CQ

September 1967
75¢

SAIL TO GLORY
HAM RADIO ABOARD THE SCHOONER "AMERICA"

The Radio Amateur's Journal

The Best Endure

A classic is a work of enduring excellence. That's why the 32S-3 Transmitter is a classic in amateur radio. The 32S-3 offers USB, LSB and CW versatility, transceiver operation with S/Line receiver, mechanical filter sideband generation, permeability-tuned VFO, crystal-controlled HF oscillator, RF inverse feedback and automatic load control. Stop in at your Collins distributor and browse through the S/Line classics.

For further information, check number 10, on page 126

COLLINS

NOW

A low cost Crystal for the Experimenter

International *type "EX"*

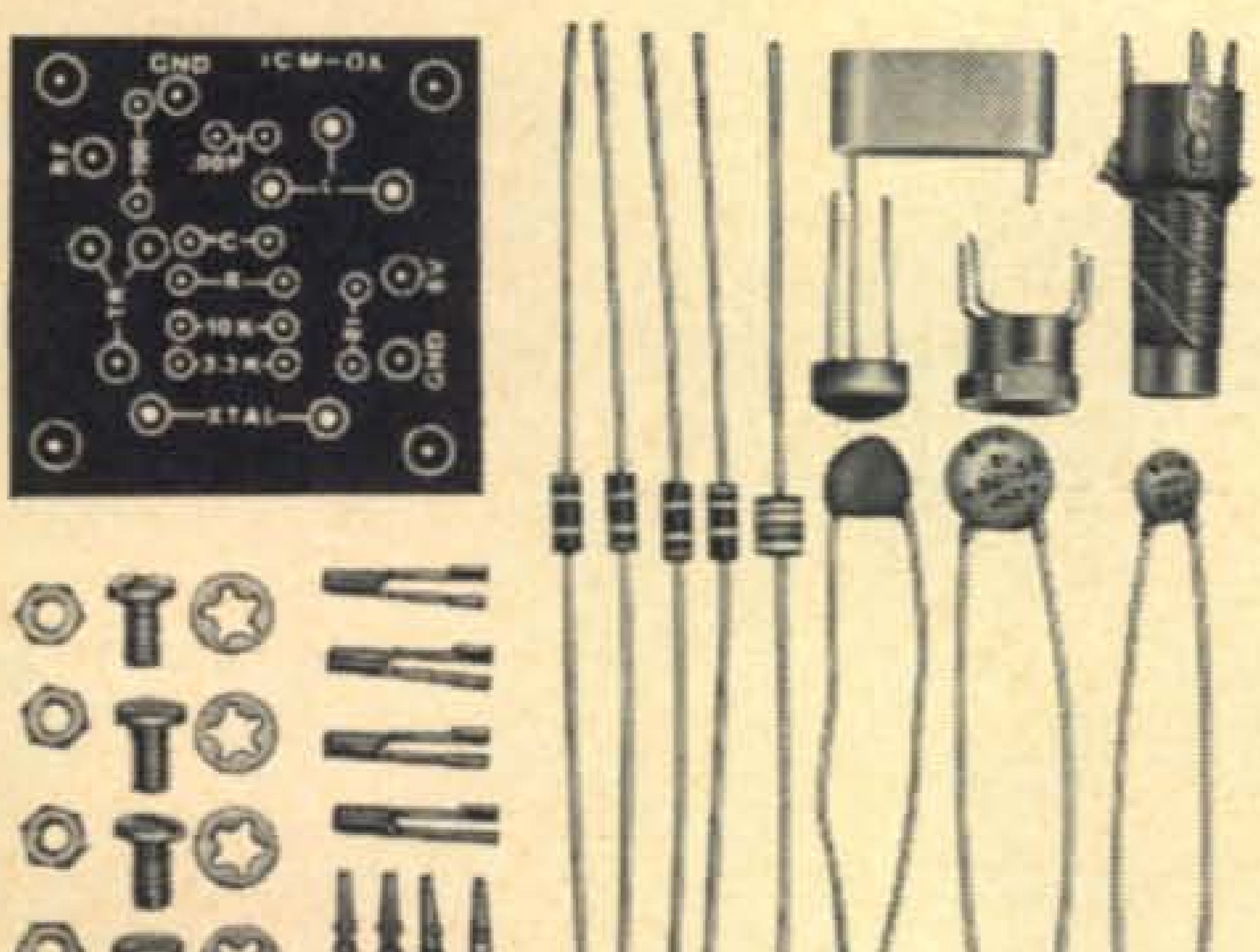
- LOW COST
- MINIMUM DELIVERY TIME

3,000 KHz to 60,000 KHz

$3.75 Postage Paid

SPECIFICATIONS: International Type "EX" Crystal is available from 3,000 KHz to 60,000 KHz. The "EX" Crystal is supplied only in the HC-6/U holder. Calibration is ± .02% when operated in International OX circuit or equivalent.

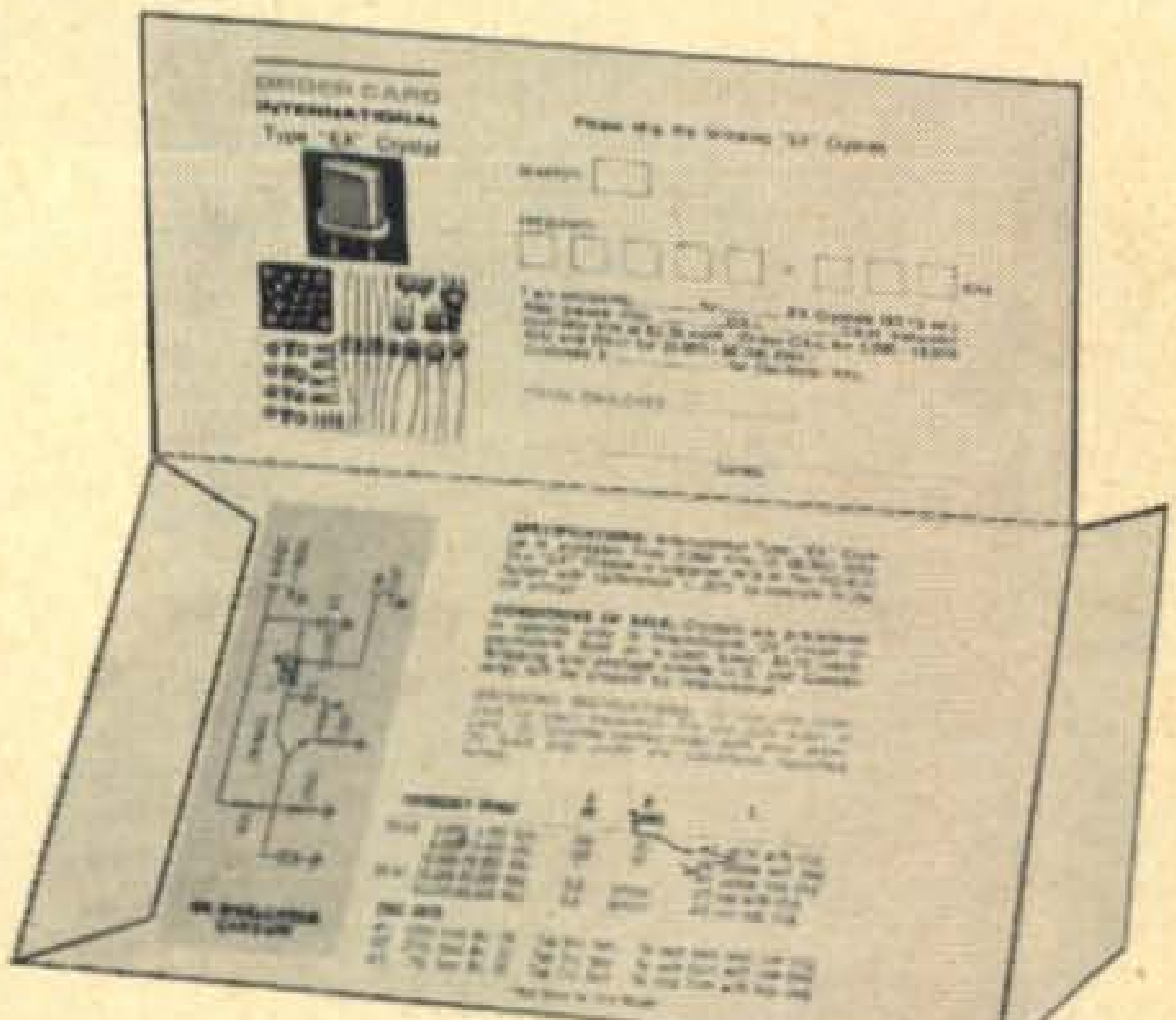
CONDITIONS OF SALE: All "EX" Crystals are sold on a cash basis, $3.75 each. Shipping and postage (inside U.S. and Canada only) will be prepaid by International. Crystals are guaranteed to operate only in the OX circuit or its equivalent.



COMPLETE OX OSCILLATOR KITS

Everything you need to build your own oscillator. Two kits available. "OX-L" kit 3,000 to 19,999 KHz. "OX-H" kit 20,000 to 60,000 KHz. Specify "OX-L" or "OX-H" when ordering. **$2.35** Postage Paid

MINIMUM DELIVERY TIME We guarantee fast processing of your order. Use special EX order card to speed delivery. You may order direct from ad. We will send you a supply of cards for future orders.



ORDERING INSTRUCTIONS

(1) Use **one** order card for each frequency. Fill out both sides of card.

(2) Enclose money order with order.

(3) Sold only under the conditions specified herein.

INTERNATIONAL

CRYSTAL MFG. CO., INC.

10 NO. LEE • OKLA. CITY, OKLA. 73102

For further information, check number 7, on page 126

SEPTEMBER 1967 VOL. 23, No. 9

CQ

The Radio Amateur's Journal

STAFF

TABLE OF CONTENTS

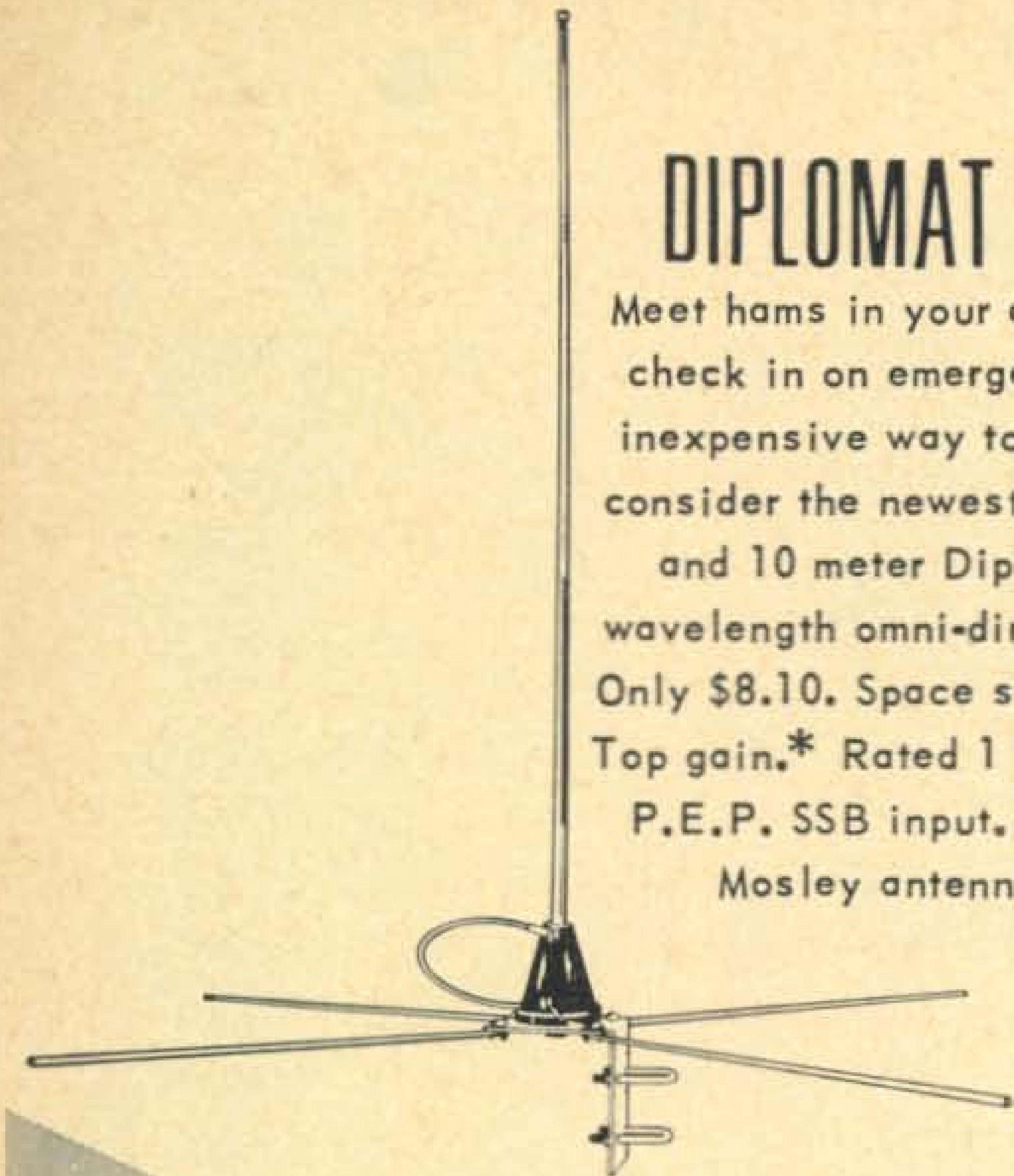
DEPARTMENTS

Offices: 14 Vanderventer Avenue, Port Washington, L. I., N. Y. 11050. Telephone: 516 883-6200.

CQ—(Title registered U. S. Post Office) is published monthly by Cowan Publishing Corp. Second Class postage paid at Port Washington and Miami, Florida. Subscription Prices: U.S.A., Canada and Mexico, one year, $5.00; two years, $9.00; three years, $13.00. Pan-American and foreign add one dollar per year. Please allow six weeks for change of address. Printed in the United States of America.

Postmaster: Please send form 3579 to CQ Magazine, 14 Vanderventer Ave., Port Washington, L.I., N.Y. 11050

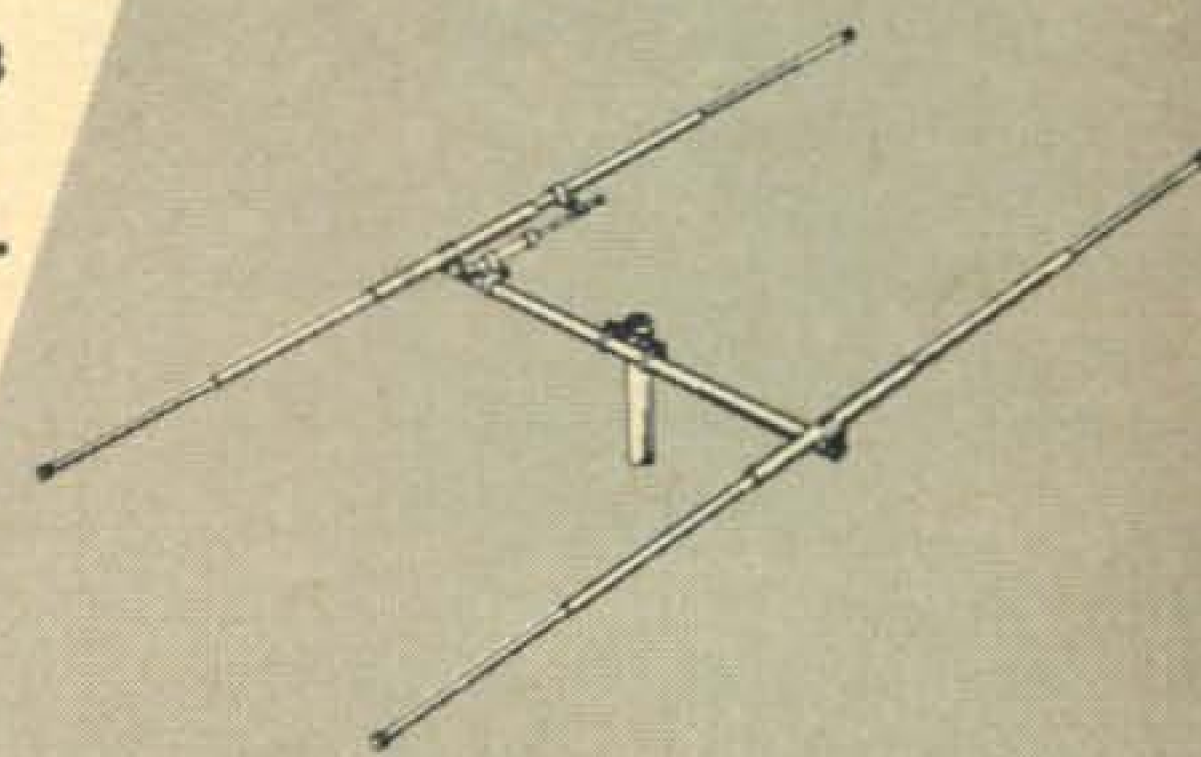
Whats NEW from Mosley!



DIPLOMAT '2'

Meet hams in your area on 2 meters . . . check in on emergency nets! For an inexpensive way to keep in touch, consider the newest addition to the 6 and 10 meter Diplomat family of 5/8 wavelength omni-directional antennas. Only $8.10. Space saving. Lightweight. Top gain.* Rated 1 KW AM/CW, 2 KW P.E.P. SSB input. Another Quality Mosley antenna!

X-15



Own a Quality Mosley 15 meter beam, yet build it yourself - - just like in magazine projects. Drill your own holes and assemble according to concise instructions given. All parts included (minus coax). Gamma matched. Outstanding gain.* Full power rated. By readjusting elements according to instructions supplied, Generals may use this beam on 10 meters.

LANCER 1000

Hams are working lots of DX with this 5-band mobile antenna! Full power rated. Use on 10 meters without coil. Interchangeable coils for other bands. Adjustable upper whip section for peaking antenna to desired frequency. Coils with whip tip pre-cut and set for each band, available (extra). Hinged break over.

The Classic 10-15

The 10 and 15 meter bands are hot again! Command your share of DX on these popular bands with this Classic New Trap-Master beam. Full power rated. Broad Band Capacitive Matching. Incorporates performance proven Mosley metal encased traps. Tops in DX punch . . . gain!*

*Gain omitted due to requirements of certain publications. For full details, send for FREE '67 catalog. Dept. 140

MOSLEY ELECTRONICS, INC.
4610 N. LINDBERGH BLVD., BRIDGETON, MO. 63042

For further information, check number 34, on page 126

ZERO BIAS

If it seems like years and years since the current Incentive Licensing situation was instigated, it's only because it *has* been years; four and one-half, to be specific. It was in the February 1963 issue of *QST* that the question was asked, 'Should we return to an incentive system of licensing whereby an amateur must demonstrate increased technical proficiency in order to increase his operating privileges?'

The question was necessitated by evidence of a decreasing level of technical competence among American amateurs, and the resultant concern that the continued existence of American amateur radio was therefore in jeopardy. Later, the point was brought up that the future of international amateur radio, and the bands we enjoy, might also be in danger unless U.S. hams were forced to "shape up" by new FCC licensing standards. Behind this worry lay the thought that wholehearted enthusiasm and backing of the amateur service by FCC was essential for their support of amateur allocations at a future international frequency conference. It was reasoned that even with strong U.S. support of amateur radio, the task of maintaining the amateur h.f. allocations would be extremely difficult. Without strong FCC support, the future was nearly hopeless.

Whether or not Incentive Licensing is shown to be necessary or desirable by the developments of the next several years, it is inescapable that it has already had a profound effect on the hobby. The fact that FCC has had under study Docket 15928, describing proposed changes in our licensing structure, has stifled the growth and vitality of what was once a very much alive and exciting hobby. It's easy to understand why, too. For four and one-half years, U.S. amateurs have lived in doubt about how, when and where they would be able to operate within the as-yet undecided new licensing structure.

Will the average amateur spend several hundred dollars for a new s.s.b. transmitter when he has no idea if he'll be able to use it a year from now? Will a potential newcomer give serious attention to becoming an amateur if he feels that drastic and confining changes in the hobby are imminent? Will a manufacturer confidently spend thousands of dollars in new product engineering and development costs if his market is in serious danger of vanishing or at least diminishing to an unprofitable level? The answer in each case is "Maybe." But a strong and healthy institution, as was amateur radio only five years ago, can't survive on "Maybe's." And it shows.

