesting. It is reported that one evening while examining bills from the State Legislature he said to his secretary, "That's enough for tonight." The secretary picked up the license plate bill and replied, "Better look at this one. The Hams have promised me that, if you sign it, I will be the first one they will rescue if we have a disaster in Indianapolis!" Apparently it worked; the bill was enacted in law shortly thereafter.

Another state signs up for call-letter license plates. Seen above are co-sponsors of the bill for the State of Indiana, Representatives George McDermott and Charles Meiser, W9MDC. Governor George N. Craig wields the pen.

(U.S. Navy Photograph)

Leo C. Young, W3WV and Fred Schnell, W9UZ, talk over old times at the 30th Anniversary of the founding of the Naval Research Laboratories, Washington, D.C.

• • •

The following story is adapted from the pages of "The Bugle" (club paper of the Confederate Signal Corps), as reported by W4LOW.

"One day last winter, Russ, W4FAX, and I had been in our duck blind since since, but nary a duck did we see. I had a jug of coffee to keep off the chill. Russ had a jug, too. Along towards the afternoon he seemed a leetle onsteady Suddenly, a single pintail comes barreling downwind about 300 miles per hour towards the blind. I yelled, 'My duck!!!' but missed with both barrels. Russ staggered to his feet and brings down the duck with one shot. I started to congratulate him, but he stops me saying, 'Oscar, I don't know what's wrong with my shooting, I usually get four or five birds from a flock that size.'"

Eimac has just released data on an amazing development in power tubes—the Umac 606. It is reported to be an infernal anode type of phantasatron using a self-flushing prophylactic plate. The remaining characteristics are so unusual that only by a close perusal of the data sheet can they be fully appreciated. To obtain your copy, drop a line to W6HB, c/o Eimac, San Bruno, Calif. Last Minute Flash: Also ask for data on the Wemac 1Z2Z.

• • •

Judging from the comments heard over the air, the most lasting impression of the Houston National ARRL Convention was its cost to those attending. As these comments parallel those following other recent Ham conventions held in millionnaire playgrounds we would like to express the hope that planning committees will next year consider "all" Hams and not just a few. Conventions need not be held in luxurious surroundings to be successful. The basic purpose of a Ham convention is to provide information and fellowship. Keep the registration fee low enough to insure a well-rounded attendance. Provide ample meeting rooms with good acoustics and see that all types of refreshments are available in the vicinity at reasonable prices. In short, let the fellows see that their convention dollar goes a long way.

A group of prominent west-coast Hams watch Jack McCullough, W6CHE, demonstrate the latest in power tubes—the UMAC 606. They are, left to right; W6HB, W6ENV, W6CHE, W6WB, W6QD and W6TI. This particular tube has a special connection to the grid leak and was won by Buck Joyner, W4TO, in one of his reportedly less ambitious moments.

Gratton George, W4PJU, and his wife, Irene. W4PJU recently received the V.F.W. "Good Citizenship" Medal in behalf of his many acts of public service as a radio amateur. George is an arthritis victim and gives most of the credit for the award to his official "antenna switcher."

• • •

The problems of message handling are always intriguing—especially if the traffic is "urgent." Last Summer, a Serviceman in Hawaii requested KH6AHQ to contact his parents in Florida concerning the reported death of his brother. With the aid of W6IQD only W4LPU in Alabama could be raised. W4LPU telephoned to Florida to find the parents had gone to Georgia. Meanwhile, W4LPU had faded out in California and Hawaii but was being read by W7MCQ in Washington who then relayed. After completing the Georgia telephone call, W4LPU relayed to W7MCQ who then found that he had faded in Hawaii, but was being read by KG6ACS in Guam. Thus the desired information was given the Serviceman in under two hours via Alabama-to-Washington-to-Guam-to-Hawaii.

• • •

A V.F.W. "Good Citizenship Medal" was recently presented to Gratton George, W4PJU, Clewiston, Florida, by the Hawkins-Kirk-Gordon Post No. 4185, in recognition of his many acts of public service. George, as W4PJU is known over the air, is an arthritic invalid. Almost all of his operating is done on 'phone and he is a member of several outstanding nets on 20 and 75 meters. His time seems to be divided between MARS activities (he is one of the very few members of both the Army and Air Force branches) and handling overseas traffic. A letter of appreciation from the Portuguese Ambassador attests to his assistance in relaying a message that obtained a rare drug to save the life of a young girl dying from meningitis. W4PJU is also very active and well up in the top scores for the SS and DX contests each year.

The VHF-UHF News

FURMAN C. COBB

c/o CQ Magazine, 67 West 44th St., New York, N.Y.

A few months ago a feature article in *CQ* dealt with the subject of transmitter hunts (WØHKF, September, 1953, page 13) with particular emphasis on 75-meter and 10-meter equipment. At that time our Managing Editor had hoped to print at a later date some dope on 6-meter and 2-meter hidden transmitter hunts. Since this doesn't seem to be coming to pass I've pestered him into turning some of this material over to me for use in the column. It originated with W2PAU and the South Jersey Radio Association.

In *Fig. 1* we see a very simple 2-element beam that has met with some success. The 300-ohm line may be run all the way to the receiver, or it may be matched to a coaxial line through the balun as is shown in the drawing. The antenna may be used either vertically or horizontally although it is necessary to dress the feeders midway between the dipole and reflector.

Figure 2 illustrates the popular *Cubical Quad* which may be constructed in a few hours' time from

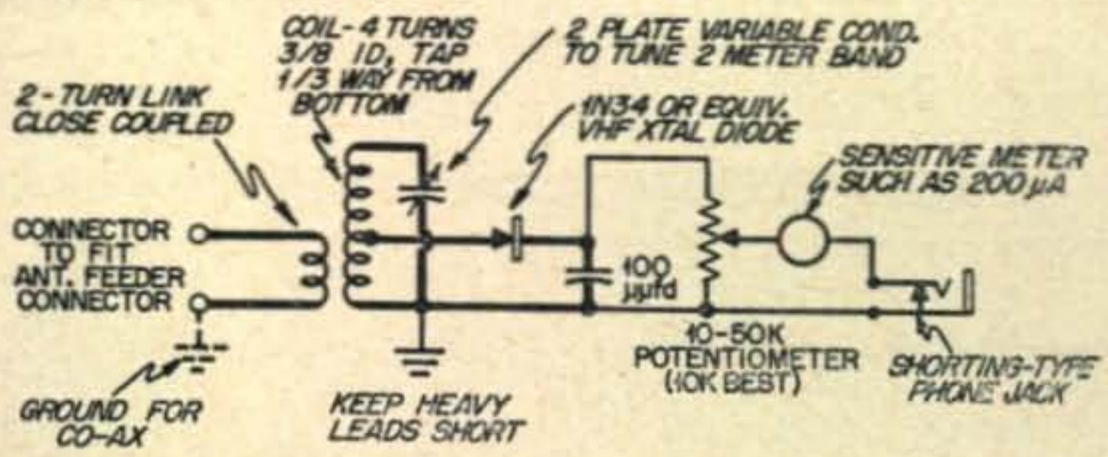


Fig. 3. This is a "sniffer" circuit for close-in work on hidden transmitter hunts. Adjust the coil coupling and tap position for best sensitivity.

scrap wood. The same balun as shown in *Fig. 1* may be used here if a co-ax line is desired. Both of these antennas are capable of yielding "sense" information as well as fairly good bearings. They should be tuned for maximum front-to-back ratio so that they can be used "on-the-nose" for weak signals, or on the null off the back for strong signals.

If the antennas are made detachable from the car there is a distinct advantage in constructing the "Sniffer" shown in *Fig. 3.* This little device is mounted in a small box for ease in carrying and will give a surprisingly sensitive reading within walking distance of most hidden transmitters.

As "Helpful Hints," our Technical Advisory Editor mentions the following important points.

1. Any existing antennas on the car should be removed, telescoped or folded flat to avoid the possibility of their reflecting a false signal into the d-f antenna. Any object that can reflect the signal can prevent a good null reading.
2. Provide some means for reading the signal level at all times.
3. For receiving strong signals on the regular car receiver it will be necessary to be able to reduce the r-f system gain. It should act on the *r-f stage*, not on just the i-f stage alone.
4. The d-f antenna should be pre-tuned for the best possible front-to-back ratio. Test it out on a signal coming from a known direction in a test area that is free of reflecting objects. An ideal method is to enlist the aid of another mobile operator whose transmitter can serve as a signal source. Select an open field or large park-

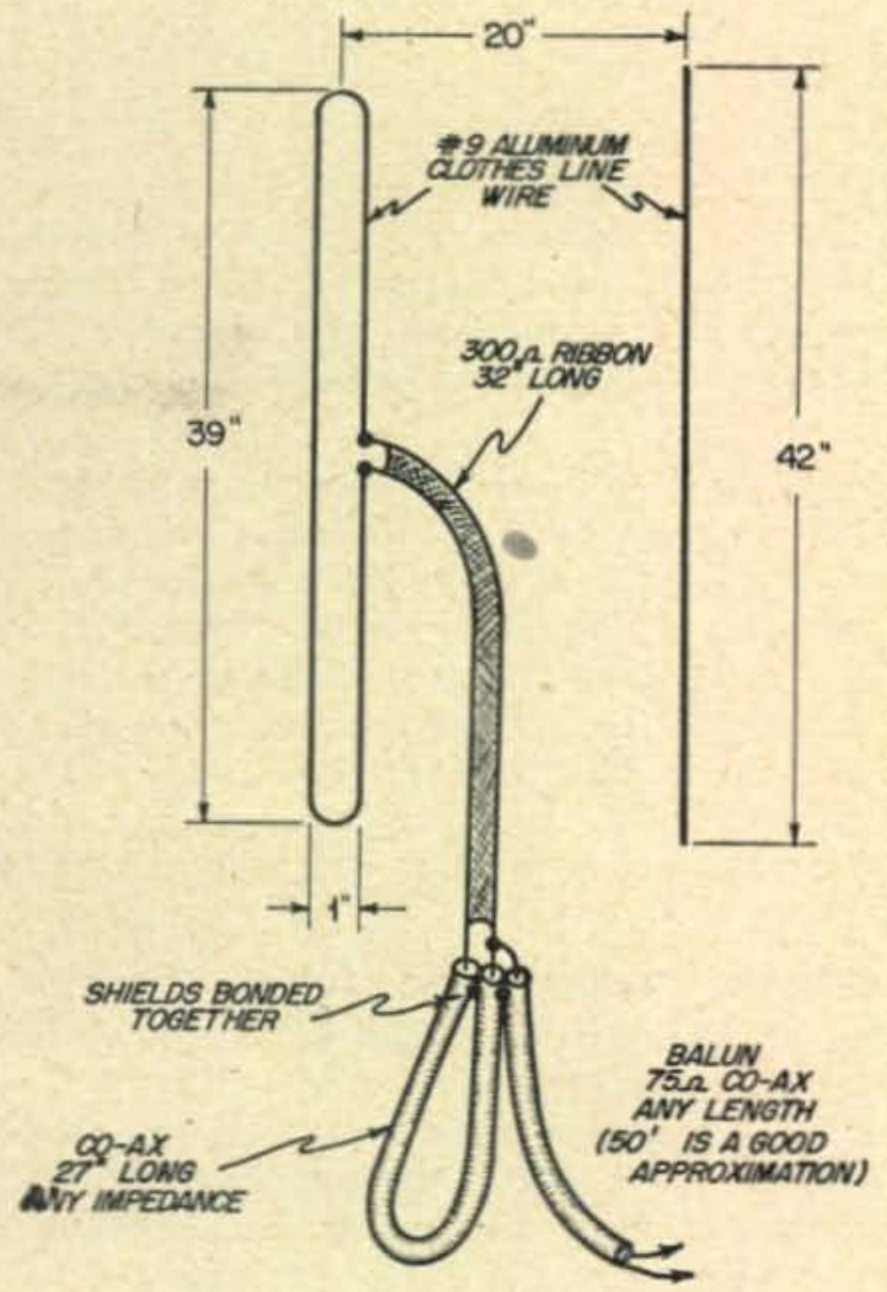
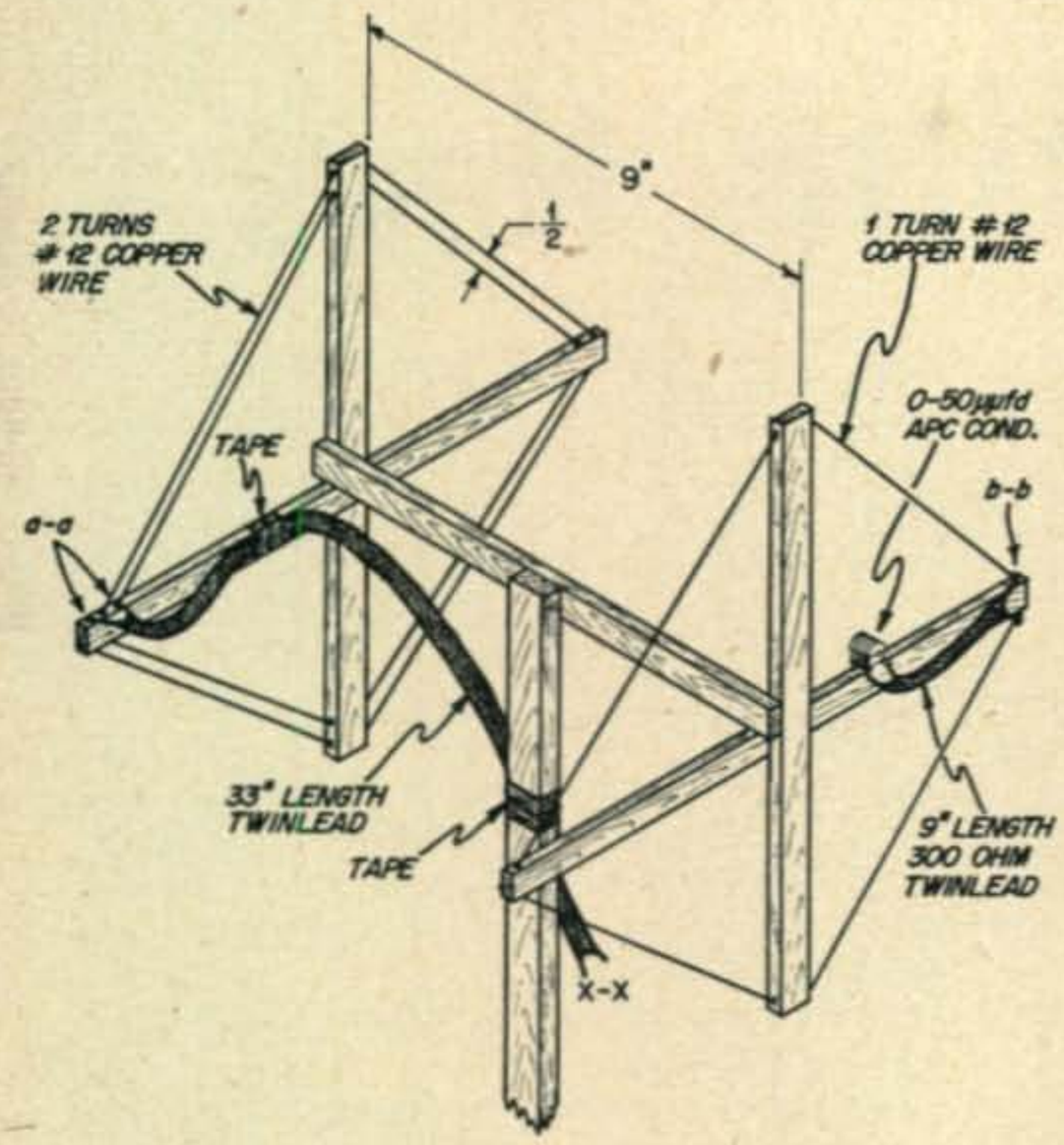


Fig. 1. Two-element beam for 144-Mc. transmitter hunts. Mount the two elements on a wood frame to preserve the spacing.