Advertising levels in all three U.S. ham publications are really quite sad in comparison to pre-1963 levels. The number of new amateurs entering the ranks is disturbingly small. The high moral and ethical standards of which we were hardly aware, but which nonetheless existed a few short years ago, have all but given way to a dog-eat-dog attitude growing from a secure past becoming a nebulous present, and pointing towards an ominous future.

It is the considered opinion of *CQ* that unless *immediate action* is taken by FCC to either adopt Docket 15928 or reject it in its entirety and drop the whole matter, the amateur service is doomed to atrophy, and will just shrivel up and die of its own accord, even *without* the threatened death blows of an international frequency allocations conference.

We have waited patiently for too long. Our health is suffering, and we can wait no longer. We need action *now*!

Dick, K2MGA

Dr. Harold Megibow, K2HLB

It is with deep regret that we record the passing of Dr. Harold Megibow, K2HLB, on July 22, 1967. Harold succumbed to a heart attack, his second in two years, while vacationing in Las Vegas. He was indeed a gentleman.

THE ULTIMATE FOR SENDING AND RECEIVING

RTTY

★ Simple Plug-In Operation

o external odds-n-ends required. Directly couples your receiver, ransmitter and teleprinter.

★ Ready to Run

tandard factory wired unit is complete with TU-1M Demodulator, S-1 AFSK, PS-3 Power Supply, BP-1 Band Pass Filter and M-1 Dual Channel Selector Magnet Driver.................... **$163.00**

★ Unique Build-On System

BASIC CABINET AND INDIVIDUAL PLUG-IN UNITS MAY BE PURCHASED SEPARATELY

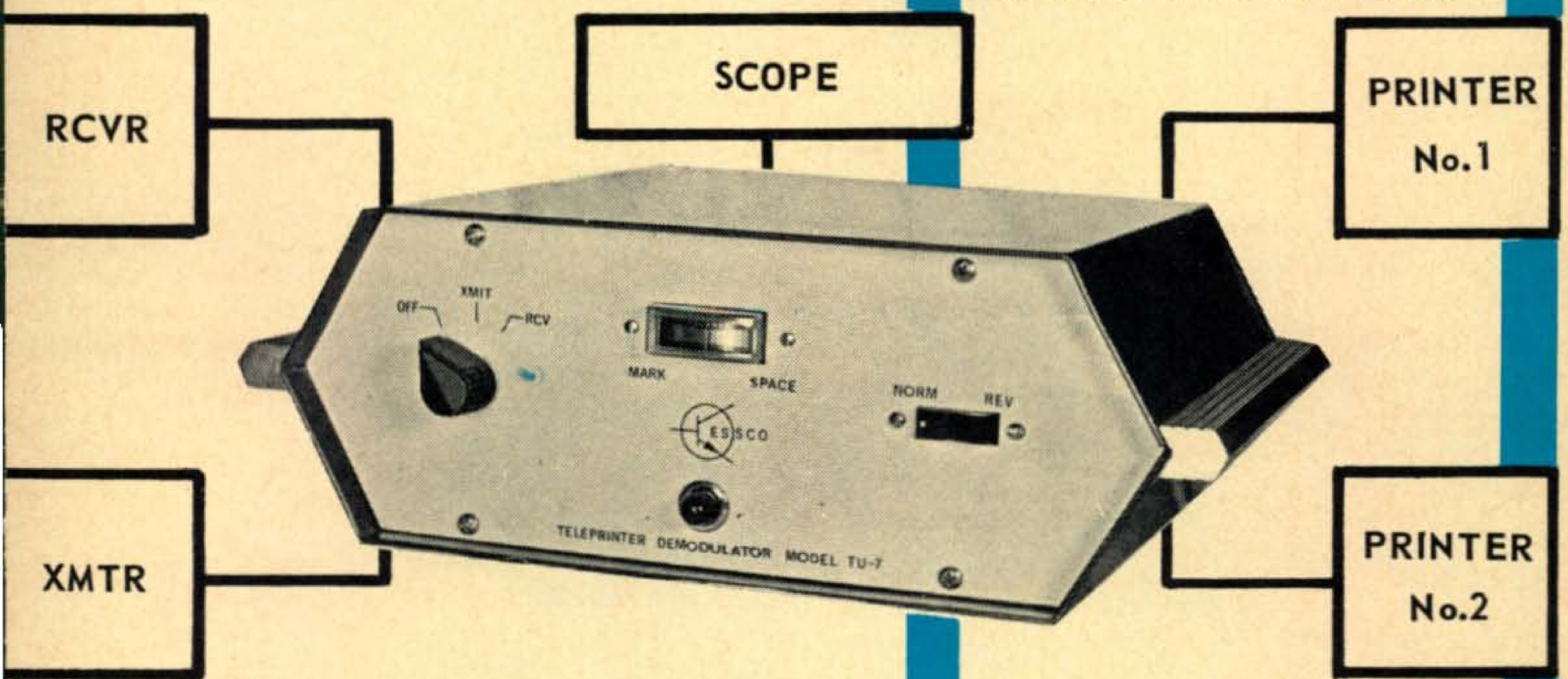
Cabinet, fully wired, with loop supply, connectors, tracks, tuning ndicator, reversing switch, jacks and function switch...... **$39.95**

F YOU ALREADY OWN THE ESSCO LINE, JUST PLUG YOUR XISTING BOARDS INTO THE PRE-WIRED CABINET.

✔ CHECK THESE FEATURES

- BUILT-IN 50μa ZERO CENTER METER
- INDICATOR LAMP
- AFSK OUTPUT FOR VHF MODULATOR OR SSB TRANSMITTER
- NORMAL/REVERSE SWITCH
- OPERATES TWO TELEPRINTERS SIMULTANEOUSLY*
- SELF CONTAINED LOOP SUPPLY (125V)
- BUD 'GRAND PRIX' CABINET
- FAMOUS ESSCO SOLID STATE PLUG-IN CIRCUIT BOARDS
- SCOPE OUTPUTS
- GUARANTEED FOR 90 DAYS

*WITH DUAL CHANNEL SEL MAG DRIVER



rices of individual plug-in units

	KIT	ASSEMBLED
J-1M, Demodulator	$21.95	$31.95
S-1, AFSK		$26.95
S-3, Power Supply	$16.95	$26.95
-1, Band Pass Filter		$ 7.50
-1, Sel. Mag. Driver	$24.95	$29.95

ESSCO MAKES A COMPLETE LINE OF SOLID STATE DEVICES FOR RADIO TELETYPE SYSTEMS

WRITE FOR FREE BROCHURE ON COMPLETE ESSCO LINE

DEALER INQUIRIES INVITED

•••

WEST COAST AMATEURS
ESSCO products available thru:
E. Buchanan & Assoc.
1067 MANDANA BOULEVARD,
OAKLAND, CALIFORNIA

ESSCO *"Teletype Specialists"*
324 ARCH STREET CAMDEN, N. J. 08102
Phone: (609) 365-6171

For further information, check number 8, on page 126

Announcements

Winnepeg, Canada

The Manitoba Association of Amateur Radio Clubs will be hosting fellow amateurs at the Centennial Mid-continent Hamfest being held September 2 and 3 in Winnipeg, Canada. The hamfest site will be the campus of the University of Manitoba in Winnipeg—in the UMSU Building. In addition to many ham events such as transmitter hunts, there will be a social evening and banquet, which will feature a distinguished guest speaker. Anyone interested in amateur radio will be most welcome. VE4's will be most anxious to welcome fellow hams, especially those from the U.S. at this hamfest celebrating the centennial of Canadian Confederation. For further information write to P. O. Box 475, Winnipeg, Manitoba.

Findlay, Ohio

The annual Findlay Hamfest will be held in Findlay, Ohio, at Riverside Park on Sunday, Sept. 10, the first Sunday after Labor Day. Come and bring the whole family. Facilities for ladies hobbies. Amusements for the children. Tickets and info from Clark E. Foltz, W8UN, 122 W. Hobart, Findlay, Ohio, 45840.

Uniontown, Pennsylvania

The 18th Annual Gabfest of the Uniontown Amateur Radio Club will be held Saturday Afternoon & Evening, September 9, 1967, on the club grounds on the Old Pittsburgh Road, north of Uniontown and about one mile from the CITGO service station, on the corner of Route 51 and the Old Pittsburgh Road. Main drawing on registration will be a WRL Duo-Bander 84 and many other prizes. Line up in the front row to display your swap & shop & surplus. Refreshment stand will be open for the hungry & thirsty with free coffee. Registration is $2.00, and facilities on the grounds compel the club to make this a Stag affair.

West Hurley, N.Y.

The Overlook Radio Society will sponsor an equipment auction in Kingston, New York, on Saturday, September 23, 1967, at 1:00 P.M. Equipment may be marked and displayed as early as 10:00 A.M. Registration is 25¢ per person. No commission will be levied on sales. Formal auctioning and private bargaining will be employed to move the maximum amount of equipment. For further information contact Herb Lacey, WB2LZJ, RD1, Box 26, W. Hurley, N.Y., 12491.

Maryland Two-Meter Termite Net

The Maryland Two Meter Termite Net wishes to announce its V.H.F. Two Meter Contest, which will begin 2100 GMT October 21, 1967, and end 2100 October 22, 1967. Trophies, Prizes and certificates will be awarded to the winners. Contest rules and further details can be obtained by writing to the following address: Maryland Two Meter Termite Net, P. O. Box 153, Linthicum Hghts, Md., 21090.

Louisville, Kentucky

The Louisville Ham Kenvention will be held Friday evening, Sept. 8 and Saturday, Sept. 9 at the Executive Inn, Waterson Expressway at the Fair Grounds, Louisville, Kentucky. Numerous speakers and many activities, including a banquet Saturday night. Admission tickets in advance $2.50—at the door $3.00. Banquet tickets $5.50—at the door $6.00. Ladies program $3.00 in advance. Banquet tickets are limited and reservations should be made without delay. For information and reservations write Louisville Ham Kenvention, Box 20094, Louisville, Kentucky, 40220.

Geneva, Switzerland

The 1967 I.A.R.C. Convention is to take place in Geneva on September 23/24. This year, the theme of the Convention is "Amateur Radio in the Modern World". The Technical Sessions, scheduled for Sept. 23 (whole day) and Sept. 24 (A.M.) will be aimed to exemplify this theme, and will as well point up the past historic achievements of amateur radio and amateurs generally. This Convention takes place during the I.T.U. World Administrative Radio Conference to deal with matters relating to the maritime mobile service, and among the hundreds of official delegates present at that Conference will certainly be many radio pioneers and amateurs from all over the world.

Gaithersburg, Maryland

The Foundation for Amateur Radio will hold their annual hamfest this year at the Gaithersburg, Maryland Fairgrounds on September 24. This annual event is a cooperative hamfest for the 23 member clubs of the Washington-Baltimore area. All of the usual features will be found—auction and rummage sales, contests, equipment displays, ARRL and MARS exhibits, transmitter hunts, ladies program and door prizes. Activities begin at 10 A.M. and continue until 5 P.M. Admission will be $1.50.

Malaga, New Jersey

The South Jersey Radio Association will sponsor its annual gala Hamfest on September 24, 1967, at Molia Farms, Malaga, New Jersey. Rain date is October 1, 1967. Advance registration for non-members is $2.00 with Sept. 16 the deadline. General admission at gate is $3.00. Ticket covers entire family. Day's activities will include 2 and 6 Meter hidden transmitter hunt, swap shop, games and swimming for the children, OM and XYL door prizes. All are invited to bring their lunch baskets, however, hot dogs, hamburgers, soft drinks, etc. will be available. For advance registration contact Joe Duffin, W2ORA, 247 Kings Highway West, Haddonfield, New Jersey, 08033. Tel. 428-5759. Checks should be made out to SJRA.

Peoria, Illinois

The Peoria Area Amateur Radio Club Hamfest will be held Sunday, September 17, at Exposition Gardens. Located on the Northwest edge of Peoria, Illinois. An All-Weather site. Lunches will be available. Free swap section, parking, contests and cartoons for the kiddies. Free coffee and doughnuts from 9:00 to 9:30 A.M. CDT. Registration: $1.50 advance. $2.00 at the gate. For further info write: Ferrel Lytle, W9DHE, 419 Stonegate Road, Peoria, Ill., 61614.

OUR MOST POPULAR HANDBOOK!

The most popular handbook ever to be presented in the CQ Technical Series was the venerable old "Command Sets." Countless signals on the air today are there because of the information contained in "Command Sets," which went on to become the standard reference guide and definitive work on the topic. It went through 5 sellout printings, and when the last book of the final printing was stripped from our stock room we decided that the next printing would be an even bigger, newer, expanded, revitalized version of "Command Sets."

PRICE: $3.00

Our new book is called "Surplus Conversion Handbook," it's 192 pages BIG (that's 58 pages more than its predecessor). We kicked out all of the space-taking ads which cluttered up the old book and replaced them with more conversions — conversions of surplus gear other than just "command sets" alone. So the new book contains all of the best command set conversions of the original edition, plus complete conversion details on a whole slew of the most popular military surplus gear available today, including such winners as: SCR-522, ART-13, BC-603, BC-620, BC-624, BC-659, BC-779, ARC-1, ARC-3, ARC-4, and many more. Actually, it covers just about every piece of surplus gear which is worth the time and effort to convert for ham use.

"Surplus Conversion Handbook," Edited by Tom Kneitel, K3FLL/WB2AAI, is a book which every ham will find to be a valuable and interesting addition to the shack. It's available for immediate delivery.

COWAN PUBLISHING CORP., BOOK DIVISION
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

Gentlemen: Enclosed is $________ for ____ copy(ies) of the brand new SURPLUS CONVERSION HANDBOOK.

Name____________________, Call________

Address____________________________

City____________ State________ Zip______

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Boy oh boys!! a person not reelizing how much amchoor radio are changing in last fifty yeers until you reely start thinking about it. Like taking last week, when, after meeting of local amchoor radio club, I inviting some of the fellers over to my shack to trying out my newest batch of cacktus jooce.

In very few minutes everybuddy feeling kinds mellow, and conversayshun flowing very freely. Finely we got talking about what each of us would do if we had all the money we wanted to spend on amchoor radio.

We talking not only about today, but what we would have done with all the money in the world if we'd had it when we put our first rig on the air. Some of these ideas so interesting I knowing you wanting to heering them.

One feller who being on air back in the spark and arc era saying he reely could have used money in those days of ancient history. Between swigs of cacktus jooce he telling us what he would have done.

First he would have bought up a few thousand acres of land, and put up antenna cupple miles long on fifty foots poles, and also string huge counterpoise under it. Also, he buying biggest rotary spark gap he can finding.

For reseever, he buying up thousands of galena crystals and testing them until he finding most sensitive ones. You know, Hon. Ed., with that rig he might have been first to work across Atlantic Ocean!

Another feller who going on air in Hon. 20's saying he would have bought lotsa land too. Only he would have put separate rig in speshul building on each band—using 204A's in final—and then surrounding each building with 36 rhombic antennas, spaced

10 degrees apart around the compass.

He having custom-made reseever in each building, using those new-fangled pentode toobs, then he controlling all rigs remotely from his house. Coming to think of it, you could making quite a splash on the amchoor bands today with bunch of rigs like that!

In the late 40's rhombics were out and rotary beems were in. Cupple of the amchoors who going on air after war discussing what they would have dǒne.

First they putting up 2000 foots towers, one on each band, and putting rotary Yagi's with eleventeen elements in them on top of towers. To saving line loss, they also putting xmitter at top of each tower. It being one of the new-fangled SSB rigs, using full maximum power.

They also having some big electronics company building speshul SSB reseevers for each band, and putting them up with xmitter. All having remote tooning devices, so hole shebang can be controlled from home QTH, wherever that being.

When these fellers finish describing all this, most everybuddy there desiding that a setup like that would be hard to improve on. Everybuddy telling how they could working all zones in cupple days if they having all that gear.

It are at this point that Scratchi are getting involved. I telling everybuddy they big bunch of pikers, with no imaginayshun at all. I telling them that if Scratchi having all the money in the world, he reely fixing up a 1/c amchoor radio stayshun.

Are you reddy, Hon. Ed? Okeydokey. Here are Scratchi's sooper-dooper to end all sooper-dooper stayshuns.

Picture to yourself some cupple dozen saddlelites in random orbit, each about 500 miles up. Each one are powered by nuclear power plant, and having in it different xmitters for each band—SSB rigs, natchyourally.

Also, each saddlelite having separate antennas for each band, with speshul reseevers that are so sensitive they can reseeving down to theoretical noise.

In addition, each saddlelite having speshul reseever and xmitter which are used to talk to ground control points. Scratchi having quite a lot of these on each continent. Any of them can talking to any one of the saddlelites that are in range.

Now, each control point having spechul

[*Continued on page 119*]

THE HALF WAVELENGTH DDRR ANTENNA

BY G. W. HORN,* I1MK

The author presents a half wave version of the DDRR antenna that results in a more manageable size for construction at very high frequencies along with an increase in gain so that the performance, at all frequencies, is almost equal to a conventional quarter wave vertical.

While important for v.l.f. and m.f., the reduced height antenna is also valuable in mobile and portable operation in the h.f. and v.h.f. bands, where the vertical height of a resonant λ/4 radiator is mechanically impracticable.

A naturally resonant λ/4 vertical radiator, as the ground-plane, is an ideal device for general communications, providing an omnidirectional radiation pattern with most of the signal's power delivered at low angles. Theoretically speaking, a radiator of this kind can be considered as a sollinear aperture: at full height its radiation resistance is far larger than any other loss-resistance, permitting excellent radiation-efficiency.

To reduce the physical height of the classical λ/4 vertical dipole, series inductances and/or terminal capacitances can be used in order to restore electrical resonance. Unfortunately, the reduction of antenna height removes a portion of its colinear aperture, the loss of which means loss of radiation resistance: antenna performance deteriorates severely because of the reduced energy coupled to space.

In 1963 Mr. J. M. Boyer [1] presented the DDRR-antenna (directional-discontinuity ring-radiator), a sketch of which is shown in fig. 1. In 1964 an amateur version of the DDRR was published in CQ.[2]

A review of the original version of the DDRR would be in order before discussing the new unit. In the DDRR-antenna, the circumferential aperture is substituted for the collinear portion lost in height reduction. A ring-conductor whose diameter D is 28.6 electrical degrees (0.078 wavelength), in which case its circumferential length will be a quarter wave, is naturally resonant. The DDRR-antenna is set up by such a ring-conductor erected over a ground-plane at a distance of approximately 2.5 electrical degrees (0.007 wavelength) from it; the ring is left open for a short distance (Y) and one end of the gap is connected to the ground plane. The mathematical analysis shows that the radiation efficiency of an antenna of this kind must be within 2 to 3 db of a full-height λ/4 vertical radiator erected on the same ground plane.

If an r.f. generator is connected across the slot set up by the ring-conductor and ground plane, an electromagnetic wave will be launched in this curved boundary region, and from that into the space. By the way, the DDRR-antenna ring forms a transmission-line (or a guide) with its ground plane:

*S.S.B. and RTTY Club, P.O.B. 144, Como, Italy.

[1] Boyer, J. M., "Hula-Hoop Antennas: A coming trend?," *Electronics*, Jan. 11, 1963.

[2] Hicks, C. E., "The DDRR Antenna," *CQ*, June 1964, p. 28.

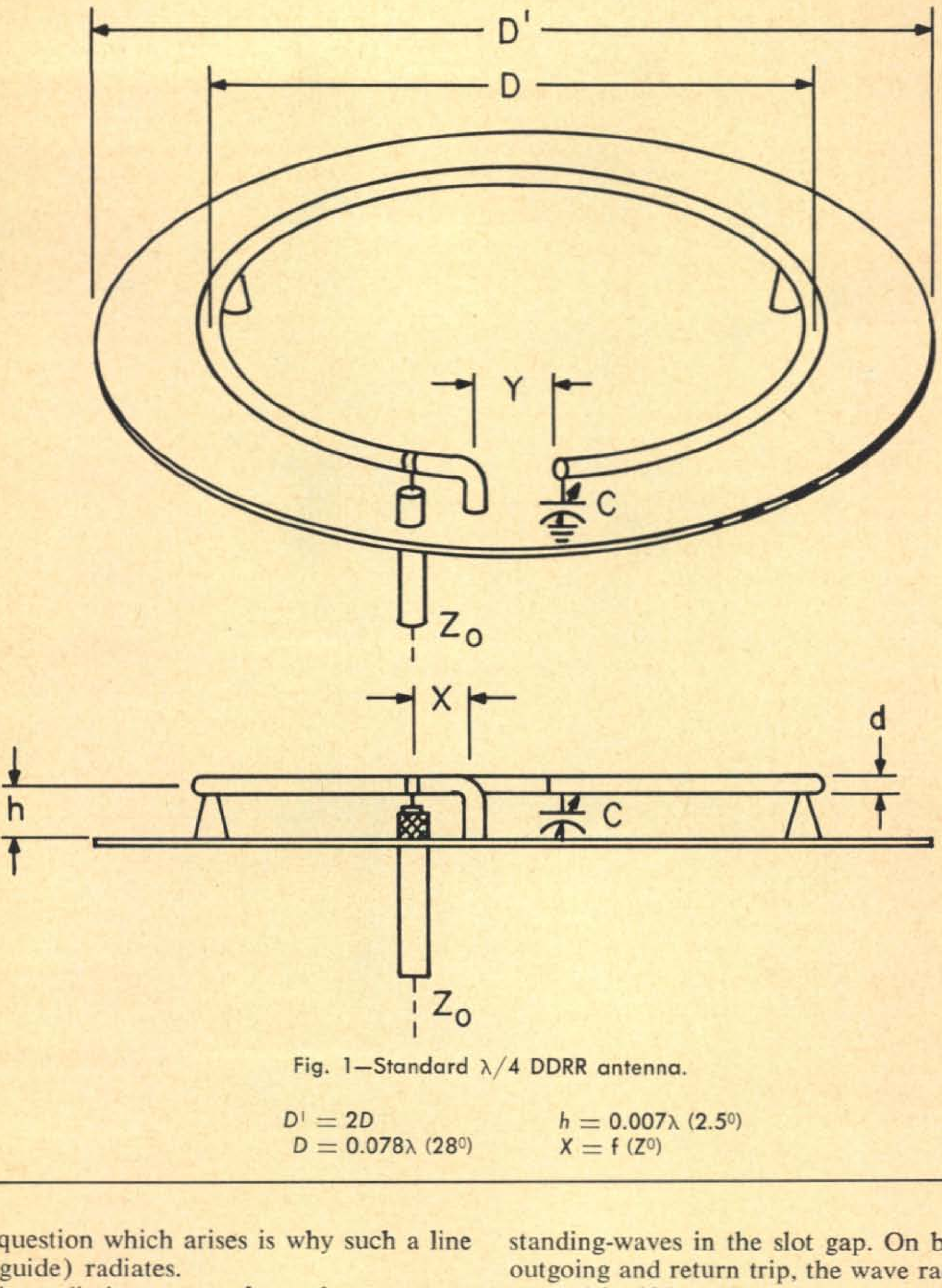


Fig. 1—Standard λ/4 DDRR antenna.

$D' = 2D$
$D = 0.078\lambda \ (28^0)$
$h = 0.007\lambda \ (2.5^0)$
$X = f \ (Z^0)$

the question which arises is why such a line (or guide) radiates.

The radiation comes from the curvature of the ring-conductor; in fact the slot between ring and ground plane is a constant series of physical discontinuities. Thus the wave, in its path along the slot, radiates continuously in a direction transverse to the ring axis throughout its full length. The electromagnetic wave, launched by the generator into the guide, radiates until it meets the far end of the slot; the energy remaining at this point reflects back to the generator and, interfering with the outgoing wave, produces standing-waves in the slot gap. On both the outgoing and return trip, the wave radiates a part of itself into the space.

The electromagnetic field radiated by the DDRR antenna is set up by a horizontally polarized component, due to the current flowing in the ring-conductor, and a vertically polarized wave which takes place from the higher modes determined by the geometrical discontinuities. The first electromagnetic component is cancelled out by its antisymmetrical in the image plane. Far from the antenna, the radiated field consists therefore of a vertically polarized wave only.

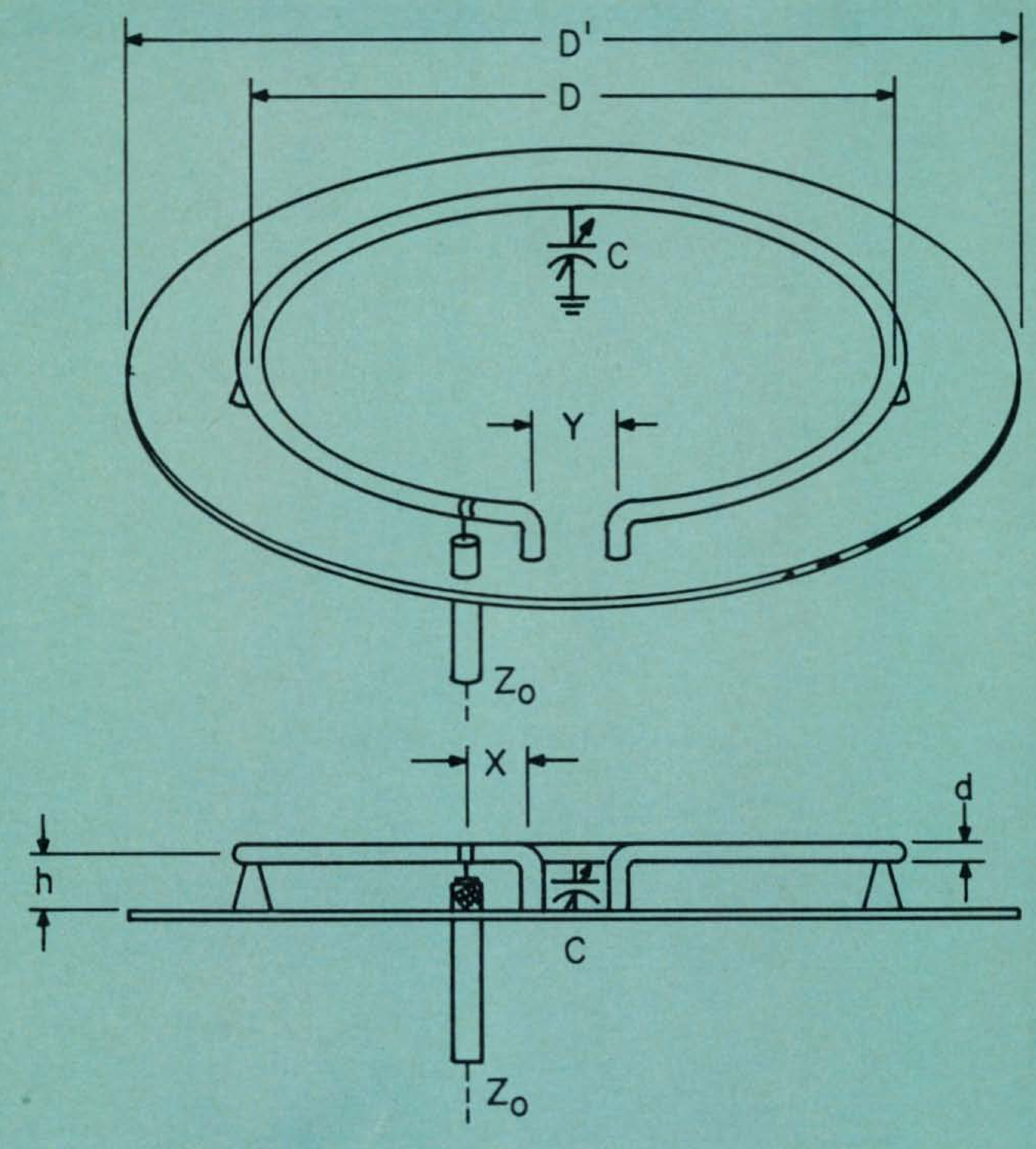


Fig. 2—Dimensions of the λ/2 DDRR antenna.

$D' = 2D$ $\quad h = 0.007\lambda\ (2.5^\circ)$
$D = 0.158\lambda\ (56^\circ)$ $\quad X = f\,(Z^\circ)$

The DDRR antenna is naturally resonant when the diameter of the ring is approximately 28 electrical degrees since the circumference will then equal 90°. Resonance is practically independent from ring's height above the ground plane. In practice, to remove small mechanical differences, it is advisable to adjust the ring's diameter slightly to restore resonance by means of a low-loss air capacitor connected from the open end of the ring-conductor to ground.

The DDRR antenna is fed by a transmission line connected between ring and ground plane: any line having a characteristic impedance from 50 to 300 ohms may be used. Impedance-matching is accomplished by varying distance *X* (see fig. 1). This operation should be carried out while monitoring the s.w.r. on the feedline.

The DDRR antenna may be tuned over a 2:1 frequency range by adjusting capacitor *C*, without the s.w.r. exceeding a value of 2. Antenna bandwidth depends somewhat on the diameter of the conductor which forms the ring. A tubular conductor of at least ¼" is recommended. Ground plane diameter is

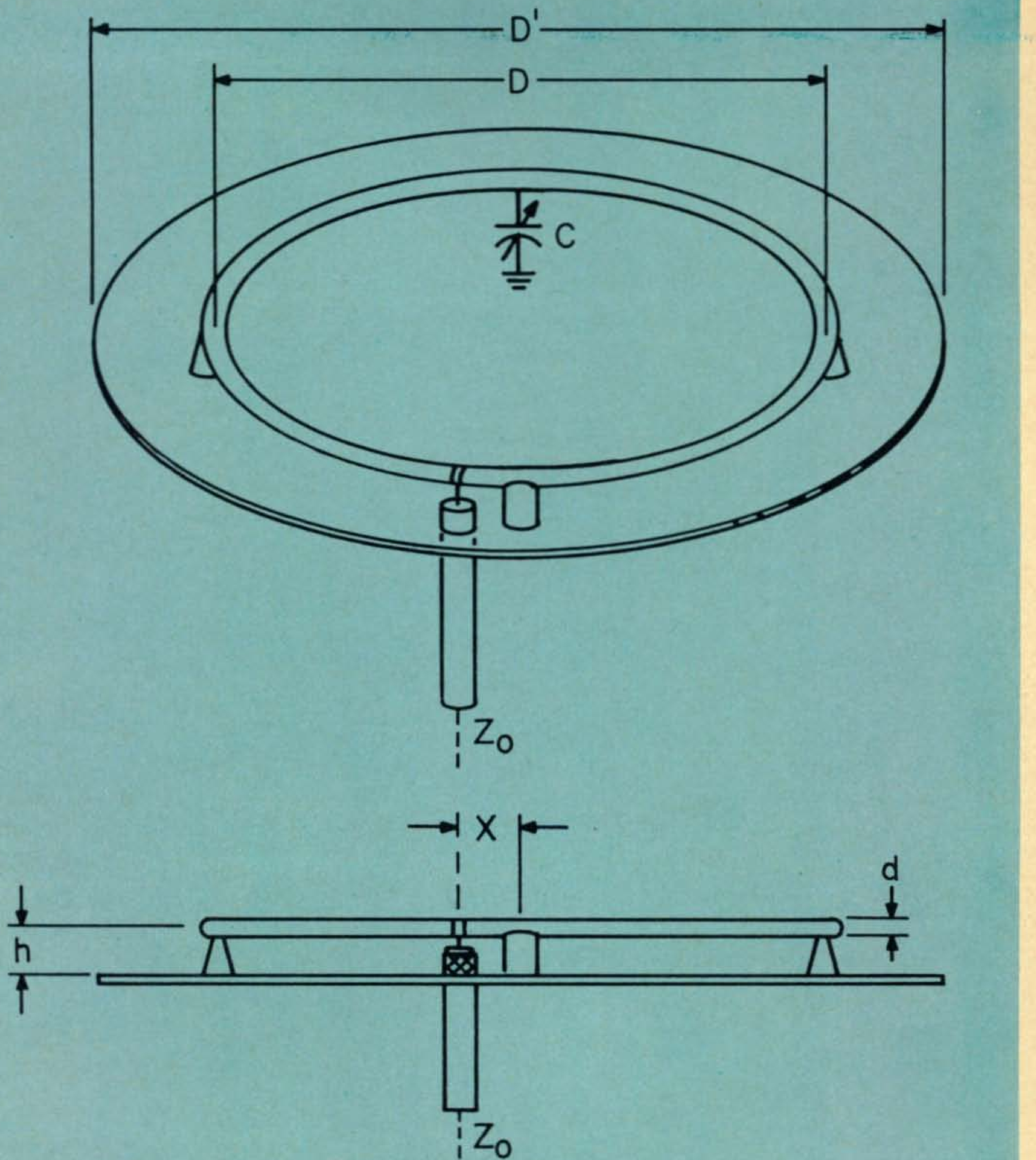


Fig. 3—Final design of the λ/2 DDRR antenna. Perfect symmetry is provided by joining the ring's ends at the ground point.

$D' = 2D$ $h = 0.007\lambda$ (2.5°)
$D = 0.158\lambda$ (56°) $X = f(Z^\circ)$

not critical at all, if it is extended beyond the boundaries of the ring. If feasible, a ground plane having a diameter of 1.5 to 2 times that of the ring should be installed; copper, brass, aluminum or even tin-plate can be used. At lower frequencies, the solid ground plane can be replaced by a star of radials.

A λ/2 Version of the DDRR Antenna

The standard DDRR offers many advantages: small horizontal-plane dimensions, extremely low height, ease of construction, mechanical strength, *etc*. Besides, it acts as a high-Q bandpass filter centered at the operating frequency, providing better selectivity which, in receiving, results in

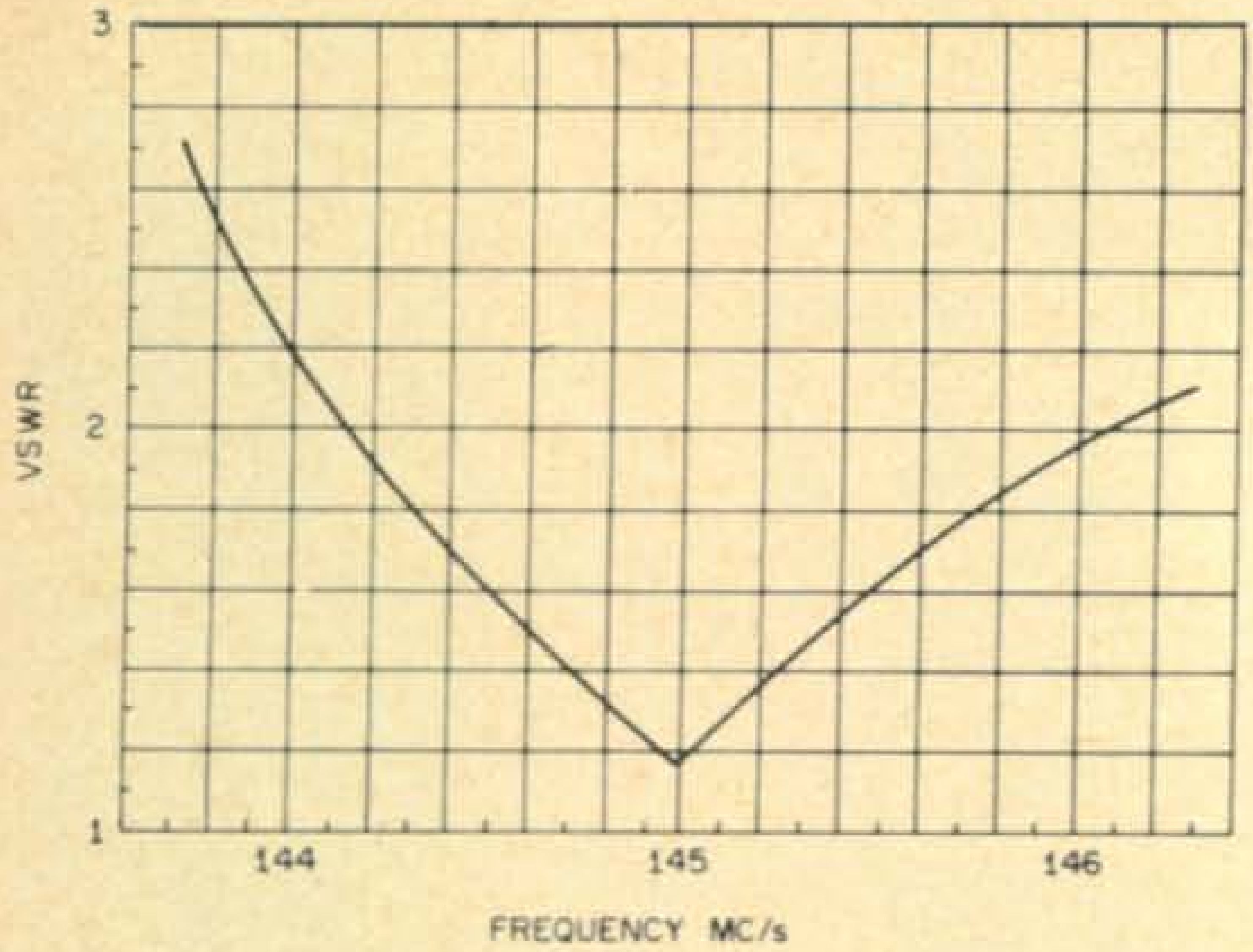


Fig. 4—A plot of the s.w.r. *versus* frequency of the 2 meter DDRR constructed by the author. The antenna dimensions are listed in Table I.

minimizing adjacent-channel interferences, improved image response and reduced cross modulation from strong signals. Being grounded, an automatic static-drain is also provided which reduces the worst effects of charges induced by fog, dust and rain.

It was thought desirable, therefore, to experiment with the DDRR-antenna at v.h.f., having in mind the installation on the car-roof, for mobile operation as the DDRR-antenna is very inconspicuous.

Unfortunately, at v.h.f., the physical dimensions of the ring-radiator become so small (half a foot in diameter, at 144 mc) that the slot cannot be coupled efficiently to space. Besides, the close proximity of ring's open end to its feedpoint causes a stray r.f. coupling on the transmission-line: impedance matching becomes very difficult, if not impossible.[3]

The standard DDRR-antenna original design has been changed according to fig. 2. The ring radiator has been made λ/2 long, 56 electrical degrees in diameter. The ring is mounted on steatite pillars at a distance of approximately 2.5 electrical degrees (0.007 wavelength) above the ground-plane. By constructing the ring as shown in fig. 2 perfect symmetry is achieved; at the same time, the cross-section of the slot is doubled. As the original, the λ/2 DDRR may be capacitively tuned by means of *C*, while feedline matching is provided by adjusting feedpoint distance *X*. The capacitor *C*, which must be a low-loss well insulated air variable, is connected between loop's highest impedance point and ground. Because of the reactive loading due to *C*, the diameter of the ring should be reduced to about 52 electrical degrees (0.158 wavelength).

Rod diameter *d* and height *h* above the ground plane determines the bandwidth of the radiating system. About its gain, a remarkable improvement over the standard λ/4 DDRR has been experienced. Distance *Y* is not critical; the geometrical discontinuity at *Y*, which causes a 3 db jump in the directivity pattern, can be eliminated, of course, by closing the loop joining its end, as in fig. 3.

Several λ/2 DDRR-antennas have been experimented and installed for operation either in the 2 meter band as in the 156-174 mobile-service band. For operation in the 144-146 mc band, the λ/2 DDRR-antenna may be built according to the following dimensions:

Table I—DDRR antenna dimensions for 145 mc.

Ground plane diameter	*D'*	(copper)	500 mm (19.7")
Ring diameter	*D*		288 mm (11.34")
Rod diameter	*d*	(copper)	6 mm (0.24")
Ring height	*h*		25 mm (0.98")
Feedpoint distance	*X*	(50 Ohms)	15 mm (0.6")
Capacitor	*C*	(at 145 mc)	7.5 mmf

In fig. 4 a graph shows s.w.r. behavior as a function of frequency. The DDRR-antenna was resonant at 145 mc and, at this frequency, the standing-wave ratio has been found to be 1.15 to 1.