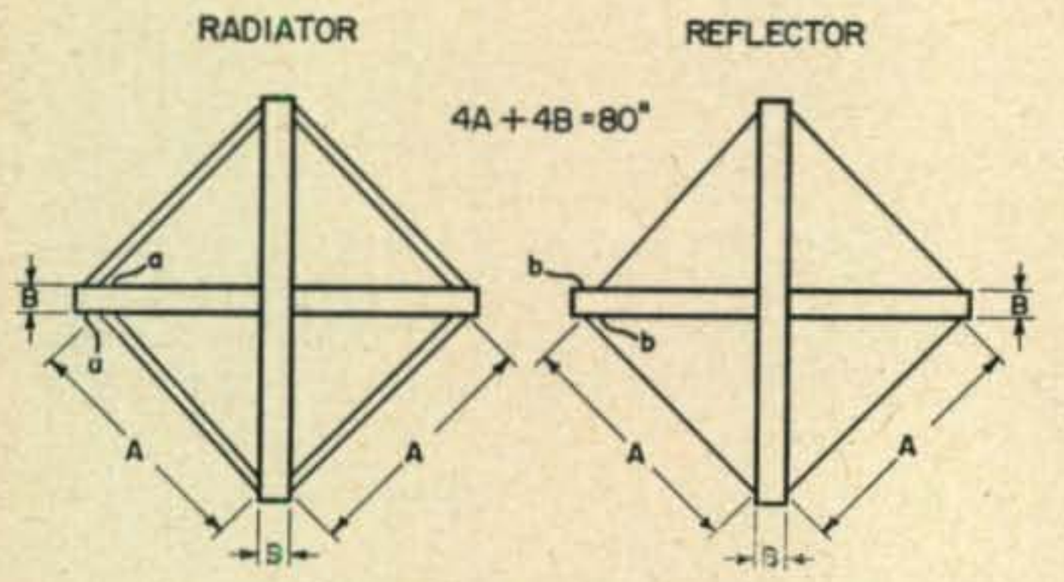


Fig. 2. This Cubical Quad has excellent front-to-back ratio characteristics which make it ideal for d-f work on 2 meters. A balun (such as shown in Fig. 1) may be used at points "X-X" if a co-ax line is needed to run to the converter.

ing area and set the two cars about fifty feet apart. Use the "Sniffer" and adjust the antenna tuning for the deepest null directly off the back of the antenna. This system avoids the possibility of reflections, stray coupling through power lines, stray pickup in the receiver, etc.

5. Be sure that the polarization of the hidden transmitter and your d-f antenna is the same.

Those "Long Long John" Arrays

Many of us have watched with considerable interest the increased use of multi-element Yagi antennas for TV fringe area reception. Eight-element v-h-f arrays are not too uncommon and the recent introduction of u-h-f TV has seen 12-element beams being advertised.

With diversified activities on both 2 meters and 420 megacycles, Hod, W9ALU (Metamora, Ill.) wrote the engineers at a number of TV antenna manufacturers in an effort to obtain any design data that might be useful. Some of the companies declined to answer, but one, the Research and Development Laboratories of La Pointe Electronics, Inc., Rockville, Conn. sent information on their "Vee-D-X" Model LLJ-U, or UHF "Long Long John."

Vee-D-X reports that a Yagi of 12-elements for the 144-Mc. band should be possible and would give a forward gain of about 14 db. The horizontal half-power points would then be 50°. They have found that the reflector does not have an effect on the gain of the array, but should be used to control the feed impedance and bandwidth. It should be 0.52 of a full wave in length. The radiator would be 0.475 of a wave regardless of whether it is for a 52 or 300-ohm feedline.

The first nine directors should be 0.42 and the end director 0.41 of a full wave. This end director will control the front-to-back ratio. The spacing between elements is critical with particular emphasis on the reflector. About 0.20 spacing between directors is used, although if the reflector is spaced 0.15 and all the directors are spaced 0.32 there will be about 15% increase in the gain. Stacking the "Long Long John" results in a 2.5 db increase in forward gain.

These generalizations are indicative that Yagi antennas can be made with fairly good "element efficiency." Although to secure the most gain with the least number of elements it's necessary to make that array long, wide, high and "empty" in the middle!

"Triode R.F. Stages on 144 Mc."

While rambling through our file of foreign Ham journals I noted an article with the above title in the *R.S.G.B. Bulletin* for July, 1953. It was written by P. F. Cundy, G2MQ and re-emphasizes that the cascode does not exhibit too much advantage from a practical standpoint over the well-designed triode r-f stage. Obviously the biggest problem is to properly neutralize the triode stage so that it will maintain a high impedance output circuit and yet incorporate sufficient stage gain at a low noise figure. The author reportedly attempted to use inductive neutralization (as in the cascode, but without the second stage) and found it unsatisfactory.

Capacitive neutralization seems to be the only answer and the circuit shown on this page is one of those developed by G2MQ. The value of *Ca* will be quite small and may be formed by a single vane soldered to the grid of the 6J6. This is "approached" from the metal chassis (ground) by a small disc (¼ or ⅜-inch in diameter) soldered to the head of a bolt. The chassis is tapped and locking nuts are provided to keep the adjustment rigid once it has been made.

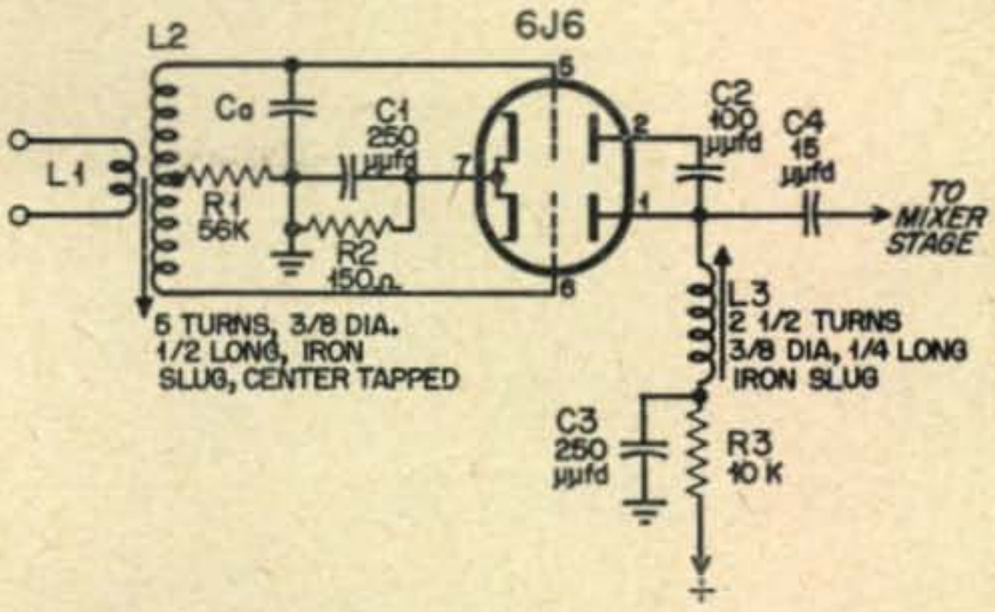
The details on triode neutralization as outlined by G2MQ were quite interesting and I have taken the liberty of summarizing them. The final criterion of adjustment is complete stability of the circuit. To set the circuit up for neutralization, disconnect *C4* and leave it hanging so that it is very lightly coupled to the r-f stage and mixer. Ground one side of the antenna coil and put one or two inches of wire on the other side of the coil as a probe. Provide a means of adjusting the voltage applied to the plates of the r-f stage. A grid dipper set on 72.5 Mc. and about eight feet from the converter may be used as a signal source (watching for the 2nd harmonic on 145 Mc.).

With a fairly low value of plate voltage the grid and plate coils (*L2* and *L3*) should be adjusted for maximum signal strength even though the r-f stage is only lightly coupled to the mixer. Should the circuit oscillate, the plate voltage may be reduced. After the maximum signal has been found the neutra-

lizing condenser, *Ca*, is trimmed. It will be found that the signal strength will go down with either increased or decreased capacity. However, in one direction the decrease in signal strength will be somewhat more marked, since in addition to detuning the grid coil there is also accompanying a loss of feed-back. Continue trimming in this direction until the point of minimum signal strength is found, all the while advancing the plate voltage to make up for the loss of signal strength. Now retune the grid coil for maximum signal strength which will throw off the neutralizing adjustment. Repeat this cycle several times until there is complete stability in the circuit with the maximum operational plate voltage.

If the point of stability is one-quarter or one-third below the value of desired plate voltage it should be remembered that re-connection of the antenna and the mixer coupling condenser will probably set matters right. This will have a slight deteriorating effect on the noise figure since obviously there is some unnecessary feed-back through the circuit. Sometimes the circuit will need complete neutralization re-adjustment when the antenna is connected. This is due to the reactance in the feedline and it is worthwhile to trim the circuit again with the antenna connected. Adjustments will be fairly broad with the circuit loaded down.

The author claims a noise factor of 4.2 db. with this circuit which sounds pretty good considering its simplicity and the use of a 6J6 tube.



Triode r-f stage suggested by G2MQ.

"Ultra High Frequency Propagation"

This is the title of a new book just released by John Wiley & Sons, Inc. (publishers: 446 Fourth Ave., New York 16, N.Y.) written by Henry R. Reed and Carl M. Russell, ex-W1KKF. As the title indicates, the book deals with propagation, although I personally think that the title is also misleading. The emphasis in the book is on a particular phase of a rather broad subject; ground-to-air and air-to-air propagation. It does not contain any new information on the problems of ground-to-ground propagation which would be of interest to the majority of the v-h-f and u-h-f minded Hams.

The authors report that the book was the outgrowth of their experimental research programs carried on at the U.S. Naval Air Test Center, Patuxent River, Md. It is designed to show the multitude of parameters that must be taken into account when the u.h.f. is used for aircraft and guided missile communication. A portion of the book is a review of the known generalized aspects of the problem. These include meteorological theory, ground reflection behavior, multipath propagation and selection of suitable antennas. The remaining portion of the book is devoted to the idea of making the reader "systems-minded." In this respect the authors have attempted to combine the theoretical approach with practical operational considerations. I think that they have accomplished their purpose quite well and that the book will become a standard text in the field. Any of the readers of this column that have connections in the propagation side of the aircraft industry would do well to keep this volume on hand.

What the Gang is Doing

Jim Lowe, W6COH (Van Nuys) sends in a long interesting letter on the 144-Mc. trials and tribulations of his Mexican call, "XE2XC." Seems that Jim felt he could have crashed into the back end of a U.S. Government Mint easier than getting permission to operate two meters in Mexico. But patience and foresight paid off and Jim finally got his "green eyed monster" (a *Gonset* you-know-what) across the border and made 34 contacts in about three hours.

Permission was granted to operate on the 144-Mc. band in Mexico with 50 watts with the proviso that two log books were kept and one of them turned over to the Mexican R.I. Anyhow, to make this story more interesting, let's quote from Jim's letter.

"After stuffing chewing gum into the co-ax fitting on top of *Gonset* (there was still some discussion as to the legality of XE2XC at that time—*Ed.*) I was permitted to pass through the gates and lo and behold I was officially in XE-land. I managed to steer my mule through the thousands of ultra-modern buildings in Tijuana and after a brief stop at the American Club (strictly for gas) I galloped up Mt. San Antonio to the 5000-foot mark. Signals were coming in clear across the dial and down onto the car seat. My first contact was with K6BE in Muretta. The strongest signal outside of San Diego heard was KN6BXW (send the $5 to my home QTH) and the only CW worked was W6ZL. I hated to leave so early as many stations were still calling me. I'm sure that if they had been using m.c.w. I would have copied them clearly, but their modulation was down in the mud.

"I plan many trips down that way and will try to operate on 144.1 Mc. with both c.w. and m.c.w. (*Gonset* pse note—*XE2XC*). I think I've QSL'ed 100%, although there are three KN6 calls not in the book and I'm holding their cards. HOW ABOUT SOME RETURN ON THOSE CARDS????

"For schedules please write my home QTH. Will also try out a beam if any are suddenly delivered by the mailman."

Dave Middelton, W5CA (Tijeras, N. Mex.) provided an interesting letter with a lot of comments on the possibility of a coast-to-coast v.h.f relay attempt. Dave says that it was talked over at the Houston ARRL convention and that many of the fellows thought that it would be worth trying. He suggests that a series of times be set up on succeeding evenings to have messages started from each coast. The "Two Meters and Down" club in Los Angeles might be willing to take over responsibility for the western end of the circuit. Undoubtedly one of the east coast clubs would be willing to handle that end of the circuit.

(Maybe some of the fellows will recall that a similar idea was attempted before World War II on 2½ and 5 meters. I don't remember how successful it was although it did seem to generate quite a bit of interest. A concerted effort on behalf of the 6 and 2 meter operators might prove useful in establishing not only relay potentialities, but the maximum ranges of the stations involved. The next step in this program seems to be the development of a committee to handle the details in setting it up. I will try to get such a committee rolling within the near future—Dept. Ed.)

Guy Janssen, ON4BZ (Brussels, Belgium) sends along some further information on the 2-meter converter that appeared in our October column (page 44). Guy says that the version I used was due to ON4XB and that it is similar to a design he prepared in 1951. The series coil (L1) in the r-f stage grid lead is quite important and should only be modified when the experimenter has a noise generator at hand. While the coupling arrangement between the r-f stage and the mixer may seem to be rather extravagant, it should be thought of as a "band-pass filter." Proper adjustment of it will insure a minimum of leak-thru on the i-f channel. The crystal in use at ON4BZ is on a frequency of 7.222 Mc. to provide an output of 14.0 Mc. as 144 Mc.; 15.0 Mc. as 145 Mc., etc. Guy claims an absence of birdies in the first two megacycles of the band.