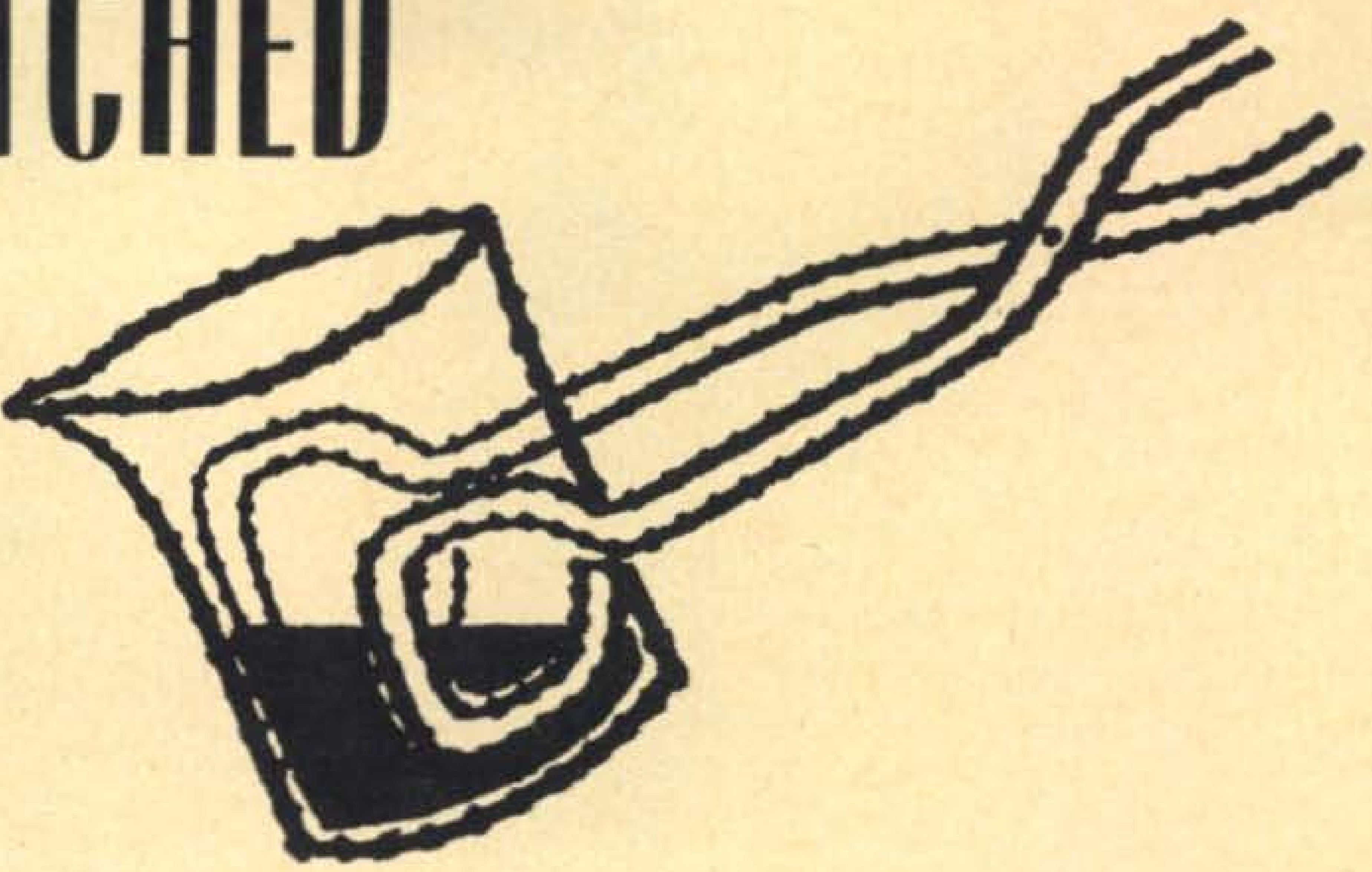
Tune Up Procedure

Tune up procedure involves first the adjustment of capacitor *C* for antenna resonance at the chosen frequency with the feedline disconnected from the ring. Resonance will be indicated by a grid-dip-meter held inside the slot in close proximity to the pillar which connects the ring to ground. Then the transmission-line may be connected and its tap adjusted for a minimum s.w.r. at the operating frequency. Capacitor setting and feedline tap adjustment are somewhat interdependent: both operations should be carried out many times till a minimum has been obtained. It should be possible to get

[*Continued on page 118*]

[3] Horn, G. W., "Una nuova Antenna Omnidirezionale per VHF," *SSB and RTTY Press*, Nr 1/1967.

SIMPLE ETCHED CIRCUIT BOARDS



BY HARRY LOWENSTEIN,* W2HWH

IT SEEMS that in the past few years, practically every construction article has a circuit board somewhere, vaguely defined as "the group of components mounted on an etched board".

About ten years ago, in *CQ*, a series was run on circuit boards including artwork, photography, hardening emulsion, etc.[1] This was the technique, at that time, for manufacturing these little boards in volume.

Don't ask the pros how they make boards today. They get involved with conducting paint for electroplating, wave soldering machines that cost thousands, art work ten times up in size, taking six weeks to complete. We all could get discouraged. The amateur on the other hand is interested in a "one time" circuit board for a speech amp, product detector, keyer or what have you.

Like it or not, circuit boards are here to stay. Parts are rigidly mounted, easy to service without pulling layers of parts to get to one bad capacitor. I have never been able to get as many parts in as few square inches of space as on even a poorly designed board. (Besides with the boards, you use up all the resistors with the real short leads, and those dandy surplus computor boards which, incidently, have high quality components.)

Making the boards for home projects, in your own kitchen, is neither complicated, mysterious nor difficult with the materials now available from mail order houses. A year ago I invested $3.65 in a bottle of etch, some board stock, masking tape and a pin vise. At my present rate of production (including a few duplicates for friends) I still have enough left for another year.

Setting Up

As an example of a typical project let's consider the 100 kc-10 kc frequency standard designed by W8VWX and published in *CQ*.[2] Here is the time breakdown for building the complete unit on an etched board.

1 hour—reading and scrounging for parts.

1 hour—laying out the board and center punching.

½ hour—laying out tape on the board.

½ hour—drilling.

½ hour—etching.

2 hours—mounting parts, soldering and troubleshooting.

Board Procedure

The step by step procedure for making the board is as follows.

*806 Morris Turnpike, Short Hills, N.J.

[1]Klein, E. L., "Printed Circuits and the Amateur," *CQ*, Part I, Feb. 1956 p. 15 Part II, March 1956, p. 38, Part III, April 1956 p. 34.

[2]Erdman, A. C., "A Simplified Frequency Standard," *CQ*, November 1966, p. 60.

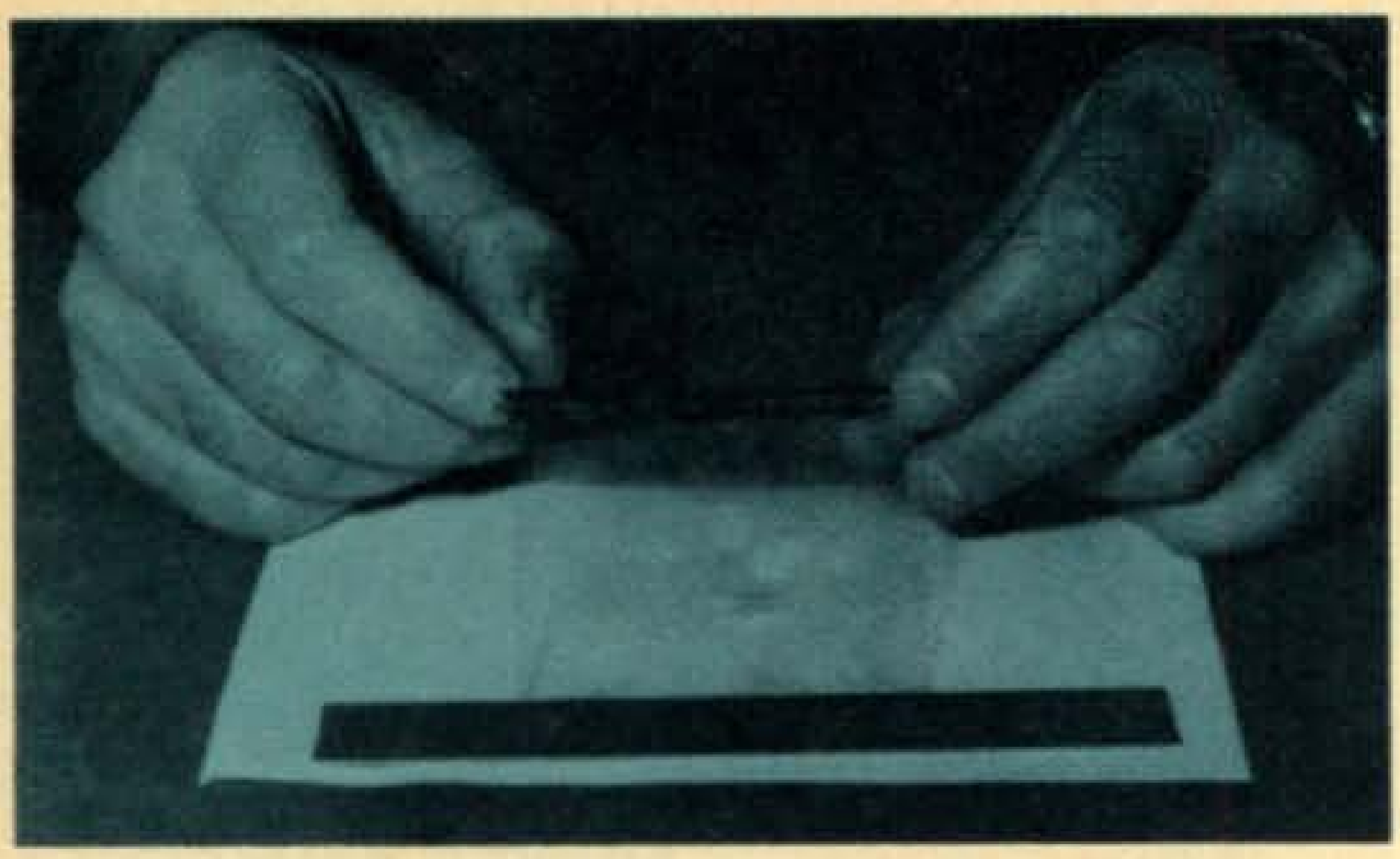


Fig. 1—Fabricate a template from celluloid, or a similar material, to aid in drawing the parts placement holes. As shown above, the template has the outline for a ¼ watt resistor and a ⅜" hole for transistors. The resistor outline and hole location is also satisfactory for most small capacitors.

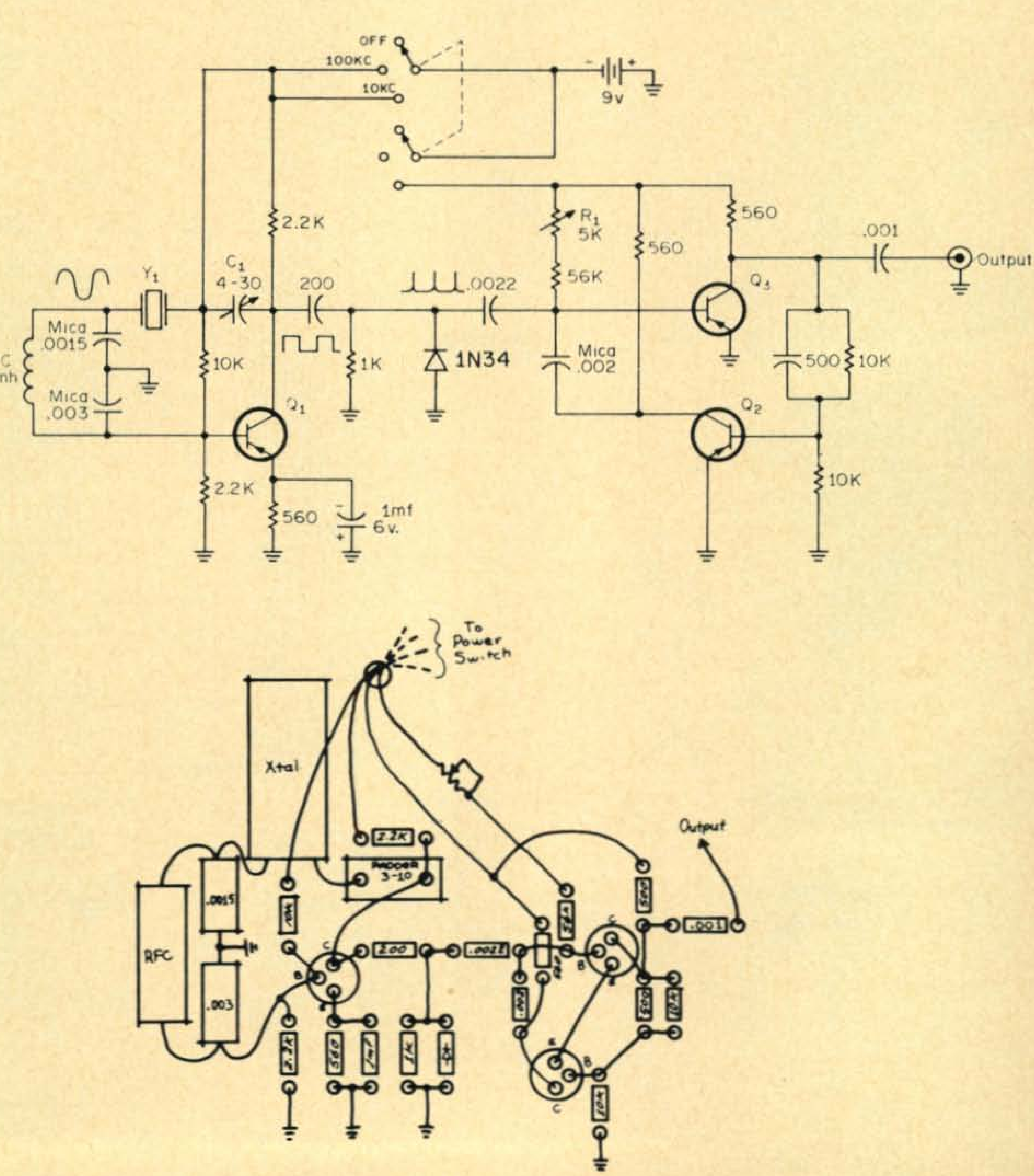


Fig. 2—The schematic shown at (A) must be laid out roughly in a preliminary sketch as shown at (B). This took about 15 minutes.

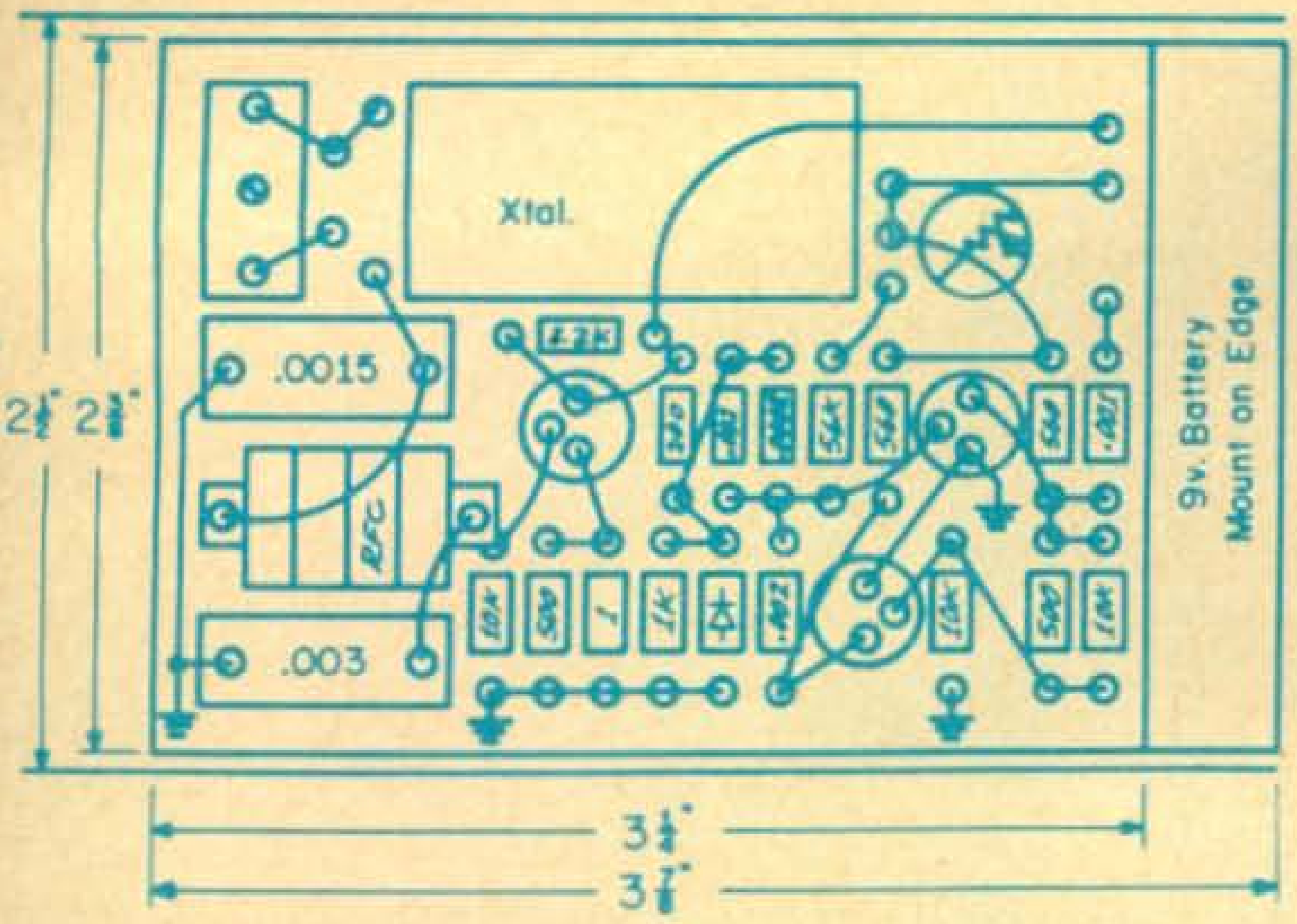


Fig. 3—Based on the preliminary sketch it is possible to decide the area of the board to be used. In this case it was decided to work in an area of 3" × 4", approximately in order to fit the board into a 2" × 3" × 4" aluminum box. Redraw the placement to improve and shorten wiring and, where possible, line up the transistors and components like soldiers. It may not benefit the operation but as the XYL says, it looks cute.

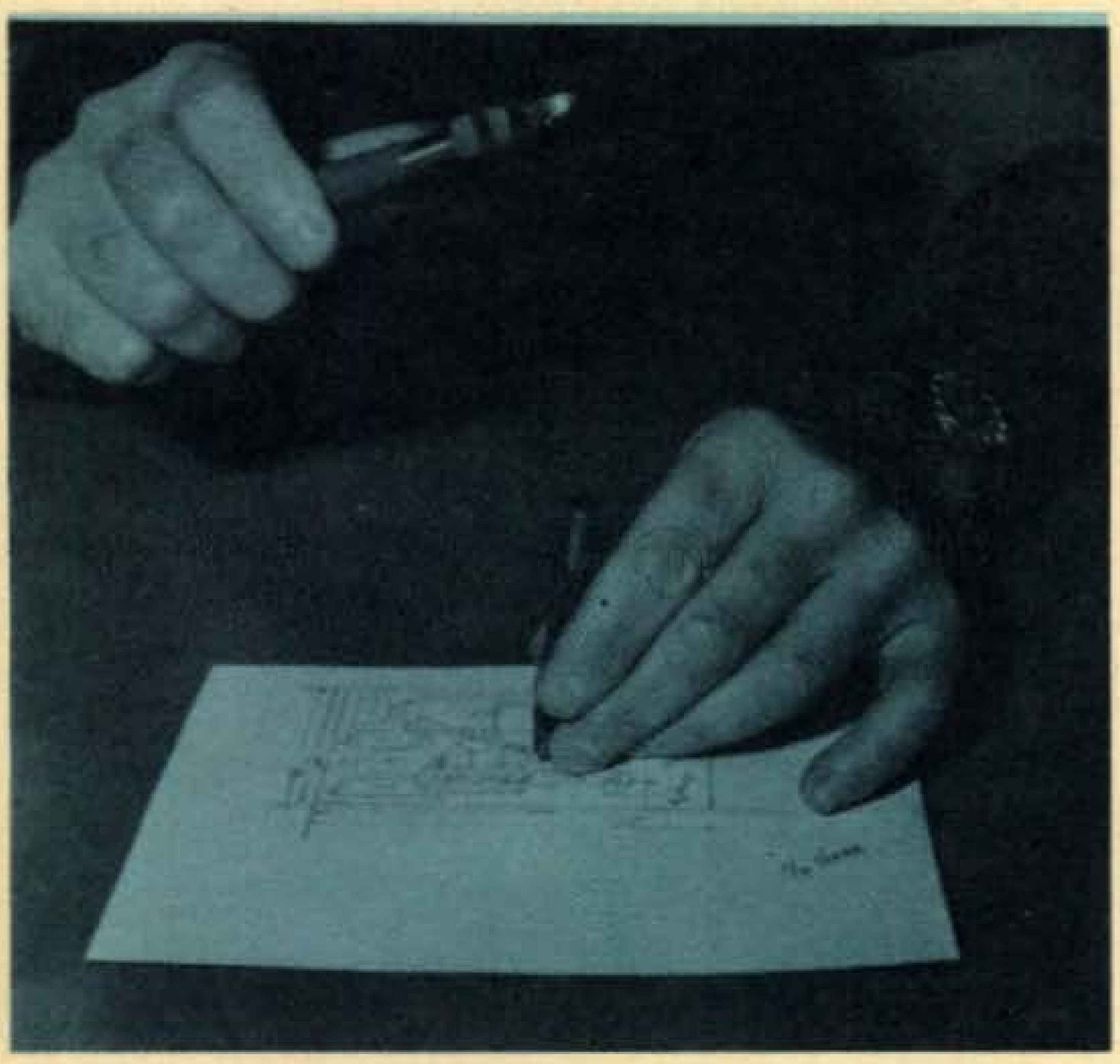


Fig. 4—After cutting the board to size with a jig saw and filing the edges, tape the copper side up to the back of the drawing. Punch the centers of the locating holes (where leads go through the board) with a light tap. Check the circuit as you go along. Don't worry too much about making an error as you can peel off the copper and substitute wire jumpers to correct the circuit.

Fig. 5—Drill the locating holes with a #55 drill in a pin vise. A small hand held high speed rotary drill would be better if it is available.

Fig. 6—Run the connections together with 1/16" tape (Lafayette #19C 6813—75¢) and cover the holes with tape (areas not to be etched). Lafayette also has 3/16" disc tapes (#19C 6816—75¢) if you would prefer them. Some constructors prefer to drill after the etch bath but I find the holes a good reminder as they prevent me from forgetting to tape a line to the hole. Every drilled hole must connect somewhere.

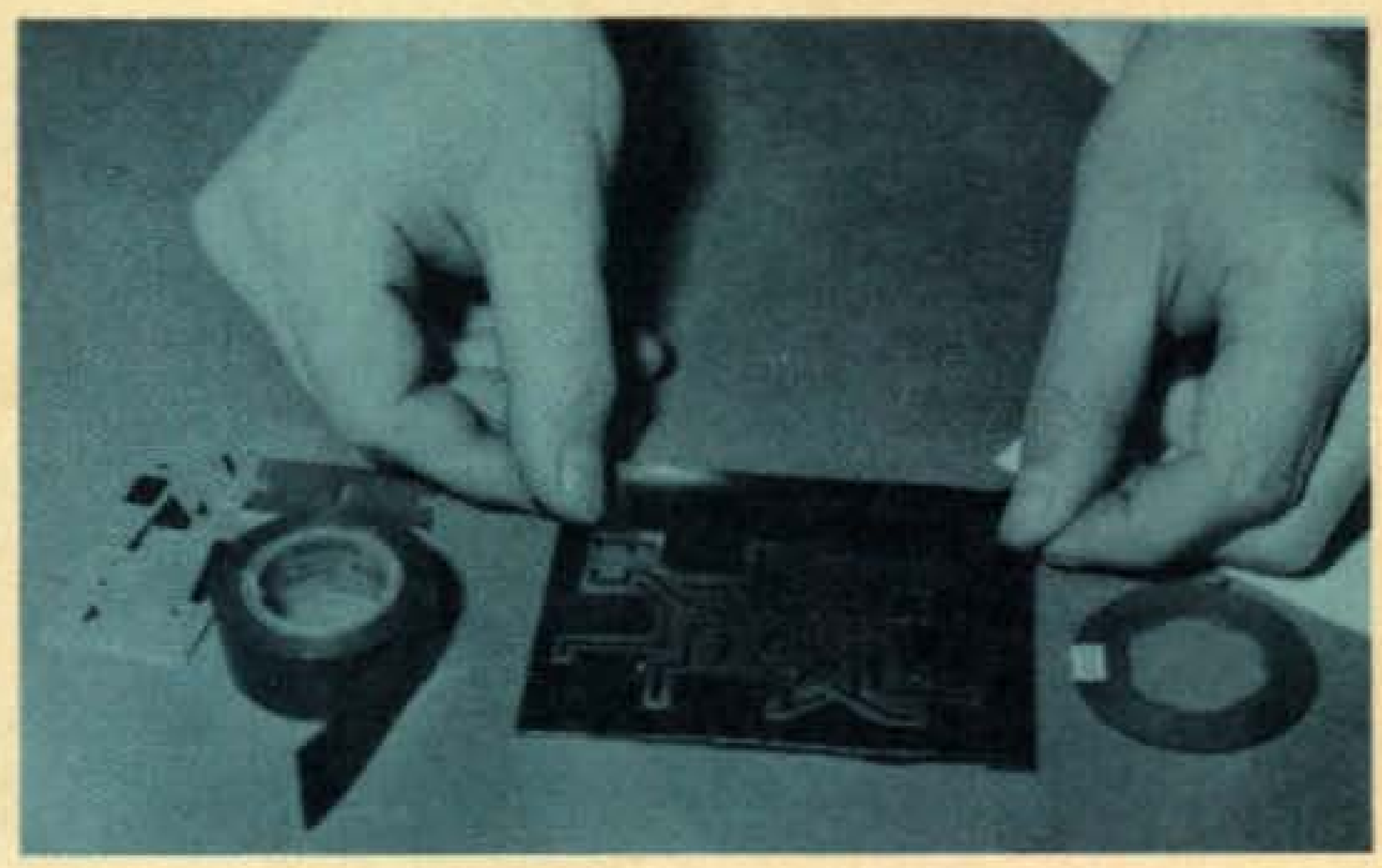


Fig. 7—Mask off the ground area that is not to be etched using ordinary plastic electric tape. The more area masked off the longer the etching solution will last as it is rated in square inches of copper removal (Lafayette #19C 6809—$1.25 pt.) Mask the plastic side of the board to prevent the etch from going through the drilled holes. Etch the board until you can see through it except for the taped areas and connecting lines. Rinse the etch off and steel wool the surface lightly so it can be soldered to easily.

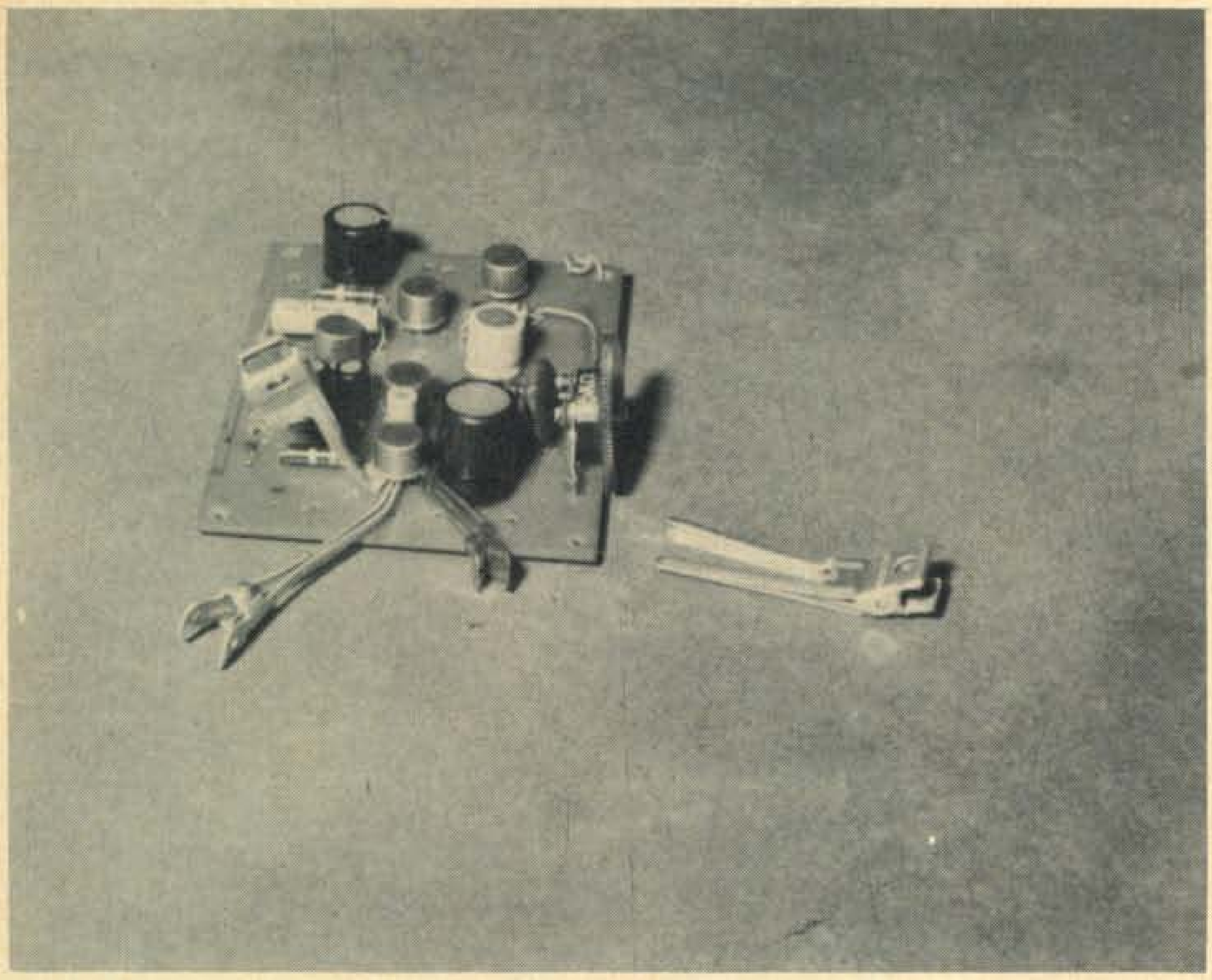
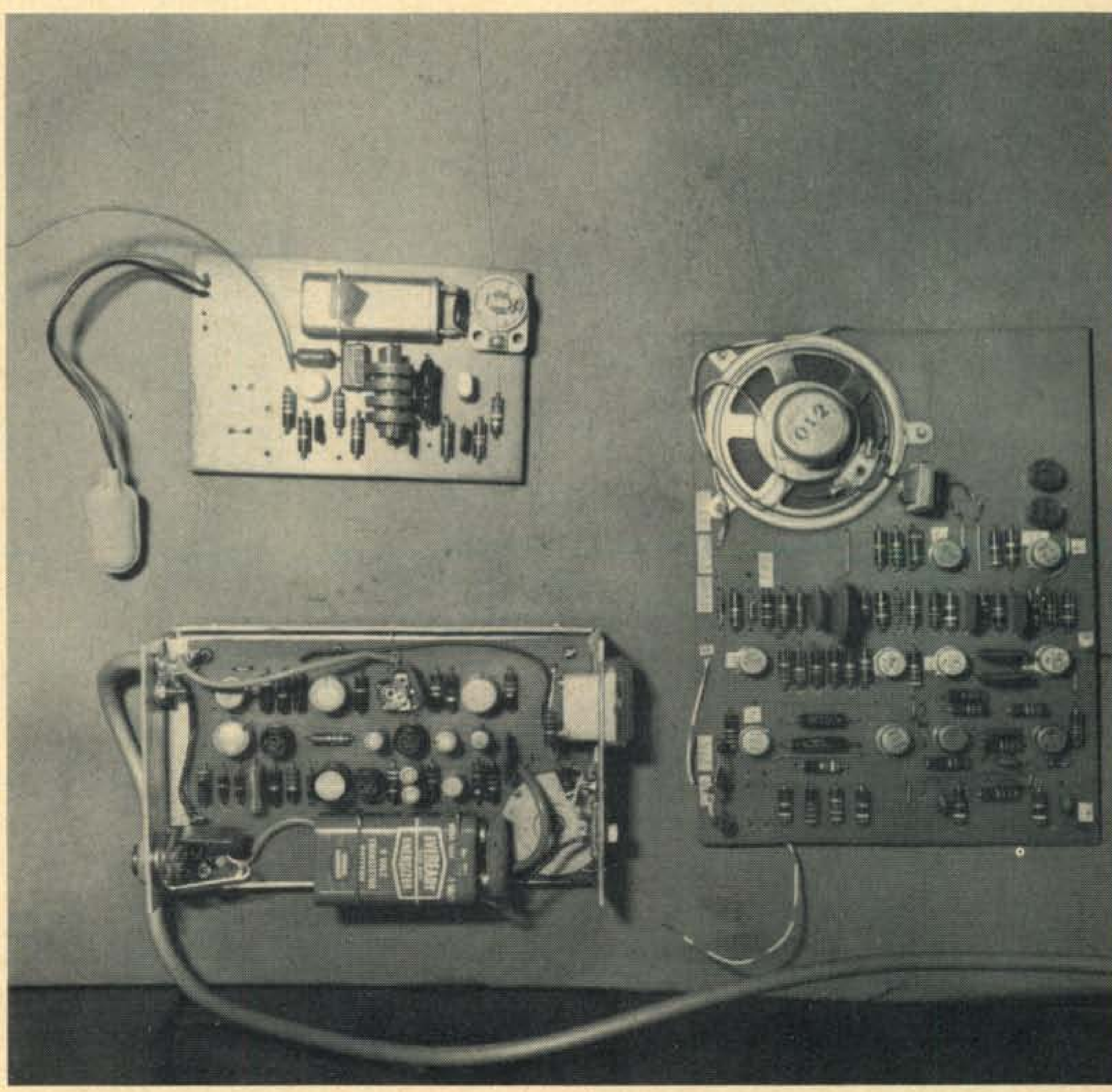


Fig. 8—Insert the parts accord-to the circuit layout and solder them down using a very light duty soldering iron (25 to 35 watts). Heat sensitive components must have a *heat sink* to prevent damage. The heat sinks shown are aluminum and can be bent to fit a confined space.

General Considerations

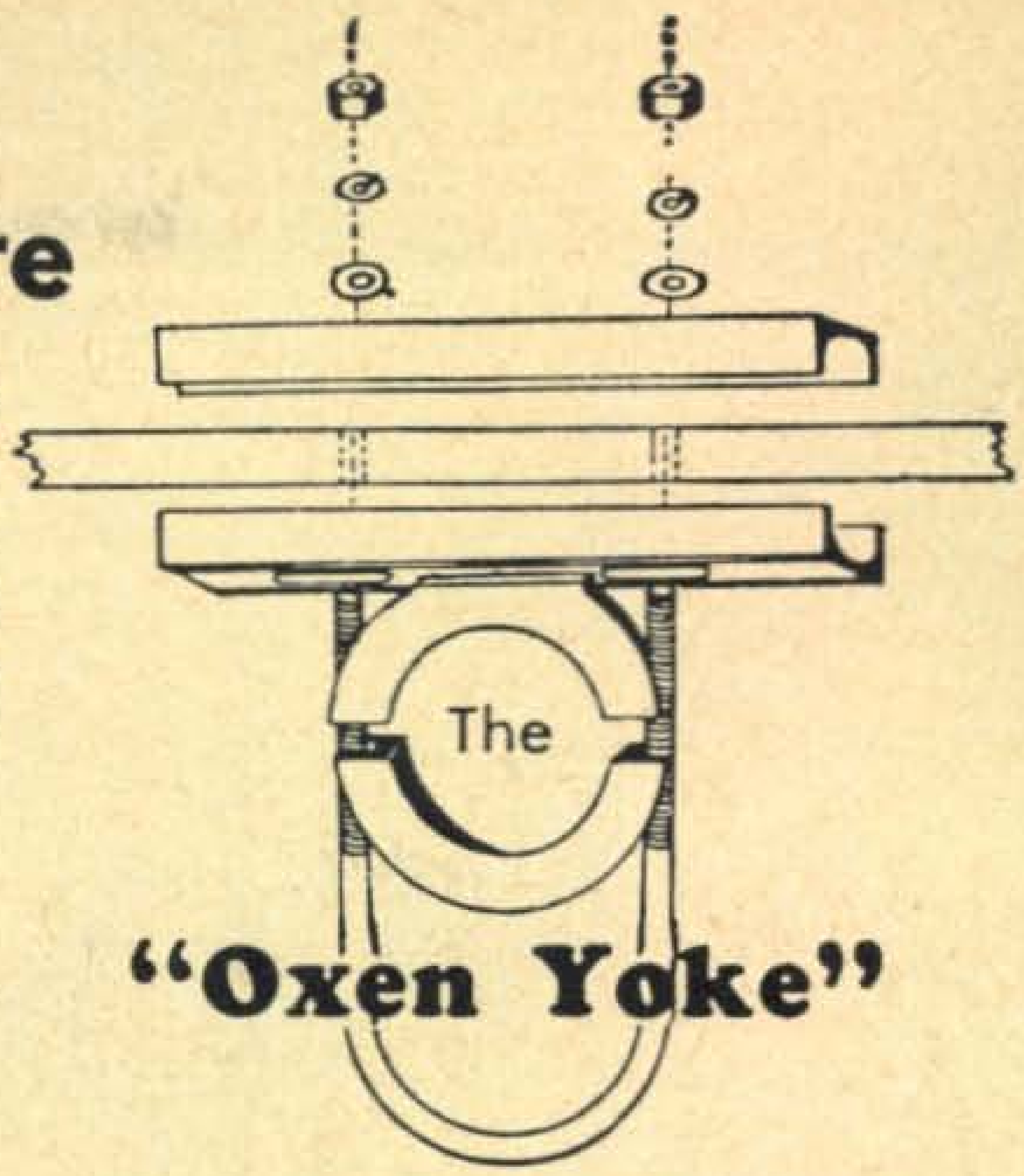
Before soldering in a transistor permanently I found it wise, particularly if the junk box variety is used, to try it in operation. To do this I use transistor sockets temporarily and plug the transistors in. If the performance is satisfactory remove the transistor and unsolder the socket leaving a small lump of solder on the copper. Redrill the three holes, drop the transistor in place and, using heat sinks, resolder by just touching the lumps of solder.

At the risk of being redundant let's talk about heat sinks again. It is very important because of the very short lead length on the transistors, diodes and other components that makes them subject to ruin even with a 25 watt iron. Using your daughter's or XYL's hair clips is a good bet because they seem to have an inexhaustable supply of them. ■



Shown are three projects built in the manner illustrated in this article. Upper left: Frequency standard described in Dec. '65 CQ. Lower left: Speech amplifier-compressor (*QST*, Aug. '65). Right: CPO Keyer (*QST*, Dec, '62).

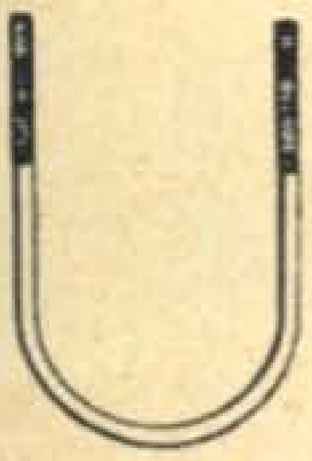
Do It Yourself Universal Beam Antenna Hardware



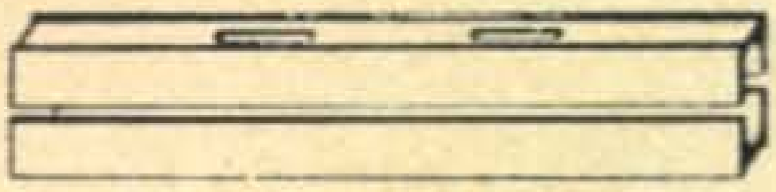
Yes, by popular demand, this time-tested product designed by W8FYR is again available so you can build yourself a better beam antenna. Any form-fitting element holder channel locks with any yoke size. Correct size U-bolt A or C are automatically supplied. Several tons of these quality die-cast clamps are in use the world over.