Good DX for 1954!

THE DOUBLE-CON 6

(from page 20)

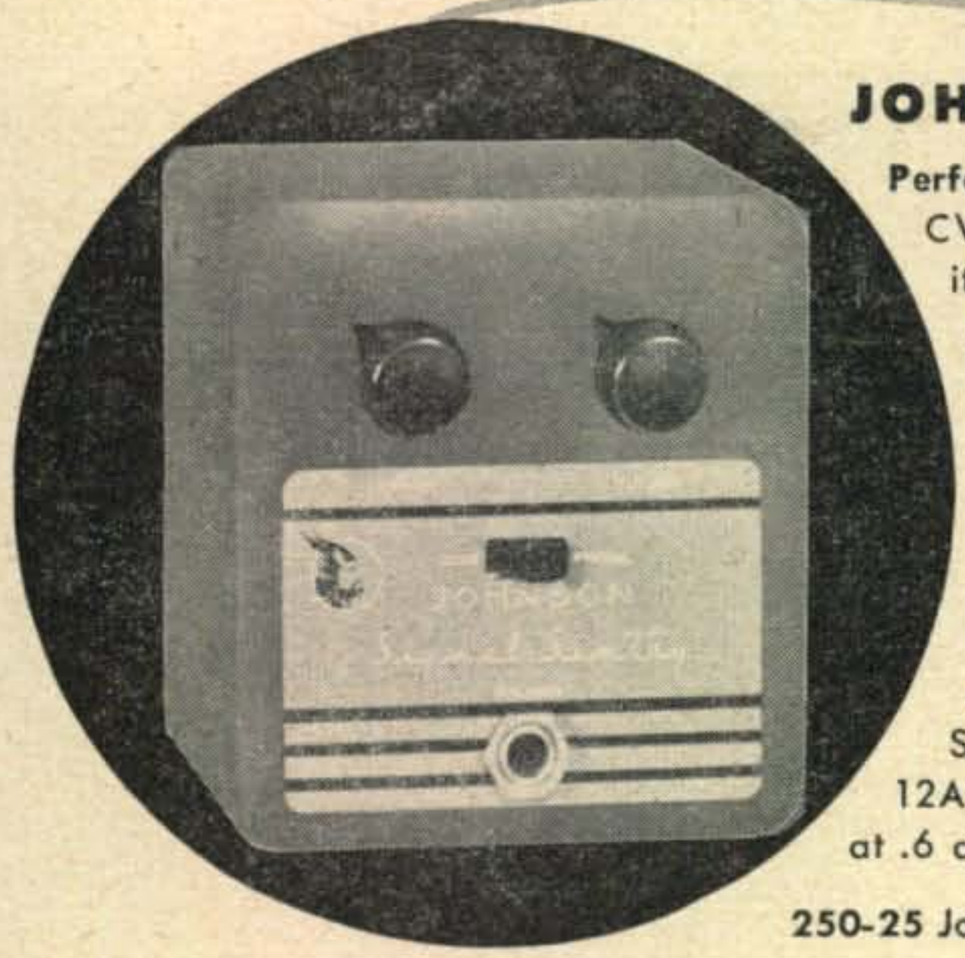
When all the coils were in place and the alignment completed, a check was made with the grid-dip meter to see if any of the unused coils had resonant points in any of the bands in use. Only one point was found. The 10-meter grid coil *(L5)* resonated at about 50 Mc. when it was switched out of the circuit. A small fixed capacity *(C11)* was added across the coil to lower the frequency and prevent any absorption loss in the 6-meter band. It is possible to add a small capacity to this coil because the trimming of the r-f stage is controlled from the panel. This trimmer is switched to all the r-f grid coils and once set for each band requires no further adjustment.

Silver mica or *NPO* ceramic condensers are used for parallel capacity in the oscillator section. The plate and grid capacitors may be ordinary mica or ceramics. The 6U8 tube has the triode oscillator and a pentode mixer in one envelope and it was thought that the stray coupling between the two would be sufficient for oscillator injection—and so it was on the 6 and 10-meter bands, but on the lower frequencies it was necessary to introduce a little more coupling by means of a small capacity gimmick of twisted wires, about ¾ inch in length, between the cathode of the oscillator and the input grid of the mixer.

Dial Calibration

The dial was calibrated by using 1000 and 50 kc. signals for marker points and on the three lowest bands 10-kc. points were inked in by stepping off the space with dividers. Fair accuracy was obtained this way because the tuning is quite linear. The panel was put on the front of the chassis and held in place with the nuts that fasten all the front panel controls. A piece of Lucite sheet was cut to fit over the dial window to dress up the appearance, decals put on to mark the controls and the chassis slid into the cabinet. In order to fit the chassis over the bottom lip on the cabinet, the panel was left extending ⅜ inch below the bottom of the chassis and a mounting leg put on the rear lip of the chassis to fasten it securely in the cabinet.

The performance of the little receiver was a pleasant surprise. It was no trouble at all to separate strong phone signals only 10 kc. apart and there just weren't any images. Weak ten-meter signals barely readable on a commercial receiver of the $150 class were copied with ease on the miniature receiver and the operation on 6 meters was good enough for the dyed in the wool six-meter man. Total cost of parts for this receiver is about seventy-five dollars. A direct comparison of this receiver with some commercial products makes one wonder why receiver construction is a lost art!



JOHNSON SIGNAL SENTRY

Performs 4 major station functions. Check these features: CW monitor, adjustable tone and volume—Phone monitor, checks audio quality, distortion, hum—"On the Air" indicator, triggered by R.F., instantly indicates transmitter failure—"Break-In", automatically mutes receiver audio for break-in operation.

A versatile CW-phone monitor; the Signal Sentry is actuated directly by transmitter RF. Easily installed, it will operate to 50 MC. without tuning; maroon cabinet only 3⅞"x3⅝"x3¾". Easily adapted for code practice oscillator by simple circuit modification. Supplied completely wired and tested. Requires one 12AX7 tube and one 12AU7. Power required: 6.3 volts at .6 amp., 175-300 volts DC at 3 ma.

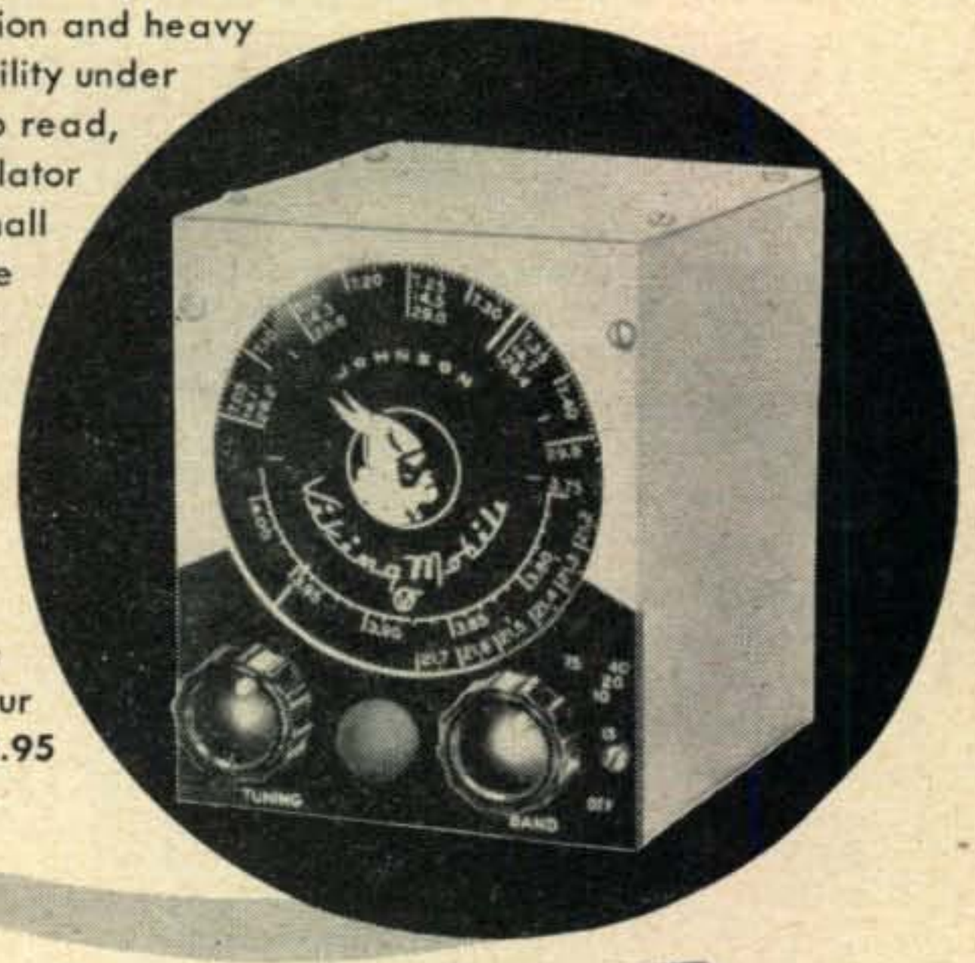
250-25 Johnson Signal Sentry, less tubes. Amateur Net **$14.70**

JOHNSON ANNOUNCES 2 NEW PRODUCTS!

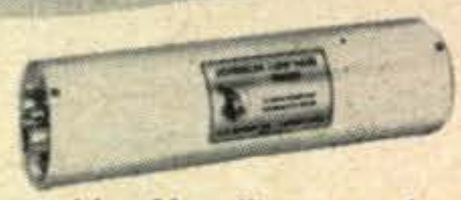
VIKING MOBILE VFO

Quick, easy QSY—more mobile contacts! Now! All the design features for an ideal mobile VFO. Circuit design, rugged construction and heavy aluminum cabinet engineered for maximum frequency stability under road shock and vibration conditions. Featuring an easy to read, edge-lighted dial, this diminutive variable frequency oscillator is accurately calibrated for 75-40-20-15 and 10 meters. Small enough for steering post mounting, the JOHNSON Mobile VFO measures only 4"x4¼"x5". Vernier tuning—7 to 1 ratio, adequate output to drive most transmitters—features a temperature compensated and voltage regulated oscillator. Tube line-up consists of an OA2 voltage regulator, 6BH6 oscillator, 6BH6 isolator/multiplier. Requires 5.7 to 6.9 v. at .45 amp., 250 to 300 v. at 20 ma., unregulated.

No. 240-152 Mobile VFO kit with all parts, hardware; assembly and operating instructions—less tubes. Amateur Net **$29.45. 240-152-2** Assembled wired, less tubes **$44.95**



NEW LOW PRICE **$13.50** AMATEUR NET *LOW PASS RF FILTER*



Consists of four individually shielded sections, capable of handling more than 1000 watts amplitude modulated RF. Provides 75 db harmonic attenuation in the antenna circuit. SO-239 coaxial connectors, assembled and pre-tuned. **Cat. No. 250-20.**

E. F. JOHNSON COMPANY

CAPACITORS • INDUCTORS • SOCKETS • INSULATORS • PLUGS • JACKS • KNOBS • DIALS AND PILOT LIGHTS

220 SECOND AVENUE SOUTHWEST • WASECA, MINNESOTA

NOVICE SHACK

(from page 31)

With a Heathkit transmitter and a Hallicrafters receiver, Tom Arnott, KN2EJE, Munnsville, N.Y., is quite active on the Novice bands.

Long CQ's

If there is one thing that all amateurs agree on, it is the futility and stupidity of calling marathon CQ's. I have never heard anyone say a good word for them, yet, the amateur bands seem full of them. Instead of condemning without a hearing the amateurs who send them, let us try to find out why they do so.

A CQ performs the same function for a radio amateur that the "commercial" does for the sponsor of a television program. The letters, CQ, form a sign "open for business" pointing to his call letters. Naturally, the longer the call, the better the chances are for it to be heard. Unfortunately, continuing the call after it has done its job is bad for two reasons. It oversells the product, and worse, it prevents the customer from placing his order.

It is an axiom of advertising that once a customer is "sold," to close the deal immediately, before he changes his mind. This axiom applies to CQ's. How often have you tuned one in with every intention of answering it, only to tune away or decide to call CQ yourself when the calling station did not stand by within a reasonable length of time? Or if you did decide to stick it out to the bitter end, QRM finally prevented you from calling him after all.

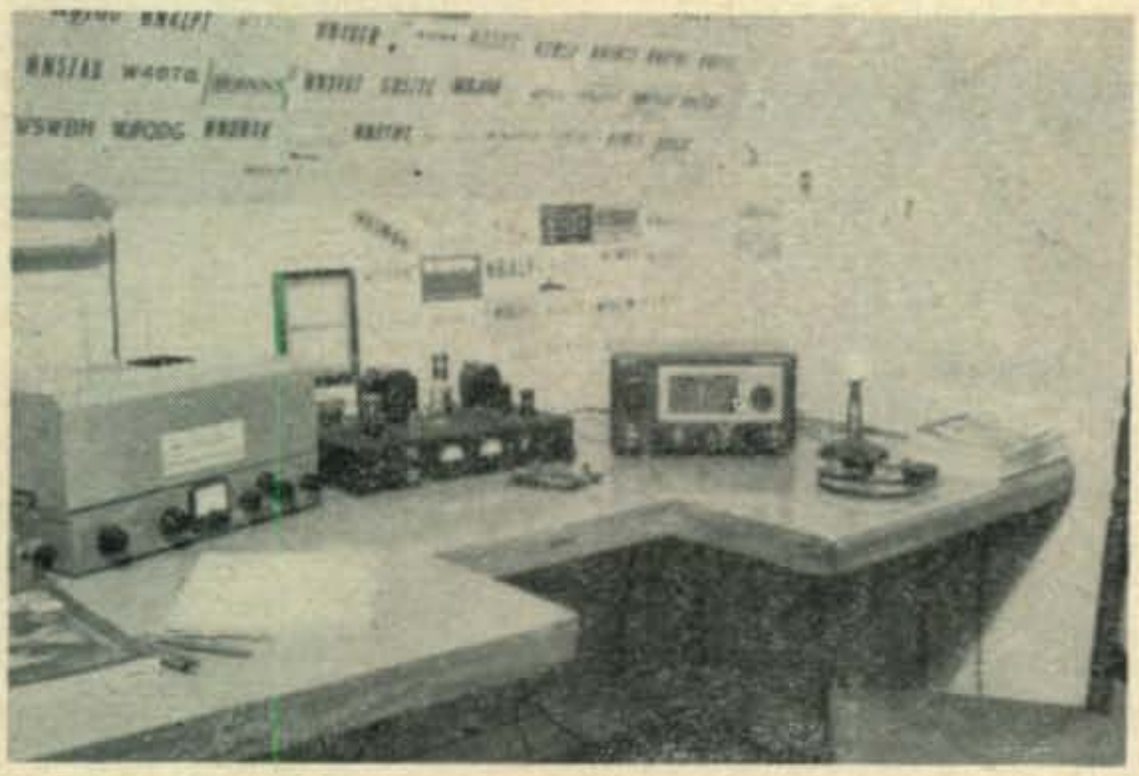
Besides the erroneous belief that long calls must get better results, another reason for long CQ's is psychological. We amateurs got our licenses and built stations in order to *transmit* radio messages. And, by golly, we are going to do it, if not through two-way contacts, we can do it with 10-minute CQ's. They have the advantage that there is no nonsense about having to listen while the other fellow sends before making another transmission.

The Proper Length For A CQ

A 3 x 3 x 3 CQ, that is, the letters CQ sent three times followed by the call sign of the calling station sent three times and the combination repeated three times is the best standard for a CQ. Some amateurs successfully modify this into a 5 x 2 x 3 combination. Stations with better than average signals frequently find that it is only necessary to send the combination once. If one short call does not do the trick, they can always send another one.

(Continued on page 48)

(from page 46)



This is the three-band Novice station of WN3WGC, West Brownsville, Pa. Bob Reese is 16 and has worked forty states and six countries.

While on the subject of CQ's, it is worth reverting momentarily to the subject of poor sending. It is surprising how many stations nullify their effectiveness by sending their call letters so sloppily that they cannot be copied. The reason for this is easy to understand. They are so familiar that they just rattle them off without thought. Probably their written signatures are equally illegible.

This fault should cure itself as soon as the operator stops to think that he is trying to make contacts and is not playing "What's My Name?" If there is any difference between the way one sends normally and the way he sends his own call letters, it should be in favor of the call letters. They should stand out like block letters, although that does not mean that one should cut his normal sending speed in half while sending them.

How Often To Call CQ

Many operators get the idea that it makes them "Big Time Operators" to make most of their contacts by means of CQ's. However, the fellow who answers them is the one who is actually in control. He votes approval or disapproval of the CQ'er by his decision whether or not to answer the call. Of course, whether you make contacts by calling CQ or by answering them is not the least bit important. The cold, hard facts are, however, that the average low-power station gets a greater percentage of replies by calling individual stations than from CQ's. But, if no one called CQ, there would be no one to call; therefore the smart operator mixes up his calls to fit conditions.

How To Make Contacts On a Crowded Band

A good operator also makes the best possible use of the frequencies available to him. The lower frequency Novice bands are overcrowded, especially in the evening hours; however, seldom is an entire band equally crowded. Therefore, a wise operator will provide himself with several crystals spaced across the band, arranged so that he can switch from one to another instantly in his transmitter. He also notes their exact frequencies on his receiver dial.

He then watches these spots closely; so that he can pop into the one with the least interference on it to call a CQ or answer one on or near the frequency without delay.

A choice of frequencies in itself is valuable, but it is the ability to shift from one to another without delay that is most valuable. Practically any transmitter tuned up for the center of a Novice band should not require more than the merest touch up of its tuning for any frequency in the band. An accurate chart of all transmitter adjustments for all available frequencies will eliminate having to go through a complicated tuning procedure each time you shift bands.

A station limited to a single frequency is severely handicapped. When interference is too heavy on it to work through, all that he can do effectively is to wait until the interference thins out. Of course, he can call CQ or other stations repeatedly in spite of the inter-

(Continued on page 52)

1625 TUBE 12 V. 807

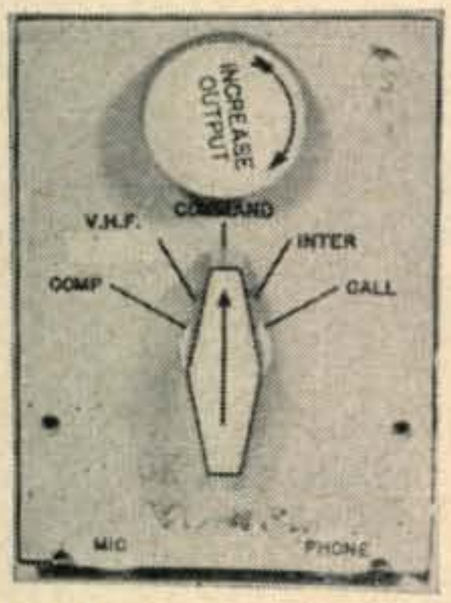
These tubes are 807's with a 12 V. filament making them ideal for new 12 V. car mobile transmitters.

BRAND NEW, Guaranteed ..... **$ .59** ea.

Lots of 10 or more ..... **$ .39** ea.

TERMINAL BOX

Contains 50 screw type terminals with 25 600-ohm 1-watt resistors. Contained in black crackle metal cabinet 17" x 10" x 3" with cover plate. The cabinet alone worth our price for use as chassis.
PRICE..... **$2.25**



BC-366 JACK BOX

Contains 5 pole switch, volume control, phone and mike jack in aluminum case 3¼" x 4⅛" x 2¼".

Lots of 10 or more ..... **29c** ea.

PERISCOPE - - NEW - - $4.50

For your youngsters or industrial use. Tank periscope with reversible ground prismatic lens in heavy steel brown crackle finished case. Size 1¾" x 6½" x 14¾". Cost Government several times this close-out price. BRAND NEW..... **$4.50** ea.

A-200 SIGNAL GENERATOR

A completely wired extremely stable AM signal generator manufactured by Approved Electronics covering broadcast and SW. RF from 100 Kc. to 75 Mc. Internal 440 CPS modulation variable from 0—100%. New RF & AF oscillators of highly stable design. Operates from 110 V. 60 cycles. Dimensions 8" x 10" x 12". Limited quantity.
NEW..... **$29.50**

HS-16 HEADSETS - - - $2.95

Famous hi-Z Air Corps type Trimm headset with pin end cord terminals.
Brand new, moisture-seal packed..... **$2.95** ea.

STANCOR 6 V. 12.5 A. DC SUPPLY - - $22.50 ea.

For auto radio operation direct or battery charging. Filtered DC with overload breaker, voltmeter and voltage step switch.
USED, Guaranteed ..... **$22.50** ea.
NEW, Guaranteed ..... **29.75** ea.

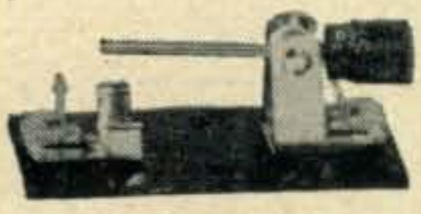
ZB-3 HOMING ADAPTOR (Also ARR-1)

Ideal Converter for Ham use. Dial calibrated 234 to 258 Mc. Uses 4—954 tubes (included). For 12 or 24 V. DC operation. Wgt. 4 lbs., size 3¾" x 3¾" x 11½".
Removed from military aircraft.
PRICE..... **$9.75**

BC-357 MARKER BEACON RECEIVER

Contains sensitive relay actuated by 75 Mc. signal. Use for door opener or other remote radio control. Contains two tubes and other parts. Sensitive plate relay worth price. 24 V. DC operation.

USED BUT GOOD **$2.75** ea.



CRYSTAL DETECTORS

With holder and crystal. Lots of 100 **15c** ea.

Holder only. Lots of 100..... **08c** ea.

AUDIO DISCS - Save 50% or More

Orange 6½"	50 for	**$6.00**
Yellow 8"	25 for	**5.50**
Red Label 8"	25 for	**6.75**
Red Label 12"	10 for	**3.75**
Alum. no label 16"	10 for	**9.75**

0—5 MINUTE TIMER

Industrial timer, Model TD-5M. 115 V. 60 cycle, 1000 watt rating. Both normally open or normally closed contacts. Timer may be set at any timing between 0 and 5 minutes. Resets automatically upon completion of cycle.
PRICE **$4.95**

40 West South Street

ESSE

Indianapolis 4, Indiana

(Continued from page 48)

ference. With a strong enough signal, he may be able to blast his way through, but the more crowded a band, the greater the tendency to call stations very close to their own frequency. As a result, he will undoubtedly have great difficulty in copying any stations he might raise. But it is his business, if he likes to do things the hard way.

Letters And General News

W8KBT leads off this month with a question. "Dear Herb, Would you please give me the dimensions for using the 21-Mc. antenna you described in the **Novice Shack** for September, 1953, on the 14-Mc. band? I built one for 21 Mc. in my attic and worked the Hawaiian Islands and many other countries."

This is typical of many other letters requesting more information on the antenna. It is a "flat-top" beam consisting of two folded dipoles spaced one-eighth wave apart and fed 180 degrees out of phase through one-quarter wave matching transformers. It is constructed entirely out of 300-ohm TV ribbon, chosen because of its universal availability. Design formulae are:

Length of dipoles: $L_{ft} = 468/F_{Mc}$

Spacing between dipoles: $S_{ft} = 123/F_{Mc}$

Length of matching transformers: $L_{ft} = 246/F_{Mc} \times 0.82$.

The figure 0.82 in the last formula is the correction factor to compensate for the use of the 300-ohm ribbon.

Bob Foxworth, **KN2EUH**, 69 Elm St., Summit, N. J., writes, "Dear Herb, I am on mornings only (TVI) with a new 35-watt rig (7185 kc.). Antenna is a ½-wave doublet just like your diagram in November **CQ**. My two gripes are that there is no one in radio around here my age (11), and too many fellows call CQ 1000 times, send their call once and turn off! I would like a pen pal about eleven or twelve to write to."

John, **WN4BBB**, says, "Dear Herb, I am fourteen years old and have had my Novice license for 2½ months and my Technician license for a month. I run eleven watts input and use a T2FD antenna, which I read about in **CQ**. It is a fine antenna. I have worked sixteen states and have received QSL cards from eleven of them. I have had a lot of help from W4UWC and W4ZBY here in Knoxville."

It appears that we have John, **OH2YV**, Helsinki, Finland, yelling "uncle." "Dear Herb, Thank you for the forty-four United States and two Canadian pen pals you got me by printing my letter in the **Novice Shack** for June, 1953. Because of my limited time, I find it impossible to write to so many. That's why I have decided to part with some of these letter pals. It is rather rudely done, but I hope those who do not hear from me any more will understand my reasons. I have not been on the air since September when school started again, but I will be on again in the spring with my new TX and RX (transmitter and receiver) and will be looking especially for W Novices on those bands which are also open for OH amateurs.

"In this connection, I would like to emphasize that high power is not necessary to work DX. A good antenna and a good RX are more important. Remember that in Europe most countries have a fifty to 150 watt power limit, and we have some pretty good DX sharks over here. Once again, I am sorry that I shall not be able to answer more letters, but I shall be eager for OH-WN QSO's as soon as possible."

Nick, **WN4APN**, writes, "Dear Herb, It seems that as soon as most fellows get their tickets, they start knocking off QSO's in thirty-eight states or more with a little 6L6 oscillator. While me—in 3½ months I have worked one state and darn little of that—only forty-seven more to go! I have a 6L6 transmitter and also one using 6AG7/807 at forty watts input. I have three crystals and have tried several different antennas and checking with light bulbs indicate that I am getting power into the antenna. The few contacts I have made in the daytime have been 100 per cent with reports of RST 579X and RST 589X, but they are so few! I know only one Ham, but he lives in Kentucky. He has been swell, but it isn't like having one nearby. I wonder if some one can give me a hint of what may be wrong. If not, I may drop the whole thing in Tampa Bay and jump in after it. 73"—Nick Bowrisk, WN4APN, 10200 Snug Harbor Road, St. Petersburg, Fla.

From Dick, **WN1YXT**, "Dear Herb, I was backtracking in **CQ** and was surprised at the number of letters you have received from Hams griping about their chances of using their Novice licenses, because they are away from

(Continued on page 54)

LEO I. MEYERSON
WØGFQ

Pay only 10% Down!
18 months to pay on Major Equipment

Now it's easier than ever to buy from WRL where you get easy down payments, generous trade-ins, and personalized service from "The World's Most Personalized Radio Supply House," and "The World's Largest Distributor of Amateur Radio Transmitting Equipment." Send for our big list of over 600 reconditioned used items — all carrying new factory guarantee.

LEO GIVES BEST DEAL ON . . . National NC RECEIVERS

NC-183 D RECEIVER

Dual conversion on the three highest ranges plus every feature you want in a truly modern receiver!

(Less Speaker). $383.50

$38.35 cash down

$30.49 per month 12 months

$20.90 per month 18 months

HRO-60 RECEIVER
with AUTOMATIC DUAL CONVERSION

Less speaker.. $533.50

$53.35 cash down

$42.42 per month—12 months

$29.08 per month—18 months

Now Available . . . NEW NC-88

only $129.95 with Built-in Speaker

$13.00 cash down

$10.33 per mo.—12 mo.

A top-notch value for both the novice and experienced amateur! Compare these features: Calibrated bandspread for 80, 40, 20, 15, and 10 meter bands. Advanced A.C. superhet circuit uses 8 high gain miniature tubes plus rectifier. Covers 540 kcs. to 40 mcs. in 4 bands. Tuned R.F. stage — two I.F. stages — two high-fidelity audio stages with phono input and 2-position tone control. Built-in speaker. Antenna trimmer — separate high frequency oscillator. R.F. gain control. Series valve noise limiter. Delayed A.V.C. Headphone jack. And, send-receive switch.

JUST OFF THE PRESS!

NATIONAL RECEIVERS AND ACCESSORIES

MODEL	CASH DOWN	CASH PRICE
NC-125 RECEIVER	$20.00	$199.95
SW54 RECEIVER	6.00	59.95
SELECT-O-JET	2.88	28.75
NFM-83-50 ADAPTER	1.80	17.95
SPEAKER (for HRO-60 or NC-183D)	1.60	16.00

FREE 1954 WRL CATALOG SEND TODAY

WRITE FOR DETAILED SPECIFICATION EQUIPMENT SHEETS

WRITE WIRE PHONE 2-0277

World Radio LABORATORIES — EVERYTHING IN RADIO — COUNCIL BLUFFS, IOWA

World Radio Laboratories C-1
744 West Broadway
Council Bluffs, Iowa

Please send me:
- ☐ New Log Book (25¢)
- ☐ Free Catalog
- ☐ Radio Map (25¢)
- ☐ NC-88 Info
- ☐ NC-183 D Info
- ☐ HRO-60 Info
- ☐ NC-125 Info
- ☐ Used Equipment List

Name_____

Address_____

City_____ State_____

(from page 52)

home. Well, this is another griping letter. I received my call, WN1YXT, five months ago. In that time I have been able to get on the air only a few times. The reason is I am in the U.S. Navy. My station is a 6L6 running twenty-five watts, an indoor, thirty-foot antenna and a **Hammarlund HQ-140X.** Some day, I may get started. I would like to hear from some Hams telling me about their stations. I will gladly answer each one. My home QTH is North Grovensnordale, Conn. 73"—Dick Martel, RM3 (WN1YXT), O-R Division, USS Wright CVL-49, c/o F.P.O., New York, N. Y.