Complete Clamp $2.29

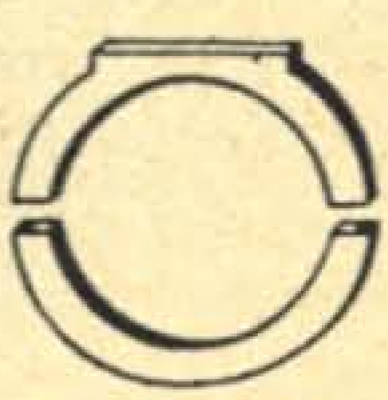
Insulated type clamps also available



SIZES
A or C
5/16 x 18



¾-⅞-1-1⅛-1¼-1½



1¼-1½-1⅝-1¾-2-3

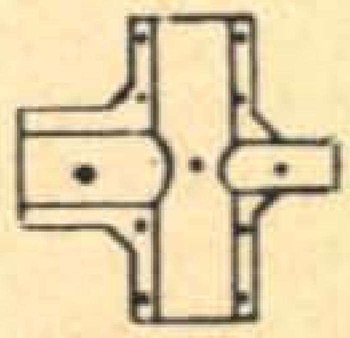
When ordering element to boom clamps, furnish us with element and boom size. When ordering boom to mast mounts, furnish us with boom and mast size.

HEAVY DUTY BOOM TO MAST MOUNTING

Heavy die cast mounting plate uses 4 U-bolts and 4 yokes. Size required. Available as a single or dual plate assembly.

Single Plate Mount **$8.95**
Dual Plate Mount **$11.95**

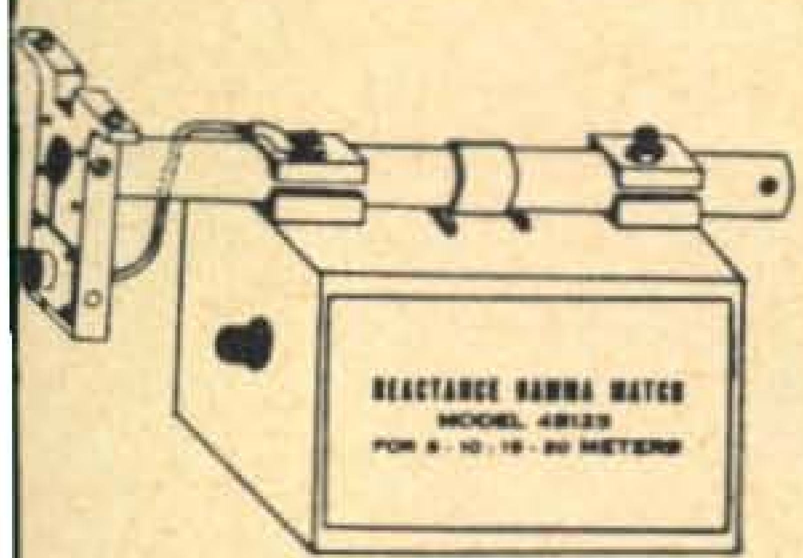
BOOM TO MAST T MOUNTS



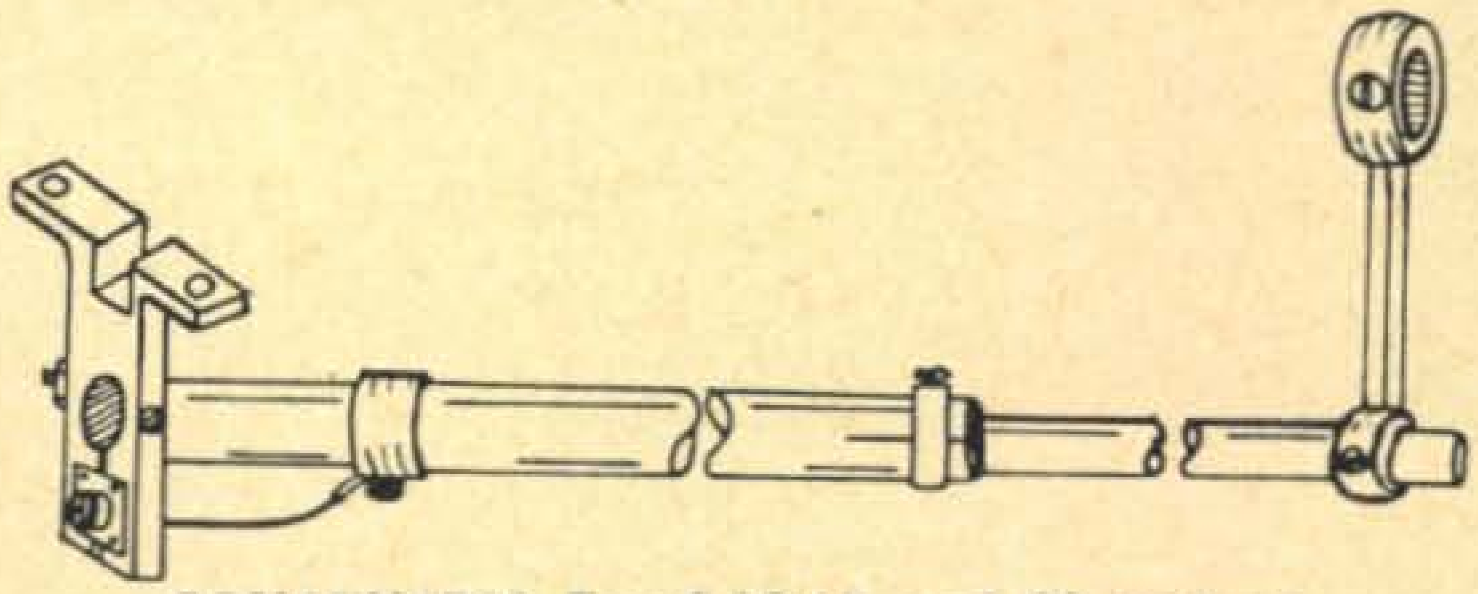
These die cast form fitting boom to mast mounts are a sure way to keep that beam in the air. Low in cost. Buy high in reliability. Available in

1¼ in. to 1¼ in. .... **$2.95 Net**
1½ in. to 1½ in. .... **3.95 Net**
1½ in. to 2 in. .... **4.95 Net**
2 in. to 3 in. .... **6.95 Net**

Reactance Gamma Matches



For 6-10-15 and 20 meters, designed for coaxial lines for perfect unity. Power to 1000 watts and over — The ideal match for unbalanced line to balanced antenna. Will t KIRK "Oxen Yoke" clamp. Provisions are also ade for mounting to boom when other than IRK Oxen Yoke antenna clamps are used. akes antenna tuning extremely easy. Tune in ve minutes. Gamma unit becomes part of amma line. Shipped with complete installation nstructions and easy tuning method. **$14.95**



CONCENTRIC For 6-10-15 and 20 meters

An inexpensive way to match an unbalanced line such as RG-8U or RG-11U to a balanced antenna is by this concentric gamma. Unit will handle maximum legal power. Always specify boom and element size when ordering for proper contacting bracket.

BAND		NET PRICE
	6M	$5.95
	10M	6.95
	15M	7.95
	20M	8.95

Send 10¢ in stamps for complete brochure and technical manuals giving construction methods and designs of monobander, interlaced dual and tri-band full size arrays.

KIRK *Electronics*

6151 DAYTON-LIBERTY ROAD DAYTON, OHIO 45418
PHONE: AREA CODE 513 — 835-5028

For further information, check number 21, on page 126

Electronics Careers

Is There One In Your Future?

BY HOWARD S. PYLE, W7OE

PART I: CRASHING THE GATE

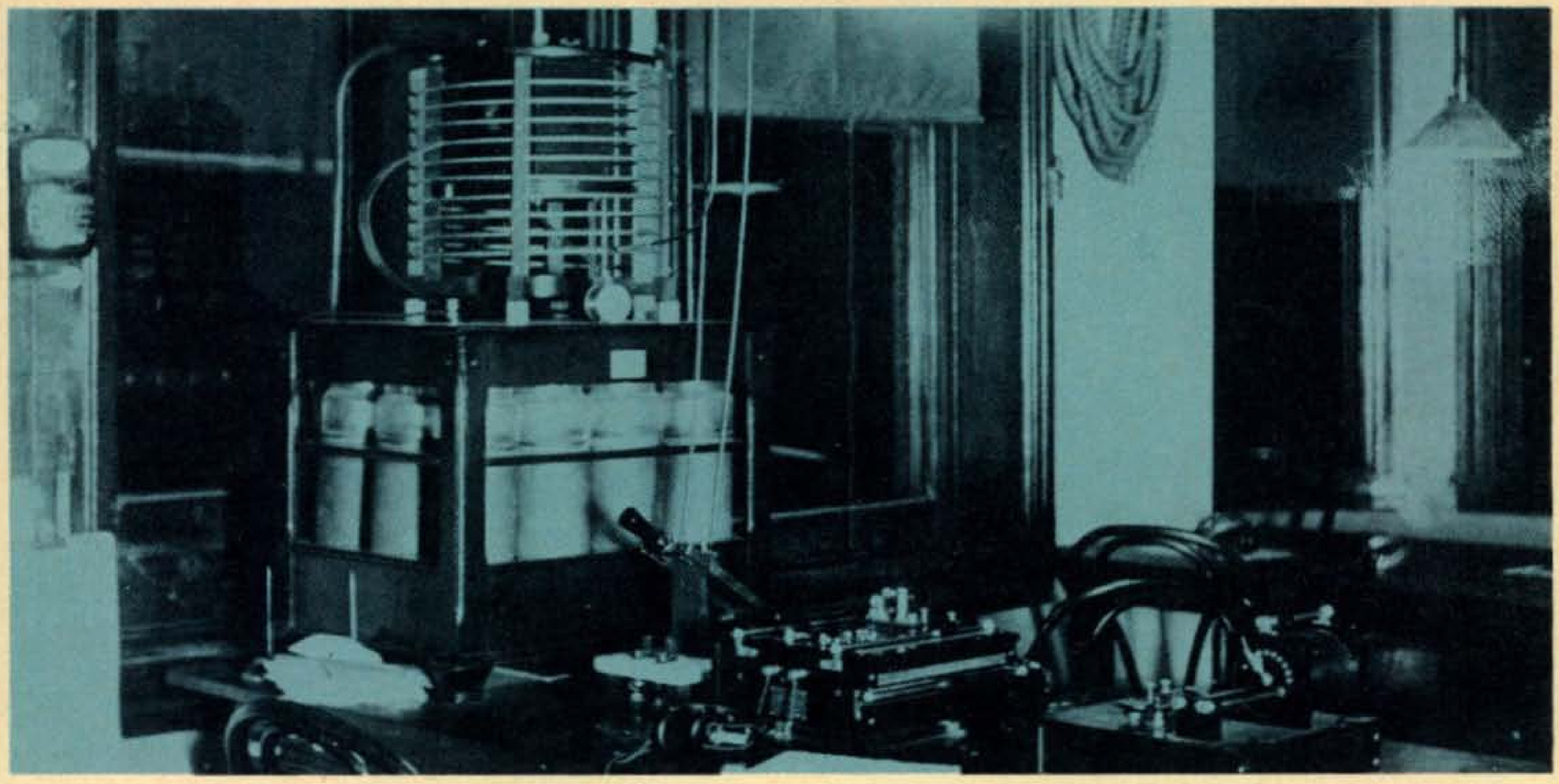
STUCK in a groove? Tied to a job you don't like but see no other way to continue feeding and housing your little brood? Or maybe you're a student looking forward to graduation but undetermined as to your future career. But you *are* a ham and for many more of you than you may think, this unlocks the 'door to opportunity' and gives it a healthy shove! That's right; knowingly or in blissful ignorance, you have more than dug a place for yourself in this crowded vale of tears . . . you have in fact, created a rather impressive excavation! And what are we talking about? Electronics, of course; one of the fastest growing and most fascinating fields open today! Not only to youth groping for a niche in which to make their bid for future fame, but clear on up through the middle-aged brackets!

Equally open is the electronic door for the graduating student; a college degree is an added asset but completion of only high school or even lesser levels does not bar you. In this and succeeding installments, we will examine the firm foundation on which the electronics science is based; we will point out to you the boundless opportunities open to adequately trained personnel who are the life blood of the art. And . . . we will show you the tremendous advantage you have in entering this field through your well-rounded basic training as a radio amateur.

In a series of three installments, the author points out the tremendous advantage a radio amateur has in seeking a career in commercial or industrial electronics. If such a goal is in your future, by all means, follow this series.

Your Headstart

Regardless of the category in which you fall, by being a ham you have exhibited a definite leaning toward electronics in general. Ham radio is a hobby which you indulge because you *like* it; nobody *forced* you to become a ham. Regardless of whether your major interest is toward building, experimenting, operating in any of the current modes or one or more of the many diversifications of hamdom, you are *basically* an electronics enthusiast. Has it ever occurred to you that the wonderful foundation for an electronics career which amateur radio provides can be turned to your life-long advantage? That it can become your source of lifetime satisfaction in work which you enjoy doing? And that it can provide you with a most satisfactory income commensurate of course, upon how far you develop your knowledge and skills in this highly specialized field? "And how," you ask, "do I increase such knowledge and skill as I may now have so that I may become eligible for employment in the electronics industry?" The answer is simple; you merely arrange to *acquire* the additional education in whatever specialized branch of electronics appeals to you most. Which, of course, brings up your next question, "Where do I get such specialized training?" Let's examine the many avenues open to you.



One kilowatt United Wireless Telegraph Company equipment operated as a commercial marine shore station for the company by advanced students of the Philadelphia School of Wireless Telegraphy in 1911, using call letters "PW". A code practice table can be seen in lower right background.

Suppose we look first at the military as many of you are awaiting inevitable induction in the armed services. Immediately you have taken your oath, let your assignment officer know at once that you are a ham and the extent of your experience and skill. Make it emphatic that you expect to make electronics your civilian career when your military obligation has been discharged, and request assignment to the electronics school. Every branch of the service has some of the finest, most completely equipped and best-staffed trade schools to be found anywhere in the world. If you are successful in being accepted for such training, you will receive a most thorough and exhaustive schooling. The stress will of course, be on the military aspects, but after discharge, you will find that the foundation you have acquired will serve you well. You need then only enroll in a residential or home-study course in one of the excellent civilian electronics schools. You will find such courses easy sailing and they will orient you to the commercial and industrial fields of electronics in short order.

For aspirants to an electronics career who have completed their military service or for those who are otherwise ineligible, they can enjoy equal educational advantages through one of the many electronic trade schools offering either resident or home-study courses. Many offer both. Such schools, with few exceptions, are long-established, reliable institutions and the prospective student's choice is wide and varied.

No New Enterprise

Schooling in what we now know as "electronics" is by no means a new enterprise. Shortly after the turn of the century when "wireless" first became the magic medium of communication between land and vessels at sea, and between remote points (such as off-shore lighthouses and lightships), and the mainland, recruiting competent personnel became a monumental task. It soon became evident that the rapidly increasing installation of equipment both afloat and ashore demanded that some means of training personnel be devised. The pioneer wireless communication company, Marconi's Wireless Telegraph Co., Ltd., a British concern, established what was very probably the world's first "wireless school" at their repair depot at Seaforth Sands, England in 1903. Even these facilities proved inadequate to supply the operator demand and additional schools were opened.

In the United States where a number of wireless communication companies had been organized, the same situation existed. Initially, operating pesonnel were recruited from the ranks of the railroad telegraphers as they were already familiar with the telegraph code then used. However, the available supply of adventuresome operators, eager to view the world through a port hole, could not keep pace with the growing demand. Meanwhile a new group of hobbyists were beginning to make their presence felt . . . the "wireless experimenters," fore-

The Merchant marine radio officer enjoys a dignified, well-paying profession plus many fringe benefits.

runner of today's radio amateurs. Many of these were rather proficient in interpreting the telegraph code; others required but a short period of training to qualify them.

It was soon found that the experimenter with his electrical background, limited though it might be, possessed an asset which the railroad telegraphers lacked: a fair smattering of knowledge of electrical and wireless apparatus and wiring. This soon resulted in assigning shipboard operators, insofar as possible, from the wireless experimenter ranks, placing the former telegraphers at shore station posts. The experimenter, faced with equipment breakdown at sea was generally able to effect at least minor repairs whereas the strictly telegrapher class would be forced to await arrival in port for a competent repairman. Even in those days, being a ham had begun to pay off!

However, even the pioneer amateur wireless man as a source of supply for operating personnel was soon exhausted as an ever-increasing number of shipboard and shore station installations were made. The many wireless operating companies which had sprung up in the United States were handicapped alike in the shortage of competent operators. The most prominent and (temporarily!) affluent of these, The United Wireless Telegraph Company, adopted the practice of their British counterpart and established schools, using a unique arrangement. Their school 'classrooms' were combined with one of their actual operating shore stations and as rapidly as students advanced to competent operating speed, were shifted from the code practice tables to the operating position. This provided them with on-the-job training by permitting them to conduct bonafide two-way communication with ships at sea.

The United Wireless Company, however, was not destined to remain long in the picture. Through various shady stock manipulations and other questionable practices, their President and other prominent officials were sent to Federal prison for fraudulent practice. Immediately the British Marconi Company stepped into the gap, purchased all of the assets of the defunct United company and formed a subsidiary organization known as the Marconi Wireless Telegraph Company of America. Rather than adopting the combination school/station arrangement of their predecessor, however, they set up a modified 'subsidiary' school system. Schools were established in existing educational institutions and trade schools of the YMCA and others. The Marconi Company supplied competent instructors and furnished standard commercial wireless equipment for instruction purposes. The institution in turn contributed class room space, light, heat and janitor service. A tuition charge was made by the school which they were allowed to keep as compensation. Their graduates were to be available for employment exclusively to the Marconi Company.

Obviously such a 'closed' avenue of operator supply, froze out the Marconi competitors, many of whom were not financially stable enough to establish schools of their own and they were therefore hard pressed to fill their operator vacancies. Accordingly it was not long before a number of independent commercial trade schools saw and grasped the opportunity. They immediately established courses in wireless telegraphy, employed instructors who could be enticed away from the operating companies and commenced enrollment. Their graduates were made available to *any* operating company.

With the rapid increase in the number of such schools and expansion of their facilities, the operating shortage was substantially reduced until the Radio Act of 1912 was enacted by the U. S. Congress. As this called for a Federal examination in both the new radio telegraph code and the theory and practice of wireless telegraphy, an acute situation again developed. A good number of currently employed operators possessing the meager technical schooling deemed adequate by the operating companies, failed the Federal examinations. A substantial portion of those who *did* pass, however, were the pioneer wireless experimenters; once again, ham radio had paid off! There were, however, an insufficient number to fill the many vacancies.

Curriculums were immediately stepped up by the schools and training efforts were greatly intensified to meet the more rigid requirements of the Radio Act. By the time the war clouds had gathered threatening United States participation in World War I, the situation had once more returned to near normal. With the actual entry of this country into hostilities, however, the picture changed radically. Many of the existing schools were placed under Government contract to train radio operators for military communications. (The term 'radio' had by then replaced the word 'wireless'.) Commercial shipping was either immediately tied up or vessels taken over by the Navy; civilian radio operators were replaced by naval personnel. Many of the commercial operators entered one of the military services; there was little or no demand for civilian operators but they *were* welcomed by the armed forces. To supplement operator training by the commercial schools, the Navy established huge training centers for embryo naval radio operators at strategically located naval bases and some universities.

With the signing of the Armistice in November of 1918, a hectic readjustment again took place. Thousands of military trained radio operators were being released from active service weekly. Most of them severely overtaxed the facilities of the Federal Radio Inspection Service in applying for commercial radio operator license examinations. As fast as they secured the coveted ticket they invaded the 'static rooms,' as the waiting rooms of the radio operating companies were dubbed, hoping for assignment. The maritime world was picking up its loose ends and shipping was gradually being restored to some semblance of pre-war activity. Radio operators were "a dime a dozen" and hundreds of them graced static rooms for weeks on end hopefully awaiting assignment to anything from a harbor tug to a palatial liner. Alas, pickings were thin and many an operator wound up pounding the pavement and knocking on doors in search of a job of any kind to stave off the wolf a bit longer.