Dick, **W8MJN,** writes, "Dear Herb, It took me three weeks after graduating from the Novice ranks to complete my WAS. As a Novice, I worked forty states with fifty watts input. Now I have a **BC-459,** running 100 watts. I have also worked Mexico, New Zealand, Argentina, and Labrador. Antenna is a folded dipole, thirty-five feet high, and the receiver is an **HQ-129X.**"

These W8's get out! From Harold, **WN8MTI,** "Dear Herb, My rig is a "JunkBox Jewel," from November, 1952, **CQ,** and the receiver is an **NC-173.** I have worked

Lament

I studied hard, I learned the code
I dressed up in my best;
And over hill and dale I rode
To take the Novice Test.

With patience and with happy plans
I waited for my ticket.
It finally came when I began
The Postman's route to picket.

The rig was built. Antenna strung.
My key I plugged in tight.
At long last I could gab with those
I'd listened to all night.

Alas! That was two months ago,
Perhaps you've heard me calling?
To North? To South? This tale of woe
Has set my ego falling.

Ten pages in my log I've filled
With calls to West and East.
I find my ardor's growing chilled
I think all Hams are beasts.

For no one ever answers me
No matter how I try.
The other eager Novices
Can talk, but I'm passed by.

I read with growing envy of
These Novices who write
They threw a switch and started out
And logged calls day and night.

I shall not stop, I shall go on,
And one day when my call
Comes back to me in some dim dawn
I won't know it at all.

Louise Moreau, WN3WRE
81 Dupont St.
Johnstown, Pennsylvania

several W/WN6's and W/WN7's on 3.7 and 7.2 Mc., and have heard a number of them on 21 Mc., but I do not have my 21-Mc. rig finished yet. When are we going to have another **Special Novice Issue** of **CQ?**"

Tom, **WN4BPO,** writes, "Dear Herb, I have had my ticket about a month and a half and sure am having fun. I run about fifty-five watts to a **TR-75TV** transmitter and use an **NC-125** receiver. At first, I was on 3.7 Mc., but now I am on 7.2 Mc. I *wouldn't* trade one 7.2-Mc. band for ten of the other one! My chief beef is that every day at 6:00 p.m., sharp, the British Broadcasting Company opens up right on my frequency! I would be most happy to help as much as I can some

(Continued on page 56)

(from page 54)

boy or girl to get a Novice license. I am going on sixteen years old. 73"—Tom Connell, Jr., WN4BPO, Rt. 1, Box 28, Valdosta, Georgia.

Another offer of help comes from the South Philadelphia Amateur Radio Klub (SPARK), via Ray Gianchetti, W3QLZ, Secretary. He writes, "Dear Herb, Our club, The South Philadelphia Radio Klub, holds code and theory classes every Tuesday night for the benefit of those desiring to become amateurs. We have gotten many a fellow a ticket. Anybody interested is welcome to join the classes. Just come to Childs School, 17th and Tasker Sts., Philadelphia, Pennsylvania, any Tuesday night."

Help! Help!

The first name of those requesting help in obtaining an amateur license is: Mr. Fred "Zeke" Bird. 869 W. Riverside Drive, Pomona, Calif. Zeke is a youngster of sixty-five, who is working with a group of five teen-age boys in Pomona. They and their teacher would appreciate any help they receive. "Zeke" is out for his Novice license, too.

Edward P. Morton (36), 6257 Livingston Road, S. E., Washington 21, D. C.

Reed Starnes, 40 Blue Ridge Ave., Asheville, N. C.

Jules Beaudoin (17), 38 Bacon, Biddeford, Me., Tel. 4-7065.

Pete McDonald (13), 1400 Grove St., Alameda, Calif. Tel. La 2-0857.

Joe Leech (15), 22 S. High St., Waterford, Pa.

Ned, **W1RAN**, is another old timer who has discovered the Novice bands and how appreciative most Novices are to receive constructive help. His letter is much too long to quote entirely, but excerpts from it make interesting reading. He writes: "Dear Herb: Being a chaser of the more-elusive CW DX, I hadn't paid too much attention to the activity in the Novice bands, but recently I have been spending some time in working WN/KN5, 6, and 7, mostly on 7.2 Mc. It was quite a surprise to learn that I was the first W1 for about ninety-four per cent of them! I could see them missing Connecticut, but W1???!

"Well, I set out to work every Novice I could who might need a Connecticut QSL card. As I worked them, I noted on the back of their card any tedious, redundant or irksome operating habits they had that might reduce their chances of making more contacts. Several of them have written follow-up letters thanking me for my help. On the few week-ends I get home to Connecticut, I shall be pleased to schedule Novices who need Connecticut for WAS. 73"—Ned, W1RAN, Theta Chi Fraternity of Worcester Polytech. Inst., 85 Salisbury St., Worcester 2, Mass.

Brad, **WN6TJI**, writes, "Dear Herb, I have nothing like WAS or WAC on 21 Mc., but I feel I have done pretty well, working thirty states and nine countries on the band. My transmitter is a **TBS-50C**, running forty-five watts input to a ground-plane vertical antenna, which I think is second in effectiveness only to a beam. My receiver is an **NC-125**. On 7.2 Mc., I have worked thirty states and four countries, including Guam and Hawaii that I had not worked on 21 Mc."

Elvis, **WN5ZNQ**, gets the honor of winding up this month's column. He writes, "Dear Herb: I am a Novice of about five months' standing, and I really enjoy being one. I do not have as much time to devote to Ham radio, but I have twenty-two states confirmed. I have a **TBS-50** transmitter and an **NC-57B** receiver. The antenna is a T2FD out of CQ. It sure is a fine antenna, and I get out well on both 3.7 and 7.2 Mc. I am thirty-five years old, and I do not run into many Novices my age. I plan to take my General Class examination after Christmas. I hope I pass, hi."

Some sections of the country are not as well represented in the *Novice Shack* as they should be. If yours is one of them, why not break the ice by writing me a note or sending me a picture of your station?

Happy New Year. 73, Herb, W9EGQ

SUPPORT THE RED CROSS

COMMENTARIES

(from page 32)

varieties of the RG-8/U cable have relatively "soft" center insulation which may adhere to the shield. It is a good idea to check the RG-8/U cable before buying.

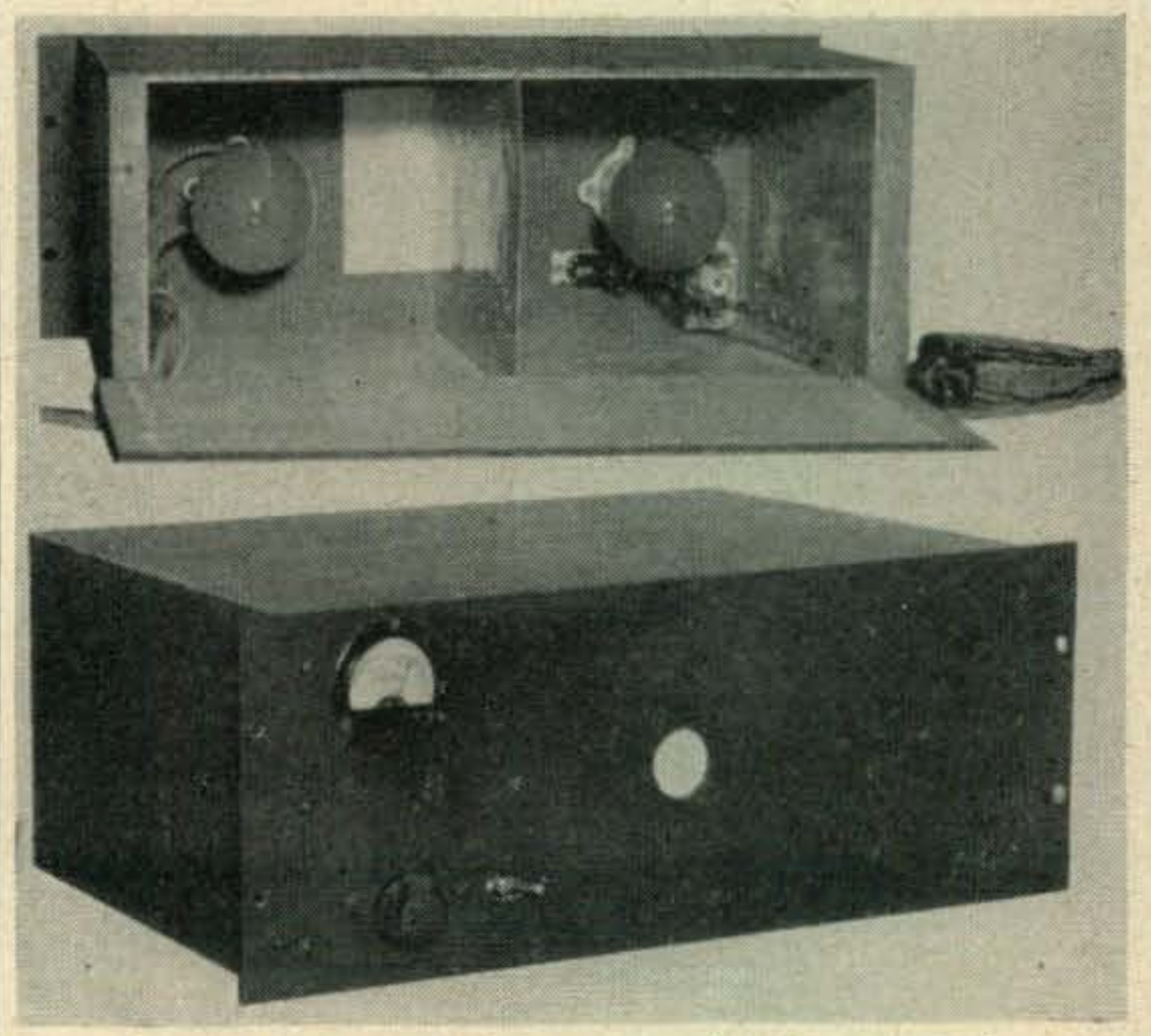
Supporting the Co-ax

The problem of supporting this type of radiator is left to the constructor with a few thoughts that may be of some help. We started at the ground end with a discarded 24-foot power or telephone pole. A 2 x 4 was attached to the top and then a 2 x 2 attached to that making the over-all height of the tip of the antenna some 42 feet above ground level. It was not guyed and has managed to stand up fairly well, although only 4 feet of the power pole was buried.

J. F. Bollinger, W5LZJ

A Photometer R-F Wattmeter

Measuring accurately the power output of an amateur transmitter is something of a problem with instruments normally available. The r-f wattmeter described here permits this to be done easily. It is a form of an optical photometer,



R-F wattmeter. Top picture: back removed to show placement of parts. The white square in the center of the panel is white bond paper, glued over the viewing hole. Bottom: Front view, showing wattmeter in operation. See text for details.

and its operation is based upon the fact that the light output of incandescent electrical lamps is independent of the frequency of the current feeding them.*

(Continued on page 60)

* Substantially true for frequencies to around 30 Mc. At higher frequencies, circuit losses and resonant effects reduce the validity of this assumption.

(from page 58)

The pictures show the practical application of the idea. A light-tight box is divided in the exact center with a thin metal partition, which bisects a 1-¼-inch diameter hole cut in the front of the box, covered with a piece of white, bond paper. Two similar lamps, with a power rating slightly greater than the expected output of the transmitter, are screwed into sockets mounted on the inside of the front panel centered in each compartment.

One lamp is connected to the power line through a variable resistor and has a 150-volt, a-c voltmeter connected across it. The other is connected to the output circuit of the transmitter, with coupling adjusted for the desired power input.

Each lamp illuminates one-half of the paper disc, and the brightness of the lamp connected to the power line is varied by adjustment of

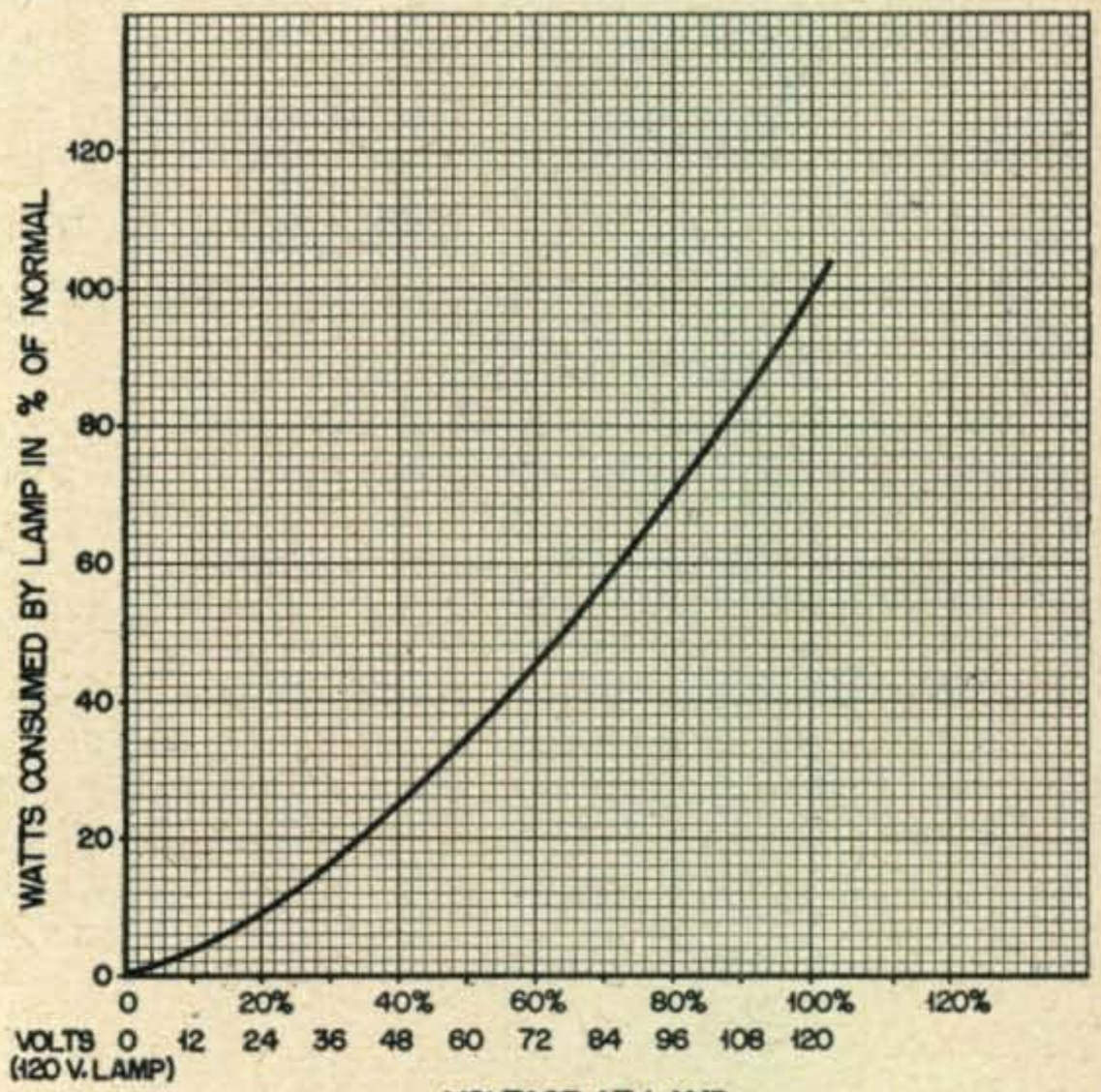


Fig. 1. Curve for converting voltage across Mazda lamps to their power consumption, both in percentage of normal.

the variable resistor, until the disc appears to be illuminated from a single light source. The illusion is very sharply defined.

At this point, the reading of the voltmeter is noted and *Fig. 1* consulted. It shows the percentage of its rated power consumed by the lamp at this voltage. This is the power output of the transmitter.

An example should eliminate any possible confusion. Assume that 100-watt, 120-volt lamps are used and that the meter reads 94 volts at the balance point. Ninety-four volts is 78.2 per cent of 120 volts. From the chart we see that a lamp with 78.2 per cent of its rated voltage applied consumes 67.5 per cent of its rated power; consequently, the transmitter output is 67.5

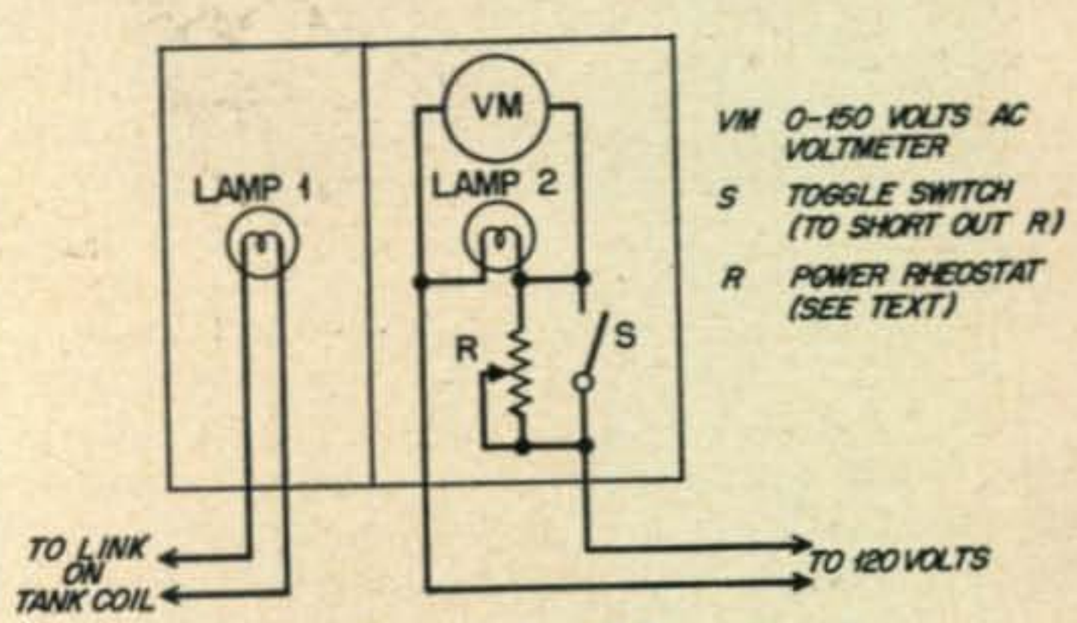
(Continued on page 62)

(from page 60)

watts. If 300-watt bulbs were used, the indicated power output would be 67.5 per cent of 300 watts, or 202.5 watts.

Figure 1 was prepared from data furnished by the *Lamp Division* of *The Westinghouse Manufacturing Company* for type C, Mazda lamps. The voltage axis (abcissa) is calibrated both in percentage and the voltage corresponding to that percentage when 120-volt lamps are used. A new set of values may easily be prepared for use with bulbs of other voltages.

Although the curve in *Fig. 1* is plotted down to zero, operating the lamps at less than half



Schematic of the R-F wattmeter.

voltage reduces the light output too much to be of much value in this application. Greatest accuracy is obtained with lamps operated near their rated voltages.

Building The Wattmeter

I designed my wattmeter to be mounted permanently in the transmitter; therefore the front panel is 19" x 7", and the box itself is 17" x 12" x 6¾". Material is masonite, except the end pieces, which are white pine. Assembly is made with nails, except for the back where screws are used so that it may be removed.

Dimensions are not critical, but the box must be light tight. Both halves are symmetrical and the metal partition bisects the paper indicating disc. The meter and variable resistor are mounted away from the center hole, in order not to affect the accuracy of the unit. The lamp sockets are mounted on the front panel in the exact center of each compartment. I painted the inside of the box gray, using a "flat" paint to insure equal light reflection without hot spots. The outside was painted black to harmonize with the rest of the transmitter.

Choosing the proper size of variable resistor requires some thought. It must be capable of carrying the rated current of the lamp used, which varies from about one ampere for a 100-watt lamp to slightly less than three amperes for a 300-watt lamp. Its maximum resistance should be at least equal to the "normal" resistance of the lamp—around 150 ohms for a 100 watter; fifty ohms for a 300 watter.

As large quantities of heat are generated by this device, it is not advisable to operate it continuously for long periods of time.

TEST EQUIPMENT

(from page 27)

to the power line frequency or its lower harmonics, unless care is taken when routing the a-c line and filament leads. For this reason all leads carrying 60 cycles current should be kept as far as possible from the RC tuning components in the grid of the 6SJ7.

One phase which has been omitted in this discussion is the calibration and use of such generators in measurement of frequency. This is something we hope to cover in a future issue.

Many volumes have been written on the subject of audio, and a few hundred words cannot touch even the important points. However, we hope that we have added another piece of test equipment to the amateur's shelf . . . even if it is used for nothing more than a supersonic weapon on the neighbor's dog that spends his spare time in the XYL's flower bed.

Yes, it works!

YL's FREQUENCY

(from page 30)

ragchewing, etc. The kids had a grand time, and so did we! We didn't get in on any scheduled YL nets, but when Dot called W8HWX, Lillian, on 40 phone, we were soon joined by W8HLF, 9LOY, 3MAX, 4SGD, 8SPU, 9YBC and 8HUX. Later we worked W2BNC on 75. Thanks again for everything, Dot and Carl—we'll always remember this visit!

About as soon as we get this off the mill we'll be heading back for New Mexico, with only a stop-off at South Bend to see W9IOP and his family and W9JTX, Louise. Sorry we didn't get to see more of you YLs along the way—next time we'll stay longer and make plans ahead of time.

Conventions

Though both the Eastern Canada Conventions and the New York State ARRL Conventions were held in September, news of them was crowded out of the last column by all the California activities. The New York State affair, held at Buffalo, brought together these licensed YLs: W2CJA, Joan; KN2CUQ, Evelyn; KN2CUZ, Mary Louise; W2JZX, Vi; W2IJR, Isabel; KN2EPW, Dorothy; W2BTB, Jeanne; KN2EPV, Lila; W2SCI, Lucille; W2ZRO, Mary; W1QON, Eleanor, and VE3AJR, Del.

At registration each YL or XYL received a hand-painted handkerchief, done by Jeanne, who was in charge of the YL and XYL activities. They then had to fill in the last line of a cute limerick to win a prize. At noon there was a YL luncheon. Each YL present introduced herself and games were played for prizes. At the convention dinner W2BTB, Jeanne, was presented with a gift from the Board of Directors of the TCPN, a sterling silver plaque for her work on the Transcontinental Phone Net. Hudson

(Continued on page 66)

(from page 64)

Division Director Cooke announced the nomination of Jeanne for the Edison Award.

Nine licensed YLs attended the Eastern Canada Convention held at Montreal: VE2RK, Therese; AOB, Stella; CA, Phyllis; NJ, Nancy, W1ZCS, Marie; K2DRY, Emily; K2CBS, Ida; VE2AKK, Betty, and VE2HI, Ethel. The evening before the convention almost everyone took a trip with guides through CBFT television studios and returned to the hotel for coffee, cake and ragchews. Saturday a.m. W1ZCS, Marie, operated the hidden transmitter for the transmitter hunt. Marie is W1BUD's secretary and VE2HI, Ethel, who sent news of the convention, tells us she's very cute and that the OMs were most anxious to find the transmitter! Other YLs met at Ogilvy's where they were welcomed by hostesses and served coffee and taken to the most interesting departments in the store. They were shown antiques, furs (they tried on mink coats, etc.), English bone china, woolens and other things and then twenty-two YLs and XYLs had lunch together. At the evening banquet VE2NJ, Nancy, drew a Hallicrafters receiver.

VE2HI

For many years secretary of the Montreal Amateur Radio Club, which sponsored the Eastern Canada Convention, VE2HI, Ethel Pick, was chairman of the ladies' activities for the convention. Ethel is quite a conventioneer—she gets to every convention within driving or flying distance. Her particular interest in Ham radio is ragchewing and though endorsed for phone she says she enjoys CW perhaps better. Licensed before World War II, VE2HI also has managed a bit of DX. For her station set-up VE2HI uses a National 101X receiver and a pair of 812s in the final.

Apart from Ham radio, Ethel has taught school (the sixth grade) for many years. She and her sister (who teaches in high school) keep house for their mother, who is over 80. For hobbies other than Ham radio, she bowls (once a week) and also belongs to a bridge club and book club. Last winter she joined a wood-working group and learned a bit about the use of power tools. Ethel owns a summer cottage in the Laurentian mountains, where she likes to swim and show her numerous nephews and nieces a few points in the handling of a canoe. She also likes to go off for trips in her wee car (an Austin with license plate VE2HI). A year ago she drove to Virginia Beach by way of Washington and returned by way of the Skyline Drive. Each year she manages a couple of weeks at Kennebunk Beach, Me., and she and her sister take turns making week-end trips. In her "spare" time Ethel also does quite a bit of knitting.

In closing Ethel says, "Sorry I can't be exciting or glamorous, but am just an old maid school-marm who manages to have not too dull a time." Hi! Many could wish for as much!

Here and There

W7HHH, Bea, has received her "YL Century Certificate" with endorsement for 50 extra. Says she'll soon have another 50 YL cards . . . **W7SBX**, Helen, has been elected president of her radio club. **W7SBW**, Pauline, is secretary, and **W7UFN**, Gertie is treasurer, Gertie's OM, W7SBU, is vice president. Gertie says, "Don't know how Roy got in there; he must have been talking in a falsetto." Hi! (It isn't a YL club.) . . . Congratulations to these YLs: **KL7BAP**, ex-W7KSQ, Phyllis, has a baby daughter, born Oct. 14th in Anchorage. **W7HER**, Marjorie, has a new son. His grandmother is W7FXE, Lucille. **WØCXC**, Mary Jo, is very happy over a jr. YL born on Nov. 6th.

And congratulations to all the recently licensed YLs at ARRL Hq. Seems Ellen, **W1YYM**, Assistant Communications Manager, Phone, has been quite a spark to the gals. With her encouragement they have held noon-hour code and theory classes and now they carry on an assembly line in the lab during noon hour and on Saturdays building transmitter kits. The line-up: **WN1ZCR**, Phyllis; **W1ZCS**, Marie; **WN1ZIB**, Ann; **WN1ZID**, Anne; **WN1ZIK**, Jeannine; **WN1ZIM**, Miriam, and **WN1ZJE**, Lillian.

33 till next month—W5RZJ

Sneaking a Look at the Future

CQ RADIO AMATEURS' JOURNAL

Because of the absence of suitable published conversion information, the next issue of CQ will feature a "Command Set Roundup." This will be our final-final story on the conversion of the ARC-5/SCR-274N receivers and transmitters. It has been especially written to combine under one heading all of the best ideas on "Command Sets" that have appeared in print (over 40 references to articles in CQ and our contemporaries). You won't want to miss this issue and the chance to keep it in your files.

If you're thinking of higher power, then it is time to consider the screen supply problems of the new tetrodes and pentodes. This particular subject is discussed in detail with an analysis of the advantages and disadvantages of various types of power supplies. A foolproof inter-locking supply for both bias and the screens is developed.

Interested in the "Class K" modulator we recently featured? Well, there is a new version coming up that will modulate a full gallon using only a minimum of components. Also material on antennas, mobile, v.h.f., plus all the regulars. Don't skip a single issue—Subscribe TODAY!

One year: $3.00 Two years: $5.00 Three years: $7:00

Buy a Ticket to Year 'Round Pleasure

CQ MAGAZINE
67 West 44th St., New York 36, N. Y.

to be sent to: ☐ *New* ☐ *Renewal*

Enclosed find $_____ for a _____ year subscription

Name _____ *Call* _____

Address _____

City _____ *Zone* _____ *State* _____

PROPAGATION

(from page 29)

lished in cooperation with the many organizations of government and industry vitally concerned with communication and radio propagation problems.

The Central Radio Propagation Laboratory receives and analyzes data from approximately 60 stations located throughout the world, including 13 located within the United States. These 13 domestic stations and 8 of the overseas ones are operated either directly or under contract by the National Bureau of Standards. Each of these stations are equipped with special electronic devices which have been developed for probing the ionosphere. From pulses transmitted and received by these ionospheric recorders, it is possible to deduce at frequent intervals over the 24 hour period of the day (usually at least hourly) some basic characteristics of the ionosphere such as virtual height and critical frequencies. This basic data permits predictions to be made up to six months in advance. These predictions are disseminated to the armed forces, commercial users, scientists, laboratories and Amateurs by publication (3 months in advance) in the CRPL-D series. This series, entitled "Basic Radio Propagation Predictions," is issued monthly as an aid in the determination of the best skywave frequencies over any path at any time of day for average conditions for the month of prediction. Charts of E, F2 and Sporadic E layer critical frequencies, of maximum usable frequency for a transmission distance of 4,000 km., and percentage of time occurrence for transmission by Sporadic E in excess of 15 Mc. for a distance of 2,000 km., are included.

Beginning with the December, 1949 issue the CRPL-D series is available on a purchase basis from the Superintendent of Documents, United States Government Printing Office, Washington 25, D.C., on the following terms:

Single Copy—10 cents.
Annual subscription (12 issues) $1.00.
(To Foreign Countries not extending franking privileges, $1.25.)

The activities of the CRPL also include the theoretical and experimental studies of maximum usable frequencies, ionospheric absorption, long-time variations of radio propagation characteristics, the effects of the sun on radio propagation, and the relation between radio disturbance and geomagnetic variation. In the microwave field, the Laboratory is investigating the relation between radio propagation and weather phenomena, as well as methods by which predictions can be made and radio communications improved in this portion of the radio-frequency spectrum. A good deal of this research is summarized in the numerous technical reports issued by CRPL. If you have any inquiries relating to the activities of the CRPL write directly to the National Bureau of Standards, Central Radio Propagation Laboratory, Washington 25, D. C., for further information.