The earlier radio schools suffered likewise and many of them fell by the wayside. A relatively few who had prospered through Government contracts managed to survive but with only a scattered few students, mainly from the military overflow who had not made the grade in the Federal license examination and needed additional training. Many had entered the service too late to receive the benefit of the complete military training prior to discharge but who were looking forward to a civilian radio operator career as soon as they could be licensed.

But . . . a brighter day was dawning. Not immediately apparent to the casual observer was the tremendous effect a World War I development in the radio field was to have on the American way of life. War-time impetus had pushed research and experiment toward transmission of the human voice through space using Hertzian waves of the radio telegraph as the carrier.

By the end of the war, some gratifying progress had been made. A few naval vessels, notably destroyers and sub-chasers, had been equipped with experimental radio telephones. These had proven very successful and with such encouragement, further development was zealously pushed. Not only was voice projected over the air waves but frequently musical selections from phonograph records were used as test signals. Radio amateurs were picking these up and could see exciting possibilities for experiment when the war ban on their operations was lifted. This did not occur until October 1, 1919; meanwhile while chafing at the bit, hams were making crystal sets for neighbors and friends; others, with no previous knowledge of radio were eager to listen to the marvels of recorded music wafting through the atmosphere. Newspapers picked it up and soon construction of elementary equipment with which to listen to such test signals appeared in their columns. A number of former shipboard radio operators, frustrated by their enforced stay 'on the beach' became 'Radio Editors' and columnists on major metropolitan dailies, solving their employment problem at least temporarily.

With the restoration of amateur radio operating privileges the full impact of this new entertainment medium was felt full

An early radio telegraph code class at the Massachusetts Radio and Telegraph School.

force. Frank Conrad, Chief Engineer for Westinghouse, and an avid ham, established an experimental radio telephone station at his home. Numerous other amateurs did likewise. Public interest was fanned to fever heat through wide publicity in the press. At Westinghouse, Conrad succeeded in interesting the officials of his company to the extent that they agreed to establishment of a commercial 'radio broadcast station,' legally licensed by the Federal government and assigned the call letters KDKA. The station thus became what has been generally accepted to be the world's first officially recognized, commercially licensed radio broadcast station.

The avalanche of response to these initial programs needs no repetition here. The tremendous impact of the human voice issuing from a 'little black box' in thousands of living rooms throughout the land was beyond even the most vivid imagination! Like an epidemic, the broadcast field expanded literally overnight. Station applications by the score were received at Federal offices and almost daily a half dozen or more new stations took to the air.

It is significant to note that *all* of these stations came within the category of "commercial" enterprises and Federal law therefore required that they be licensed. It was therefore mandatory that they employ *only* Federally licensed radio operators to handle their equipment! No longer were radio operators as thick as fleas; the static rooms of the various commercial marine operating companies were suddenly deserted except for a few to whom the sea-going life still proved most attractive. A surplus of operators immediately became non-existent; rather, a shortage again threatened! With hundreds of heretofore unemployed operators being quickly absorbed by the broadcast station demand, the reactivation of the merchant marine steadily progressing with its consequent requirements for operating personnel and schools now turning out relatively few graduates, the situation rapidly became acute. The schools which had managed to survive quickly restored many of their wartime facilities, intensified their training and stepped up their somewhat curtailed advertising programs. Additional schools were soon established and thrived on preparing students for the broadcast industry. What broadcasting represents today is old hat to all of us; it is a healthy, wealthy and permanent part of American family life. And, were that not enough, the relatively recent introduction of TV broadcasting has opened an even greater field to the properly licensed commercial radio operator, an awesome number of whom received their baptism in electronics through their activities as radio amateurs.

In the foregoing paragraphs we have placed considerable emphasis on the opportunities existing in the *entertainment* field of radio communication. Before leaving this installment suppose we backtrack, and examine the marine radio operator field a bit more closely. Just what are the rewards to be expected here should you choose a sea-

[*Continued on page 114*]

"Duo-Bander 84"

80-40 Meter SSB Transceiver

Ham Net $159.95

WRL CHARG•A•PLAN $8 Monthly

NOW —GO MOBILE 300 WATTS

AT AN AMAZING SAVINGS!

A Complete 80-40 Meter MOBILE PACKAGE!

Includes 1 ea.: Duo-Bander 84, DC384 Power Supply, one Bandspanner Antenna, BDYF Mount, 350C mic, Mic. Plug, PL 259 Plug, UG176/U Reducer and 25' RG58/U coax Cable. All supply cables are included.

ORDER: ZZA-103 package ($15 monthly)..Regularly $299.95 WITH BONUS COUPON...$279.95. ($14 monthly)

A Complete 80-40 Meter FIXED STATION PACKAGE!

Includes 1 ea.: Duo-Bander 84, AC48 250 watt supply, 80/40 Duo-Doublet Antenna kit, 350C mic., Mic. Plug, PL259 Plug, UG-176/U Reducer and 100 ft. RG58/U coax cable.

ORDER: ZZA-104 Package ($11 monthly)...Regularly $225.00 WITH BONUS COUPON...$205.00 ($10 monthly)

ORDER: ZZA-105 Package (same as above with 300 watt AC supply)...Regularly $255.00 WITH BONUS COUPON $235.00 ($12 monthly)

SAVE $20.00

WITH THIS BONUS COUPON!

This coupon may be applied against the package ZZA-103, ZZA-104 or ZZA-105 regular prices, provided there are no trade-ins involved, and will reduce the regular package cost by $20.00.

Only one coupon may be used. This coupon invalid after October 31, 1967.

A GREAT RIG... AT AN AMAZING PRICE!

Designed for the Amateur whose interest is 80 and 40 meter SSB. Here's Power to make good contacts...a Selective Receiver...Stability...Compactness (only 5x11¼x10"). A GREAT value at the regular price ...NOW SAVE $20.00 on a package with the BONUS COUPON. Purchase yours NOW with our easy, monthly terms, too!

Look at these DUO-BANDER 84 FEATURES!

• 300 watts PEP-SSB • Rugged–Reliable Printed Circuitry • 2k-Hz Dial Calibration • Dual-Speed Vernier VFO tuning • E-Z One-Knob Tune-Up — "Just Peak Output" • Built-in Speaker • Mobile Bracket supplied • Combination "S" and Output meter • Crystal Lattice Filter.

Use this Handy, Quick Mail Order Form —

WORLD RADIO LABORATORIES, Inc. CQ-21X
3415 West Broadway Council Bluffs, Iowa 51501

Please ship me the following:

☐ Duo-Bander MOBILE Package ZZA-103 @ $299.95
☐ Duo-Bander Fixed Package ZZA-104 @ $225.00
☐ Duo-Bander Fixed Package ZZA-105 @ $255.00
☐ Your FREE 1967 HAM Catalog
☐ I am enclosing one BONUS COUPON as I have no trades. Deduct $20.00 from the regular package price above.
☐ My check or Money Order for $________ is attached.
☐ Charge it to my WRL charge Acct #________

Name________

Address________

City________ State________ Zip________

For further information, check number 6, on page 126


TAXI
TAXI

2,189,503 radio-dispatched vehicles and only one tetrode rated for PTTS*

Drivers of most radio-dispatched vehicles are rarely on the air with their dispatcher for as long as 60 seconds and they usually drive at least five minutes between calls.

PTTS* (Push-To-Talk-Service), with its duty cycle of ONE MINUTE ON and FOUR MINUTES OFF has been shown to be the most realistic, economical and practical rating system for vehicular communications systems.

For this reason, Amperex developed the 8637, the only twin tetrode ever designed and rated for PTTS. Featuring high thermal inertia anodes and incorporating a wealth of twin-tetrode manufacturing experience, the 8637 offers the designer a new approach in creating a better vehicular radio. Fewer, and less costly components may be used. Some typical operating conditions which bear this out are shown on the chart below... lower plate voltage, lower drive and higher efficiency at the VHF frequencies.

The 8637 is a 'small tube', (only 3⅛" seated height), perfectly suited for today's low-profile designs. Its cost is lower than ICAS and CCS rated tube types of the same power.

For data, applications reports and engineering assistance, write: Amperex Electronic Corporation, Tube Division, Hicksville, L. I., N. Y. 11802.

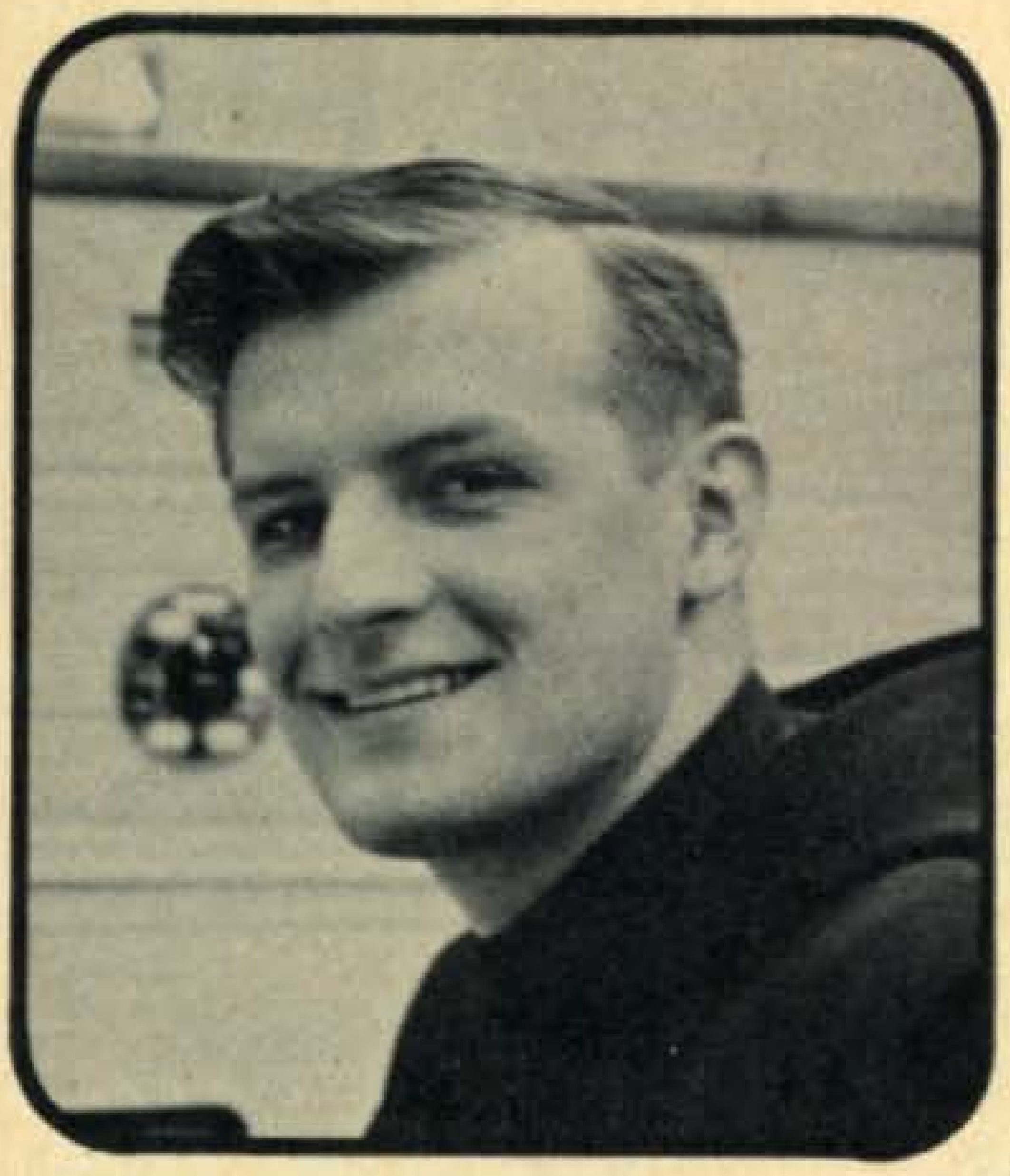
ALL THIS—and AMPEREX QUALITY, TOO!
ONE 8637—PUSH-PULL
Internally Neutralized Throughout Entire Freq. Range

50 MHz	PLATE	OUTPUT	DRIVE
CCS	375v.	25w.	0.67w.
ICAS	450v.	34w.	0.82w.
PTTS	**600v.**	**84w.**	**0.86w.**
175 MHz			
CCS	300v.	18w.	1.4w.
ICAS	350v.	26w.	1.6w.
PTTS	**560v.**	**63w.**	**2.2w.**

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

For further information, check number 4, on page 126



News from the INTERNATIONAL MISSION RADIO ASSOCIATION

BY TOM AQUINAS COX, O.F.M. CAPUCHIN W2CBX*

DURING the summer months I received word that we lost one of our members. The Most Reverend A. Escalante, XE1MJ, died at his post in Mexico City, Mexico. Bishop Escalante was the Superior General of the Missioners of Guadalupe. He was a member and strong support of IMRA.

He died of Typhoid Fever which he contracted in his work. We lost a wonderful and dedicated person. Our sympathy goes to those people for whom he worked and gave his life. They lost a wonderful friend and we all lost a dedicated person.

Last December I received a letter from Bishop Escalante. In this letter he expressed his ideas on amateur radio.

"For me," he said, "amateur radio is a means of contacting people for the sake of just getting to know them." "It is a way for me to offer my help to them whenever and wherever possible".

These thoughts are from a man who knew humanity well. I think it would do us well to ponder them from time to time.

From The Field

By the time you read this month's article, the IMRA Convention will have been concluded. I'll have a full report of the results of the sessions of the Convention in next month's issue of *CQ*.

For the moment I would like to introduce you to another missionary and IMRA member.

For many of you Ernie Paquet, 5H5KE, needs little introduction. Perhaps some of you have wondered what happened to Ernie since he has not been on the air for a while. Here is his story.

"Tom, many thanks for your interest. Enclosed are a few photos of myself and some of the lads I have been working with.

"I went to East Africa as a teaching brother in 1947. I found East Africa calm and friendly, even idyllic. This country surrounds Lake Victoria, the second largest fresh water lake in the world. It is almost a mile above sea-level as you probably know. The area, although on the equator, is only moderately hot in the day and rather cool in the evening. About 360 evenings each year the skies are clear and conditions are just wonderful for DXing.

"We have many schools around Lake Victoria spread out over an area of a few hundred miles. In the early days the roads were mud tracks and often impassable. We learned to live with things like that. Today things are much improved in Uganda, but I can not say the same for Western Tanzania.

"It was on my first leave home from Africa, eight years after I arrived there, that I became acquainted with amateur radio. It wasn't until three years later, while in British East Africa, that I passed my test for a British amateur license. Three years sounds like a long time, but it was nothing like the wait I had before I received my call letters. I had to wait seven years. Maybe we should be a little more patient with the FCC—Hi. After this 7 year wait I finally received permission from the Tanzanian government to go on the air.

*Mary Immaculate Friary, Garrison, New York.

"All I needed now was equipment, but why be impatient. In 1965 a friend of mine in Cleveland, Ohio, sent me a Galaxy III. So in October of 1965 I had both my call, 5H3KE, (how's that for c.w.) and a rig.

"Immediately I became one of the most sought after stations in the world. I loved every moment of it. I contacted people from all over the world. Really I was more or less a novice, but yet had one very rare call. I was in contact with stations in British Columbia to Australia on the otherside of the world. All this with less than three hundred watts and a dipole.

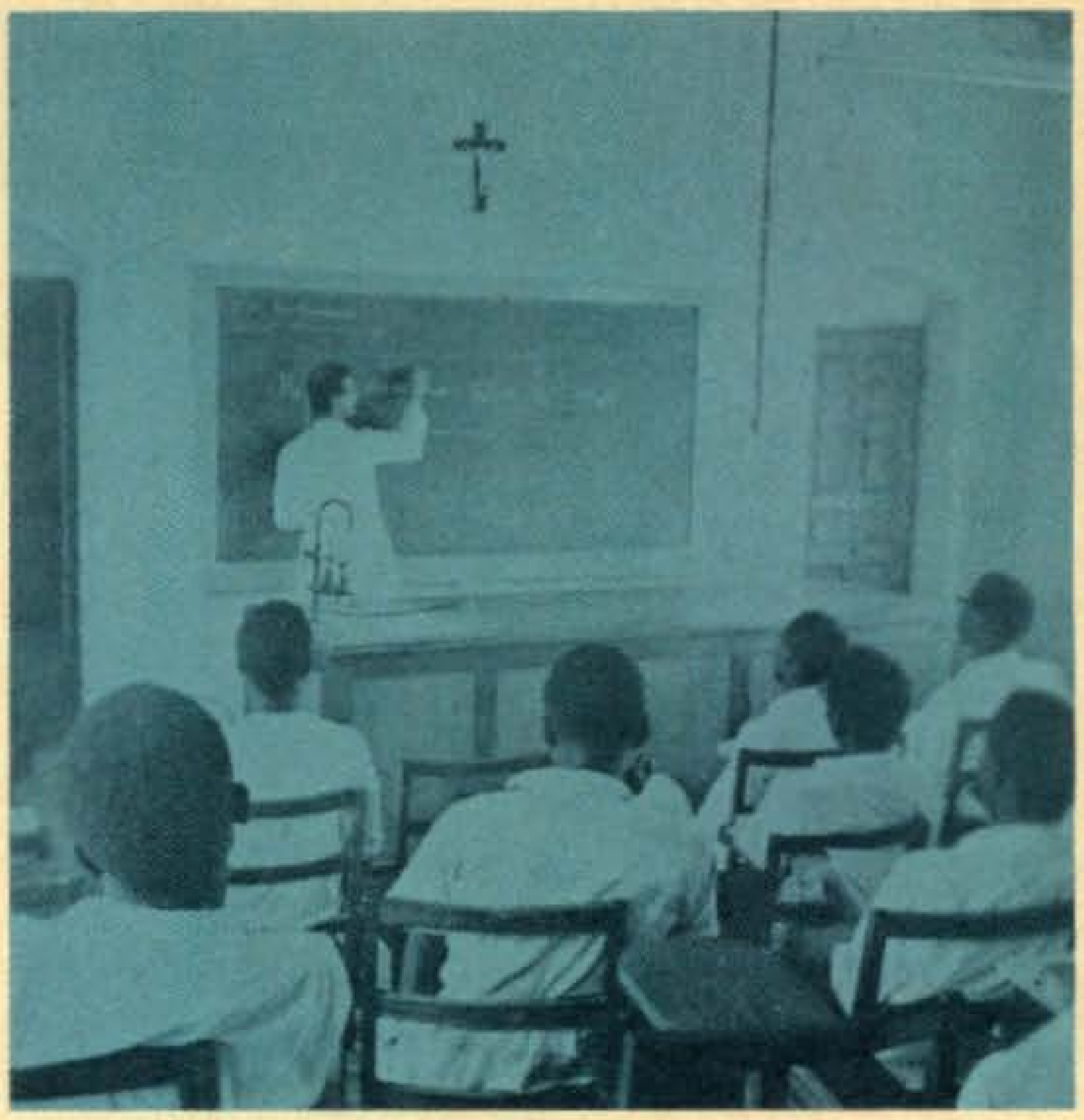
"The friendly spirit of the ham world was a new revelation to me every weekend. That seven year wait was worth while.

"Last year, however, I had to close things up for a while. I had to return home to the States to finish work on my degree. At the moment I am concluding that up at the University of Detroit. I'll be back in East Africa in less than a year now. I will have to go through the whole process of getting a license again. I can't stand the thought of another seven year wait! Things should go faster this time, however.

"Our widely scattered secondary schools and junior colleges in Uganda, Kenya, Tanzania, and the Seychelles Islands are in bad need of communications services. Nothing less than amateur radio will do. This is all the more true during these turbulent times in African history.

"For years I have been trying to convince others in my position over there of the advantages of amateur radio. My preaching only caught on after I finally did get on the air. Three others have now passed their exams and are awaiting their licenses. As far

After seven years Ernie calls CQ.



Part of Ernie's job includes teaching school on the shores of Lake Victoria. Here he is conducting a class in chemistry.

as gear goes, they haven't as much as a final tube. Sideband is the answer. In most places we have 235 volt 50 cycle electrical power. In other places they generate their own power, for example where Chuck is, alias Father Tardif, alias 5H3JR alias Jack Rabbit.