Due to a type setting error, an important paragraph was omitted in November's discussion of "One Way Skip." The first paragraph on the continuation of the article on page 60 should have been as follows:

. . . may exist at each end of a circuit, usually accounts for one way skip" conditions.

"One Way Skip," especially during ionospheric disturbances, can also occasionally be caused by **scattering** from the layers of the ionosphere. Reflection from the ionosphere is not altogether like a reflection from a perfectly smooth surface since the layers of the ionosphere are subject to some amount of turbulance which increases considerably during disturbances. This turbulance can produce areas of rough irregularities. These irregularities cause the horizontal surfaces of the ionosphere to tilt.

DX AND OVERSEAS NEWS

(from page 23)

is up to 104 CW/Phone . . . **TI2RC** cracked the century mark and stands at 101, 99 on A3 . . . **VQ4RF** is also over the barrier at 104, A3 . . . **TI2TG** is within smelling distance with 99 on CW/Phone. Some of the latest were KX6BF, KR6LJ, DU7SV, KL7PI, ZB2I and PZ1AL . . . **FA8CR** nabbed LU3ZS . . . **G5BZ** upped to 81 while Fred, **W4KRR,** hit 82 with YN1AA, HR1AA, KX6BF, W5QDF/KG6, HC1JW, ET2US, SP3AN, ZD2ACS, ZD4AB and VS1DF . . . Al, **W2WZ,** reached 68 with KX6BF and ZB2I while W1RY rests on 64 . . . Carl, **W1BFT,** is up to 55 but is very QRL with biz . . . **W2LYO** grabbed ZE3JO, 4X4BX, ZB1BU, ZS2IO, EA9AP and FA8IH . . . Ev, **KP4KD,** accounted for 20 zones and 44 countries during the contest and stands at 78 with CP5EK,

SP3AN, YO3RD, IS1FIC, KL7PI, OK1HI, VP4LZ, ET2US and KX6BF . . . **PY2JU** goes to 65, A3 only, with YI3WH, VP8AJ, CR4AP, YN1AA, SM5TF, HC1FS, CR6AB, OQØDZ and KP4WI . . . **W2MNN** took a crack at the band and came up with such as VP9BG, PY6DK, LU3ZO and 4X4AC . . . **W6ZZ** completed his phone WAS which may be No. 1. Miles also boosted his total to 59, CW/A3, with VQ2AB, KR6LJ, CR6BF, CX5AF, PAØALO, KX6BH, FO8AD, KJ6FAA, DU7SV and ZS9G . . . **W1BUX** hooked AP2K, KJ6FAA, KX6BF and FO8AD . . . So-o-o-o- there they are, go get 'em.

Here and There

The yacht "Mollihawk" left Gloucester Nov. 1 for Bermuda and Antigua. **VP2AJ** was aboard with rig. The yacht "Yankee" left the same day on another world cruise. It is not known if any Ham operation will take place . . . **VP4LZ** is ex-W6IWZ . . . A Russian contest was heard on Oct. 24 with such morsels as UA9KWS, UB5KAA, UL7KAA, UO5KAA and UG6KAA coming through . . . **W4BQY**, ex-KG4AF/W6EHV, is going strong on his DXCC No. 4 . . . **W9NH**, on 7 Mc., nabbed KV4AA for 1st QSO with new vertical and "Viking" . . . **W2QHH** rec'd a number of LZ1DX/ZA QSL's which he promptly forwarded . . . **VK3AAW** is ex-VK4TU/VK5CN . . . Via W3AS here's a reminder of a change in U.S.A. first class foreign postal rates as of Nov. 1, Canada and Mexico excepted. Cards, four cents and letters eight cents for the first ounce and four cents each additional ounce . . . With help from LZ, W8PQQ rec'd a card from **UA1KEC**, contacted in 1949! . . . **W2COH** and XYL dropped in on KV4AA . . . Via KZ5EM and W3PDJ we regret to report the death of **W3PSH**, on Sept. 25, in a private plane crash . . . Heard in VK were **FI8AE, FI8AR** and **FI8AZ**. The last mentioned was also heard by W6QL at 0300 GMT, 015 . . . **W4EPA** still seeks Zones 22, 23 and 26.

A "DX Log of Awards" with check lists may be obtained from **W4RKJ** for the sum of one dollar. Several months work went into this project and it is a handy addition for any station. QTH: 19 Highland Road, Easley, S.C. . . . Frank, **W4LZF**, will spend six months in New Hampshire working on new cable plant . . . W8PQK is now **W4CKD** . . . First meeting of W9 DXCC members was scheduled to be held in the Sheraton Hotel, Chicago on December 5. W9PGW will conduct a tour of the WGN-TV studios. Spark-plugs of this meeting were W9NN and W9KA . . . Gene, **W2ESO**, advises that resumption of the VOA Ham program is remote . . . We regret to report the passing of Bill Weston, VK6MW on June 6 . . . The ZL 3.5-Mc. band was cut from 3960 to 3900 kc. on Sept. 1.

Latest QSL Addresses

C3PM—	Box 39, Taipei, Formosa.
DL4QX, ex-W6CUF—	Pvt. Jim Maxwell, Hq. Det. (Unit B) 7822 SCU, APO 407, PM, NY.
EA9DD/EA4BH—	Luis Vigueras, Ayala 55, Madrid, Spain.
JA1CV	Kazutada Ohira, 2-4817 Ashicho, Warabi, Saitama, Japan.
JA2AI—	Yosinobu Tange, 2 Warizuka Kasugai, Aichi, Japan.
JA3AA—	Isaji Shima, 17 Kajiyacho, Otsu, Japan.
JA3AF—	Ichiro Sakurai, 284 Domyoji-Cho Minamigawchi, Osaka, Japan.
JA3BP—	Seimi Hamada, 25, 5 Nagaga-Cho, Nagataku, Japan.
JA7AB—	Tsunehiro Miura, P.O. Box 41, Akita, Japan.
JARL Bureau—	JA1AH, Neruma, Tokyo, Japan.
LU3EX/LU5BM—	Alfredo Lieberwirth, Casilla Correo Central 4553, Bs. As. Argentina.
PK6RN—	PK6VK Airfield Penfoer, Kupang, Timor, Indonesia.
PY7ME—	Manoel, Box 184, Campina Grande, Paraiba, Brazil.
SM8VC (Mobile)—	Olle Ryden, Hypoteksv 17, Stockholm, Sweden.
VQ3EO—	Box 13, Kikagati, Uganda.
VS9AP/now G2AVP—	Flt. Lt. J. E. Van Puyenbroek, Officers Mess, RAF, Poling, Sussex, Eng.
W4BQY/ex-KG4AF/W6EHV—	Burt Fisher, 1533 Morris Ave., Norfolk, Va.
ZK2AA/now ZL1BA—	Bill Scarborough, c/o Mrs. Best, 18 Norwich St., Auckland, N.Z.
9S4 Bureau—	KWACS, QSL Mgr. Box 310, Saarbrucker, Saar.
YK1AH—	Fadel, Box 35, Damascus, Syria.

Thanks to: So. Calif. Bulletin, W3AS, W9UKG, VK3XO, TI2TG, W6KFV, W3AXT and W4AAL.

CLASSIFIED ADS

Advertising in this section pertains to amateur radio activities. The publishers of CQ do not guarantee any product or service advertised in this section.

RATES: 25c per word per insertion for commercial ads:
5c per word per insertion for non-commercial ads.

Remittance in full must accompany copy. No agency or term or cash discounts allowed.

CLOSING DATE: the 25th of 2nd month preceding publication date.

WRITE: CQ Magazine, 67 West 44th St., N.Y. 36, N.Y. Attention, Jeanne C. Gillespie.

For Sale:

JOHNSON VIKING I, BC221 converted to VFO for Viking with VR power supply, National NC183, recently factory overhauled. Turner xtal mike. Fifty feet RG-8/U co-ax with connectors. $425 takes all. Ralph Blad, 21 Brooksbie Road, Bedford, Massachusetts.

SURPLUS BARGAINS. New oil-filled condensers 2 μfd. 600 VDC 69c—4 μfd. 600 VDC $1.65—6 μfd. 400 VDC 85c—8 μfd. 600 VDC $1.85—4 μfd. 1000 VDC $1.59—12 μfd. 2000 VDC $8.95—2 μfd. 4000 VDC $7.95. 200 asst. ½ watt resistors, all insulated $2.50. Postage extra. Request bargain bulletin. Reliance Merchandizing Co., 2217 Arch Street, Philadelphia 3, Pa.

813 TRANSMITTER $120; custom-made wooden "living room" cabinet $65; 12 drawer steel parts cabinet, crammed $20; assorted valuable parts for high power rig $20; all for $200. K2GDO, James A. Ross, 37 Ridge Place, Neptune City, New Jersey.

SELLING OUT—Can fellow amchoor reader of Hon. magazine use: ECO, 150-watt 40 meter rig, XE-10, Drake LP-300, giant power supply for same? Also have new Sonar MB-26 2-meter xmtr and 50-watt oscillator-final. Can use recorder. Please make offers. Nothing reasonable will be refused. R. Levy, K2CID, 608 East 7th Street, Brooklyn 18, New York.

FOR SALE: Intertalk Telephones Set, $10; Astatic JT-30 microphone, $7; Sperti portable ultraviolet lamp, $10; Columbia microgroove player, $10; RCA record-changer, 78-rpm, $10; Brush PL-20 transcription pickup, equalizer, $10; Audak transcription pickup, $10; Astatic FLC-33 microgroove pickup, filter, $7.50; record-player, 78-rpm, $5; GI Green Flyer phono motor, turntable, $5; GI two-speed, $7.50; neon-sign transformer, use for xmtr high voltage, $7.50; Speidel men's gold watchband, $5; vertical stand for ¼" drill, $5; Supreme 589-A tube tester, $20; Fabrico vinylite waterproof fishing pants, $5; Fabrico vinylite raincoat, $3.50. Priced FOB. Money-back guarantee. V. R. Hein, 418 Gregory, Rockford, Illinois.

SELL: Teletype #21A midget printer, $49; #12 typing unit, $50; 7-B tape transmitter, $25; Wheatstone polar relay, $12; Panadaptors: APA-10 $125, REB $85, RC1032-A $85, AR-88-F diversity receiver $250. Want: ART-13, APN-9, BC348, BC342, BC312, CU-25/ART-13 antenna loading coil, 32V-1, 32V-2, 75A-1, LM, BC221, manuals. Sig. Catalogs. Will buy or trade. Tom Howard, W1AFN, 46 Mt. Vernon, Boston 8, Mass. RIchmond 2-0916.

FREE MONEY SAVING bargain list. 10 μfd./600WV oil capacitor 98c, RCA 3AP1A $4.95 add postage. Mark Electronics, 1888 Randell Avenue, Bronx 72, New York.

REAL BARGAINS: New and reconditioned Collins, Hallicrafters, National, Hammarlund, Johnson, Elmac, Gonset, Babcock, Morrow, RME, Millen, Lysco, others. Reconditioned S38 $29, S53 $49, S40A $69, S40B $79, SX43 $99, SX42 $179, NC57 $69, NC125 $129, NC173 $149, NC183 $199, NC183D $299, HRO60 $399, HF-10-20 $49, VHF152A $49, SX71, HQ129X, HRO50T1, 75A1, 75A2, 32V2, 32V3, HT9, Viking I, many others. Shipped on approval. Easy terms financed by us. Write for free list. Henry Radio, Butler, Missouri.

FOR SALE CLEANING SHACK: ARC5 xmtrs convert to 160M $10, 2M $20, BC457 for 80M $10, BC458-A for 40M $10, BC459-A for 40M $12. ARC4 xmtr-receiver for 2M $25. Preamplifier BC1284-A $5, AYD3 xmtr-receiver $5, BC456-A modulators $3, all complete, some new. Also RCA receiver 15-600 kc. $5, UTC kw plate transformer $25. Will ship postage collect. Dan Johnston, Viewmont Tazewell, Tennessee.
Terrace, Little Falls, New Jersey.

NOVICE—75 WATTS: S38C receiver both abt 3-month old. $110. Trade new 410 shotgun for VFO. WN4AXQ,

For Sale:

JOHNSON VIKING II transmitters kit form $279.50; wired and tested accordance factory specifications $319.95; modified for remote control operation like the 32V series $334.95; modified for 4D32 final in lieu of 6146s $339.95; with 4D32 and remote control features $354.95; Viking VFOs, wired and tested $54.95; we trade and offer terms. Write W1BFT, Evans Radio Concord, New Hampshire.

W2MHL IS CLEANING HOUSE, first come, first served. Complete 100-watt plate modulated phone transmitter with BC459-A VFO, BC348 receiver, Turner 22X mike and stand, antenna changeover relay and operating table, $150 or nearest offer. Audio, modulation and power transformers, 50-watt Millen exciter, KW power supply 6 ft. enclosed rack, antenna rotator, transmitting and receiving tubes, transmitting micas and variables, 110 and 6v. relays, meters, BC610 coils, 1250 d.c. supply, 250-watt modulator chassis, xtals, LV power supplies, basic scope unit, HV filter condensers, and more . . . Write for list, W. Zmetronak, 147 Farview Avenue, Paramus, New Jersey . . . or Call ORadell 8-6153-J.

HRO5TA1 receiver in perfect condition with power supply, speaker, and coils for 10, 20, 40, and 80 meters. $125. Otto Witte, 1018 LeClaire, Chicago 51, Illinois.

SURPLUS SPECIALS!! RG-8/U cable—225 ft. $12.25; RG-59/U cable—250 ft. $15.00; Coaxial connectors PL-259, 5 for $2.25; SO-239, 5 for $2.00; manuals for SCR-522; BC610, BC779, BC348-J, N, Q—$.100 each (plus postage); New tubes 1619, 1625, 1626, 1629—6 for $1.80; 813—$10.50, 866A—$1.48. Postage extra. Request our free bulletin. Want to Buy: Selsyns, Synchros, Servo Motors, Amplidynes, surplus tubes, equipment. Lectronic Research, 717 Arch Street, Philadelphia 6, Pennsylvania.

FOR SALE: New Carter dynamotor 6.3-volt input, output 425 volts 375 ma. Gonset Tri-band converter and noise limiter. Harvey Wells TBS-50C and home-made power supply, Viking one twenty-two VFO SX-71 receiver and speaker, Master mount Antenna. Gordon Landsburg, Sandusky, Michigan. Need money—make offer.

TWO HANDY-TALKIES, Sperti, 144-148 mc., used, in good condition, each $22.00, both for $40.00. Joseph Rapien, W8KKE, 5907 East Woodmont Avenue, Cincinnati 13, Ohio.

FOR SALE: American Tel. & Radio model 110RSC inverter. Practically brand new. Input 110 volts dc.—output 110 volts ac., (List $54.95); with 600 volt WVDC—10 μfd. oil-filled condenser (List $15.85) Will accept best offer. Box RS, CQ Magazine, 67 West 44th St., New York 36, N.Y.

FREE LIST. New and reconditioned receivers, transmitters, etc. A hundred big bargains every month. Highest trade-in allowance. Fast four-hour shipping service. Special Novice department. Write today. Dossett, W9BHV, 855 Burlington, Frankfort, Indiana.

HALLICRAFTERS 5-10 receiver in good condition with external S meter and Gonset noise clipper. Best offer. W8KJ, Irving Davis, 5050 Grayton, Detroit 24, Michigan.

CLEANING UP SHACK. RG-22/U 95-ohm twin conductor co-ax, 4c per foot, $7.50 for 200-foot roll. RG-7/U 97.5-ohm co-ax, 4c per foot, $7.50 for 200-foot roll. New tubes: 5-872's @ $2.00 each; 4-816's @ $1.00 each; 4-801A's @ 35c each; 6-717A's @ 70c each; 15-6H6's at 30c each; 2-6AS7G's @ $3.00 each; 3-7H7's @ 50c each; 6-807's @ $1.00 each; 6-6L6M @ 90c each. George Jacobs, W2PAJ, 144-40-72nd Avenue, Flushing 67, New York.

COMPLETE MOBILE short wave gear for one-half of original cost. Elmac transmitter, Tri-Band converter, all associated equipment, nothing else to buy, used very little. Stephen Popp, c/o WIL, St. Louis 8, Missouri.

SURPLUS UTC-PA429 transformers: Pri. 115VAC, Sec's 600-525-0-525-600 at 250 ma., 5v. 3a, 6.3vct 3A. 7.5vct 3a, tapped at 6.3v 4a. $7.95. 3X5 μfd. 400v oil condensers 5 for $4.00. Jack Hardwick, KRSN, Los Alamos, New Mexico.

BARGAINS: Extra Special: Motorola P-69 series mobile receiver $19.50; Gonset 10-11 converter $19.95; DM-36-10 meter converter $19.50; VHF-152 $49; Breting 12 $49.50; HF-10-20 $59; S-40A $75; RME-45 $99; RME 2-11 $99.50; HRO-senior $99; SX-43 $119; S-76 $149; SX-71 169; SX-42 $189; HRO-50 $275; 75A1 $275; MB611 mobile transmitters $14.95; 90800 exciter $22.50; HT-17 $32.50; EX Shifter $69; Globe Trotter $69.50; TBS-50D $99; HT-9 $199; Supreme AF100 or Temco 75GA $225; Globe King $295. Free trial. Terms financed by Leo, WØGFQ. Write for catalog and best deal to World Radio Laboratories, Council Bluffs, Iowa.

For Sale:

BC610-D and HT4E; 2-TCS transmitters; 3-frequency meters BC221, for sale or swap. All inquiries answered. No reasonable offer refused. W6GFL, 11624 East Garvey, El Monte, California.

WILL SELL OR TRADE new war surplus radio equipment for stamp collection. List free. A. D. Wellborn, Box 1690, Ft. Worth, Texas.

TVI MONITOR, compact 7" set $35. Larger screen, $40. Want Eldico or Multiphase SSB Exciter. W4API, 1420 South Randolph, Arlington, Virginia.

FOR SALE—$125 or best offer takes QST, complete run 1925 to 1953, first five years bound; CQ, complete run 1945 to 1953 all bound CQ style except 1953. Ed. Newman, 217 New York Ave., Massapequa Park, New York.

QSL Cards:

QSL's WORLD'S FINEST, 100 super gloss, one color, $1.95 up. Samples 10c, QSL Press, Box 71, Passaic, New Jersey.

QSLs of DISTINCTION. Three colors and up. Uncle Fred, Box 86, Lynn, Pennsylvania.

QSL's, SWL's. High quality. Reasonable prices. Free samples. Write, Bob Teachout, W1FSV, Box C124, Rutland, Vermont.

QSLS—"Brownie" W3CJI, 3110 Lehigh, Allentown, Pennsylvania. Samples 10c with catalogue 25c.

QSLs HIGH QUALITY, fair prices. Samples? W7GPP, 1380 F, The Dalles, Oregon.

QSLs! "America's First Choice!" Samples 10c. Tooker Press, Lakehurst, New Jersey.

QSL samples 25c (refunded). Sackers, W8DED, Holland, Mich.

QSL's—SWL's. Excellent quality. Fair prices. Samples 10c. Almar Printing Service, 602 Barker Building, Omaha, Nebraska.

Positions Offered:

PHYSICIST: Specializing in antenna design and analysis. Writing ability desirable. Permanent position in excellent location. Advancement commensurate with ability and results. State qualifications, salary desired, and availability in first letter. Telrex, Inc., Box 879, Asbury Park, New Jersey.

Miscellaneous:

"AMATEUR RADIO FRONTIERS" magazine, winner of the 1953 A.R.T.S. award for the outstanding amateur radio publication; send only $3.00 for issues #25-36. Published by W2NSD, 1379 East 15th Street, Brooklyn 30, New York.

FOR DXers—"Ham Interpreters," Ham words and phrases translated into seven languages, $1.00. For SWL's—"World Radio Handbook," complete information on international stations, $1.50. For SWL Novices—"How To Listen," 40c. World Radio Publications, 47 Mounthaven Drive, Livingston, New Jersey.

DON'T FAIL those FCC exams. Use Surecheck Tests. Novice $1.50, General $1.75, Extra $2.00. Amateur Radio Specialties, 1013 Seventh Avenue, Worthington, Minnesota.

CANADIANS write for list of equipment for sale including HT-9, SX-42, Gonset Triband. Crabtree, VE2AJ, 765 118th Street, Shawinigan South, Quebec.

INCREASE CODE SPEED. New method. Free particulars. D. H. Rogers, Fourth Street, Fanwood, New Jersey.

10, 15 & 20 METER BEAMS, aluminum tubing, etc. Perforated aluminum sheet for shielding. Radcliff's, Fostoria, Ohio.

MAP PINS—$1.00 for fifty, wrapped in cellophane bag. Red, blue, brown, orange, yellow, green. Give preference. Robest Products Co., 701 Dewey Street, Harvard, Illinois.

PRECISION and Custom-built ANTENNAS for any band and frequency. Literature on request. Antenna, Inc. Wakefield, Rhode Island.

Wanted:

WANTED: Plate transformer 900-0-900 VAC at 250 or 300 ma. Also power transformer for I-222-A frequency meter. Trade new single barrel 20-gauge shotgun and used Mossberg 42M .22 calibre rifle. Also need mobile equipment. Larry Kleber, Belvidere, Illinois.

WANTED: Surplus (or amateur) receivers, transmitters, test equipment, teletype, Loran, radar, manuals, in trade for new Johnson, Viking, Hammarlund, National, Harvey Wells, Gonset, etc. Alltronics, Box 19, Boston 1, Massachusetts. RIchmond 2-0048, 2-0916.

WANTED: 400B transmitter. Please state age, condition, price. Hal Cushing, W1EUS, 16 Preston Drive, Manchester, Connecticut.

NEED: BC348 and BC342 radio receivers. Hoffman, 1406 G Street, N.W., Washington, D.C.

WANTED—All types of aircraft radios, receivers and transmitters. Absolutely top prices. W2KUW, 308 Hickory Street, Arlington, New Jersey.

WANTED: Hallicrafters model S76 receiver. Please state condition and price. S. W. Nock, Hallwood, Virginia.

WANTED: 35-40 watt mobile transceiver. Also need very low-priced tape recorder in working condition. S. Luben, 302 Melbourne, Columbia, Missouri.

WANT: AN/ARC-1's, AN/ARC-3's, BC610-E's and components. Write: B. Spivey, 7013 Rolling Road, Chevy Chase, Maryland.

NEW or NEW LIKE BC453 with tubes in good working condition. 110 v.a.c. power supply and tuning knob desired but not absolutely necessary. State price & condition. Paul Powell, 801 Matamoros Street, Laredo, Texas.

WANTED: AN/ART-13 transmitter and/or parts. Robert Wegelin, 410 Cedar Street, N.W., Washington, D.C.

WANTED: ART-13; ARC-3; TCS; BC348; used receivers, transmitters. FARR Electronics, Box 273, Lexington 73, Massachusetts.

WANTED: Collins 310B-1, or 310B-3. Please advise price, condition, and modifications, if any. Box 3931, Victory Center Station, North Hollywood, California.

WANTED: Bargain in transmitters, receivers, laboratory and test equipment, power supplies, miscellaneous gear and parts. What have you? Please state price desired. W5ZZ, 718 North Broadway, Oklahoma City, Oklahoma.

WANTED: BC348 receiver and parts. Write: James S. Spivey Co., 1406 G Street N.W., Washington 5, D.C.

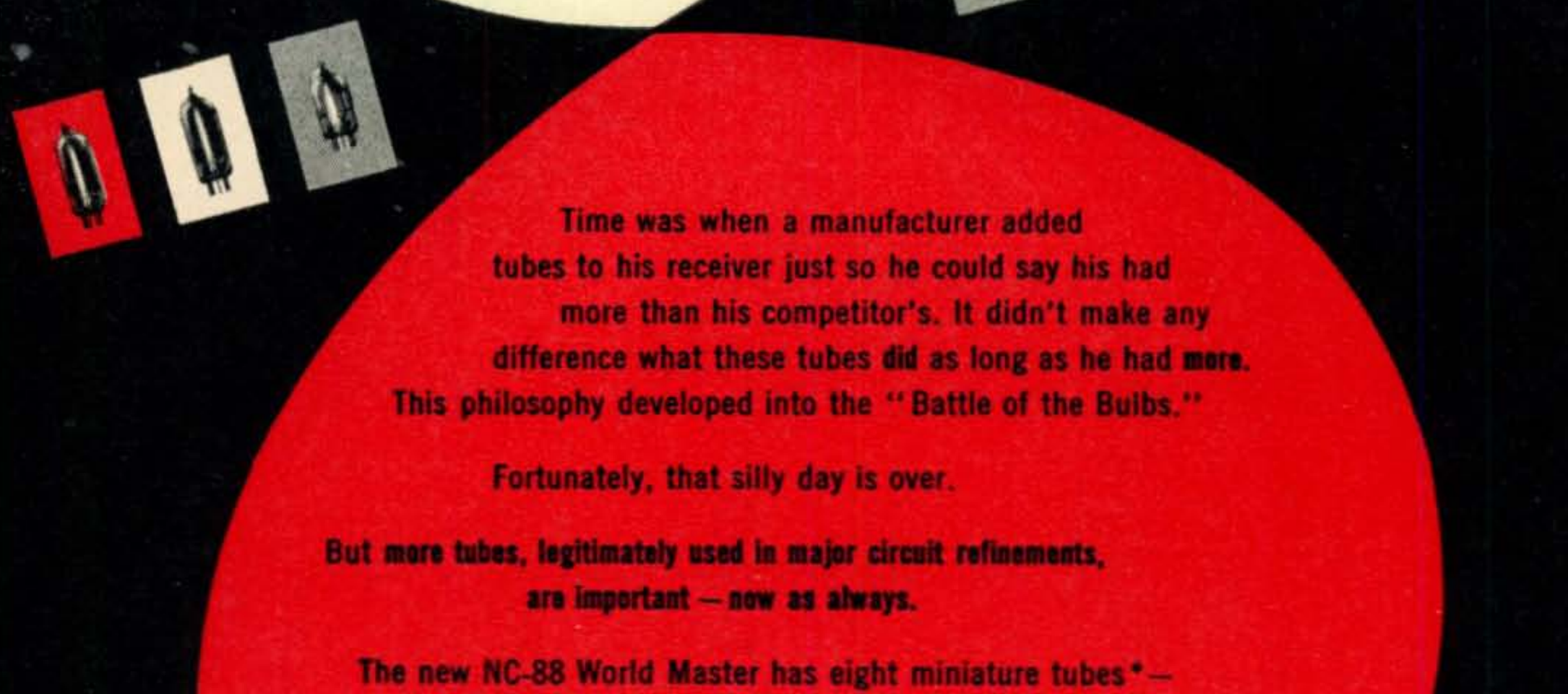
WE NEED USED RECEIVERS. We give highest allowances for S-20R; S-40A, B; NC-57; NC-100; NC-125; SX-24; SX-25; HQ129-X; and similar receivers. World Radio Laboratories, Council Bluffs, Iowa.

Personals:

RECORDING HAMS—Join world-wide club; swap tapes, make friends everywhere. Details FREE. P.O. Box 1404-C, San Francisco, California.

CQ Ad Index

how important is how many tubes?



Time was when a manufacturer added
tubes to his receiver just so he could say his had
more than his competitor's. It didn't make any
difference what these tubes **did** as long as he had **more.**
This philosophy developed into the "Battle of the Bulbs."

Fortunately, that silly day is over.

**But more tubes, legitimately used in major circuit refinements,
are important — now as always.**

The new NC-88 World Master has eight miniature tubes* —
more than comparable receivers in its price class.
All are used to provide the finer selectivity, or sensitivity, or stability
you expect in a National receiver.

More tubes are just one of 8 "exclusives" you get with the
World Master. You get them with no other receiver
at the price. $129.95

(slightly higher west of the Rockies)
*plus rectifier

NATIONAL

NC

NATIONAL COMPANY, INC., 61 SHERMAN STREET, MALDEN, MASS.

RCA RECTIFIERS...

—Built for "commercial" service —priced for amateurs

Ever look at the power supplies of a commercial transmitter? Rectifier types like these are what you generally see—*because they're built for "around-the-clock" reliability!*

The five tubes pictured here meet all power requirements of amateur transmitters. With choke-input filter, one high-vacuum *RCA-5R4-GY* can supply 175 ma at 750 v to the filter. With the half-wave mercury-vapor rectifiers—using choke-input filters and full-wave circuits—two *816's* can supply 250 ma at 2380 v to the filter; two *866-A's* can supply 500 ma at 3180 v to the filter; and two *872-A's*, or two *8008's* can supply 2.5 a. at 3180 v to the filter. (type 8008 is the same as the 872-A except that it uses a heavy-duty base.)

For free technical bulletins, see your RCA Tube Distributor. Or write RCA, Commercial Engineering, Section A15M, Harrison, N. J.

NOVICE NOTE

With mercury-vapor tubes it is important that the tube be warmed up by application of filament power and that the mercury be vaporized before high voltage is applied to the tube plates. Allow at least 30 seconds, and more if the shack is very cold.

RADIO CORPORATION of AMERICA

ELECTRON TUBES — HARRISON, N. J.

®