"For eleven years I was in Bukoba, Tanzania, on the western shore of Lake Victoria. The place is beautiful. To go with the beauty of the country we are also provided with some of the worlds most intense electrical storms. More than half our buildings were struck at one time or another. We were so used to the flashes bouncing all around that we forget how lethal they are. Once our three-phase meter on an outdoor high-tension transformer was burnt out. I was examining it with a flash light, standing in wet grass, and accidentally touched the frame of the meter. Wham! I was all but dead. Such is life."

Well that is the story of Ernie Paquet. He'll be back to work in Africa soon, so be on the lookout for him on the air. Ernie expects to spend the rest of his life teaching in Africa. He wants to keep in touch with the folks back home by means of amateur radio. Ernie is also bringing the world of amateur radio to these people where he works. A better ambassador of amateur radio would be hard to find.

I'll see you next month with news of the August Convention of IMRA. ■

"Changed My Life"

"My CIE course and new job have changed my life completely. Before getting into electronics, I drove a cab, repaired washers, rebuilt electric motors and was stuck at $1.50 an hour. Now that I'm an electronics technician, I work eight hours a week less and earn $228 a month more. We have a new home and two good cars. We also have color TV. My CIE training was worth every minute and every dollar I spent on it."

EUGENE W. FROST
Columbus, Ohio

His Own 2-Way Radio Business

"Prior to my CIE course, my only professional skill was as a crop dusting pilot. Today I own my own 2-way radio service business. I manufacture radio equipment and employ seven men. I found the training thorough and easy to understand. My CIE course is undoubtedly the best investment I've ever made."

EDWARD DULANEY, Scottsbluff, Nebraska

Who else wants to make big money in Electronics?

CIE's home training helped these men change their lives —it can help you too

Swamped With Job Offers

"I completed my CIE course and passed my FCC exam while in the Navy. On my discharge, I was swamped with job offers from all over the country. My only problem was to pick the best offer, and I did—engineer with Indiana Bell Telephone. CIE made the difference between just a job and a management position."

THOMAS E. MILLER, JR.
Indianapolis, Indiana

"You Make Electronics Easy"

"I give CIE credit for my Government FCC (Federal Communications Commission) License. Even though I had only six weeks of high school algebra, your lessons make electronics easy. I now have a good job... enjoy my work and am on my way up."

MATT STUCZYNSKI
Senior Transmitter Operator
Radio Station WBOE

ENROLL UNDER NEW G.I. BILL

All CIE courses are available under the new G.I. Bill. If you served on active duty since January 31, 1955, or are in service now, check box in coupon for G.I. Bill information.

WANT TO CHANGE YOUR LIFE like the men shown here? Get into today's big "growth" field—Electronics! The flood of electronic "miracles" pouring out of laboratories and factories has created a growing demand for trained men in TV and radio broadcasting...mobile communications...electronic automation...computer technology...the aerospace program...and many other high-pay areas.

You can be one of these "men in demand." You don't even need a high school diploma. You will need a good grasp of basic Electronics—but we can teach you that, at home, in your spare time. Even if you know nothing about Electronics today, our home-study courses make it easy to prepare for the high-paying job of your choice in this booming field.

Get the full details on the rich new life waiting for you in Electronics. Mail the bound-in postpaid card for two FREE books. If card has been detached, just send your name and address to CIE at the address below.

CIE Cleveland Institute of Electronics
1776 E. 17th St., Dept. CQ-32, Cleveland, Ohio 44114

For further information, check number 15, on page 126

Front view of the 160 meter s.s.b. transmitter. The controls are, from l. to r., upper row: PLATE TUNING, PLATE LOADING, V.F.O. Lower row: POWER, TRANS.-RCV., EXCITATION, AUDIO GAIN.

A TOP BAND S.S.B. TRANSMITTER

BY RICHARD A. GENAILLE,* K4ZGM

This 160 meter sideband transmitter is a clean, basic job design for simplicity of construction. With the component values indicated it will operate upper sideband, lower sideband or c.w. in the 1800 kc to 1825 kc segment of the band at a d.c. input of 50 watts.

After a hiatus of many years from the 160 meter band the author recently discovered, much to his surprise, that there is a considerable amount of activity on the "Top Band." As a matter of fact this band is about on the same par as the 80 meter band for local daytime rag-chewing and for nighttime moderate range and DX operation. After monitoring "160" for a period of months the author's interest in the band was rekindled and it was decided that station capability should be expanded to include operation on this interesting portion of the amateur radio spectrum.

*719 Quarterstaff Road, Winston-Salem, North Carolina 27104.

With a satisfactory general coverage receiver capable of receiving in the c.w., a.m., and s.s.b. modes the only thing lacking was a transmitter for 160 meters. With limited spectrum space available and certain maximums imposed by the FCC in regard to power it was decided that the most effective mode of transmission for voice operation would be s.s.b. It was noted, after hours of fruitless searching through countless back issues of popular ham publications, that not much has appeared concerning the construction of s.s.b. transmitters for the 160 meter band. It was also discovered that very few manufacturers of commercially available s.s.b. transmitters have included the 160

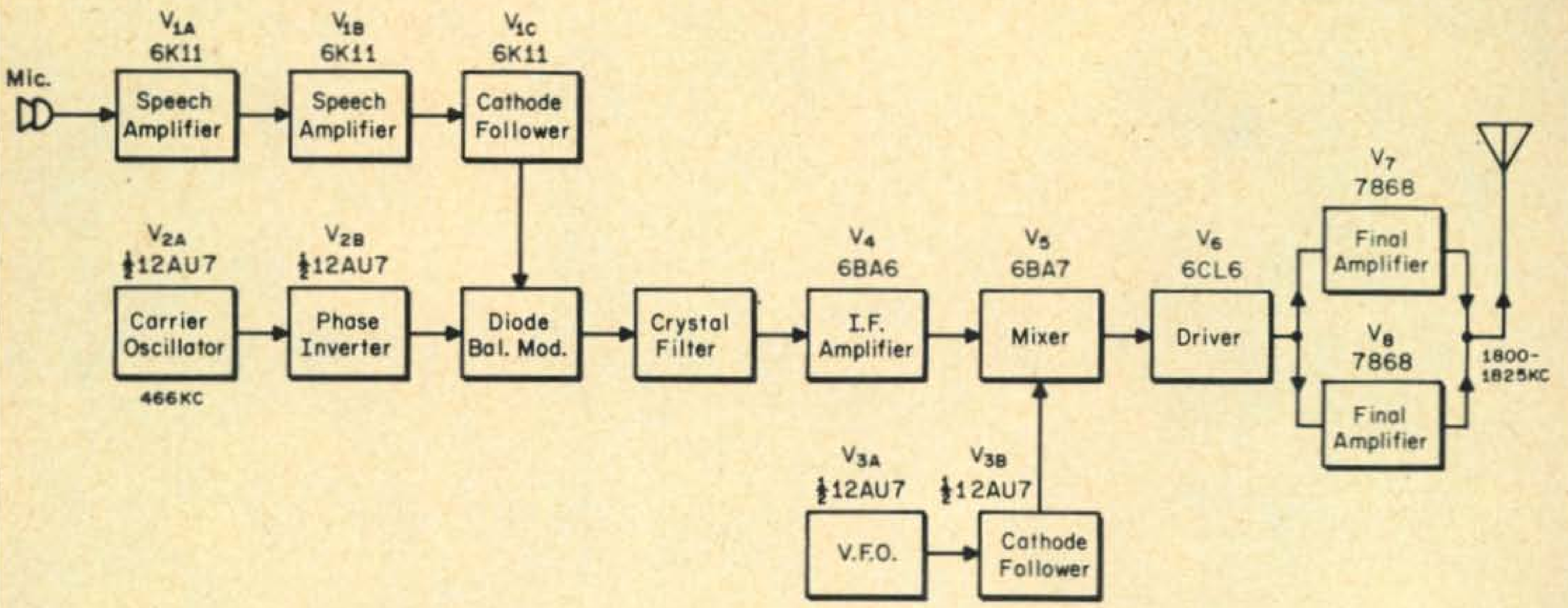


Fig. 1—Block diagram of the 50 watt 160 meter s.s.b. transmitter.

meter band in the band coverage of their equipment. These factors possibly account for the dearth of s.s.b. activity among the inhabitants of the "Top Band."

The purpose of this article is to fill the need for detailed information on the construction of a simple, yet effective, s.s.b. transmitter for the 160 meter band. It is hoped that the article will also stimulate interest in operation on this band as well.

Block Diagram

The block diagram for the 160 meter s.s.b. transmitter is shown in fig. 1. The transmitter operates in the 1800-1825 kc range, is capable of a d.c. input of 50 watts, and is about as basic as this type of transmitter can be due to the elimination of various frills such as vox operation, carrier insertion, and other unnecessary circuitry. The frills can always be added after one has completed the construction of the basic transmitter.

While the 160 meter band is divided into three segments (1800-1825 kc, 1875-1925 kc, and 1975-2000 kc) and there are a number of variations in the legal amount of power that can be run, the fact that the 1800-1825 kc portion is available for use in most areas of the United States with a nighttime power of 50 watts d.c. input more or less dictated the design parameters used for the transmitter. For operation in a particular area the author recommends that a check be made of the FCC regulations concerning 160 meter band operation as shown in Table I.

As shown in the block diagram, dual sidebands are generated at 466 kc in the balanced

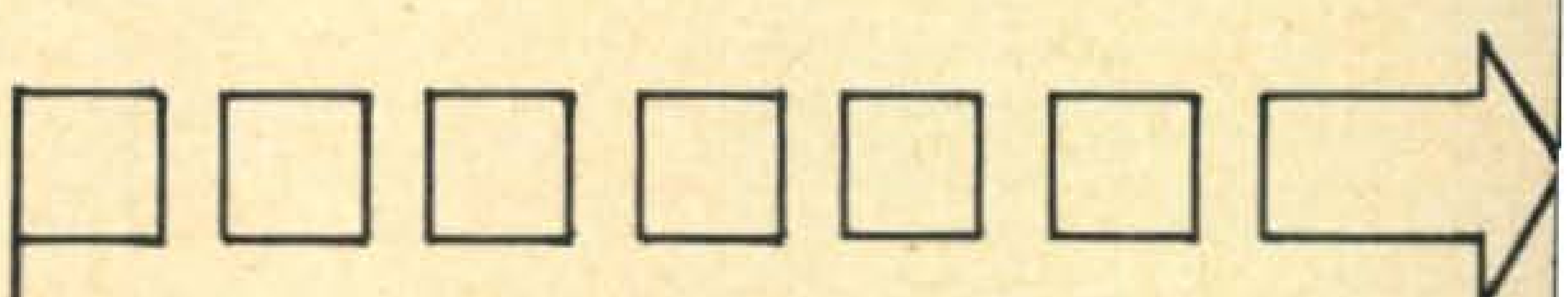


Fig.2—Schematic diagram of the 160 meter s.s.b. transmitter. Unless otherwise noted all capacitors greater than one in value are in mmf, less than one are in mf and all resistance are ½ watt.

C_1—140 mmf variable. Hammarlund APC-140-B or equiv.

C_2—365 mmf variable. J. W. Miller 2111 with 10 rotor plates removed.

C_3, C_4—3 section variable, 365 mmf per section, paralleled. J. W. Miller 2113 or equiv.

CR_1, CR_2—1N35 germanium diodes, matched pair.

K_1—D.p.s.t. relay with coil for the required control voltage.

L_1, L_2, L_3—High Q ferrite antenna coil, J. W. Miller 6300 or equiv.

L_4—Tapped oscillator coil. J. W. Miller 279-C or equiv.

L_5—220 microh. adjustable r.f. coil. J. W. Miller 22A224RBI or equiv.

L_6—14 microh., 2¼" length of B&W 3015 Miniductor stock #20, 1" dia., 16 t.p.i.

PC_1, PC_2—10 t #22 e. wire, spaced on 47 ohm 1 watt composition resistor.

R_1—Carrier balance control, 500 ohms linear taper IRC CT3 11-103 Carbon type PQ, or equiv.

RFC_1—2.5 mh, 200 ma. J. W. Miller 4537 or equiv.

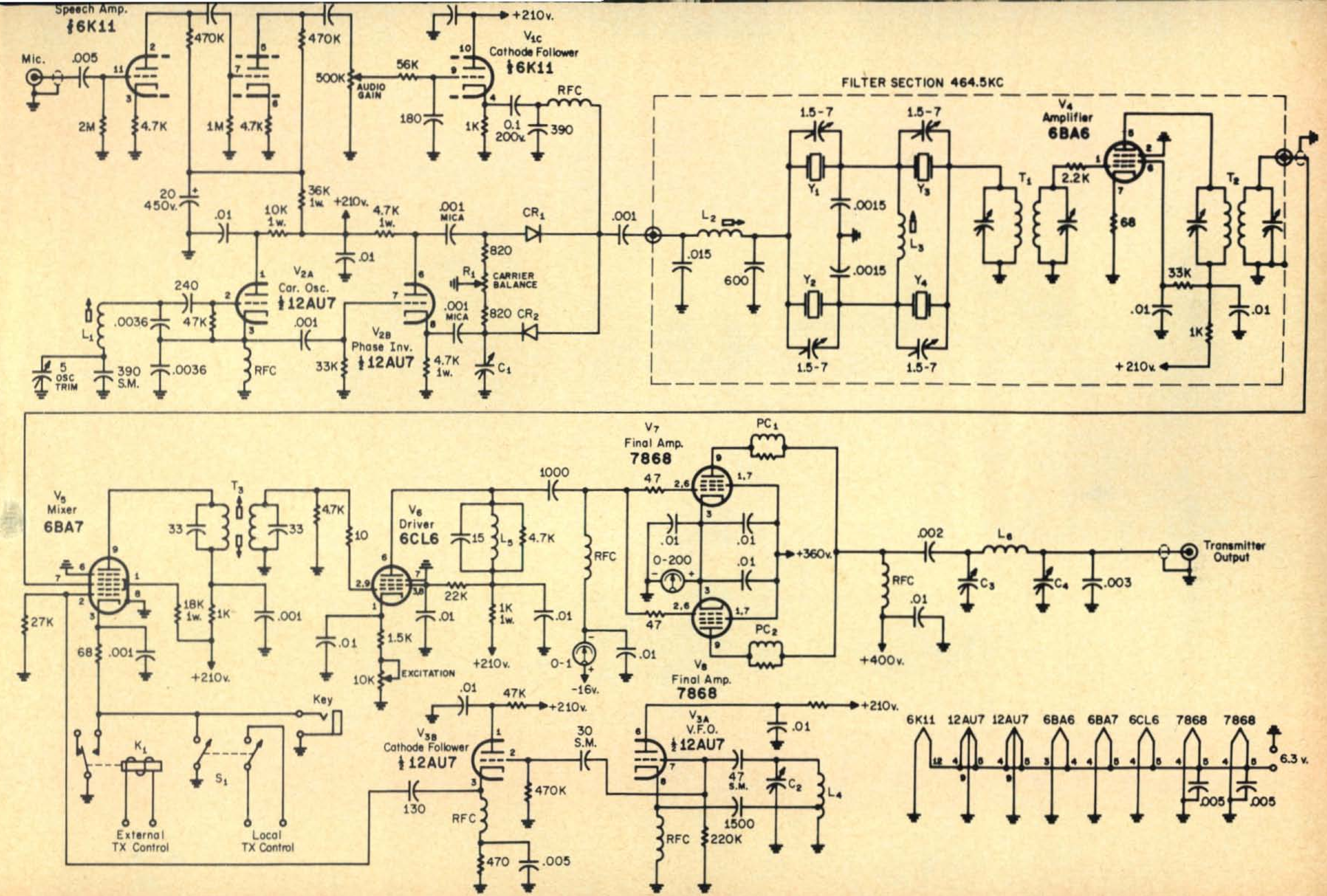
T_1—455 kc i.f. transformer. J. W. Miller 112-C1 or equiv.

T_2—455 kc i.f. transformer. J. W. Miller 112-C4 or equiv.

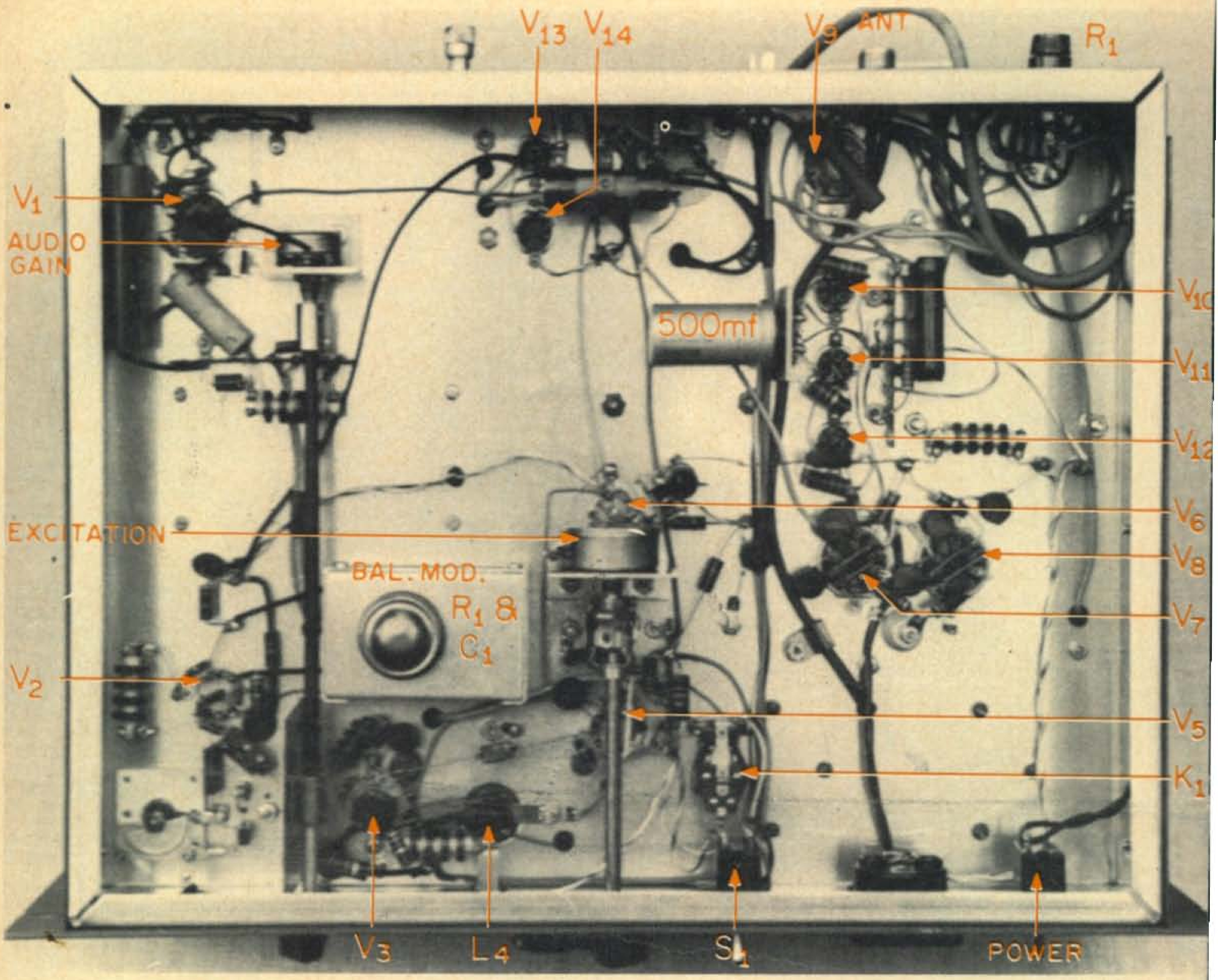
T_3—1800 kc i.f. transformer. J. W. Miller 1730 or equiv.

Y_1, Y_3—465.277 kc, FT-241-A crystal Channel 335, matched pair. Texas Crystals.

Y_2, Y_4—462.963 kc, FT-241-A crystal Channel 50, matched pair. Texas Crystals.



Speech Amp.
½6K11
Mic.
.005
2M
4.7K
470K
1M
4.7K
470K
500K
AUDIO GAIN
56K
180
V1C
Cathode Follower
½6K11
+210v.
1K
0.1
200v.
390
RFC
20
450v.
36K
1w.
.01
10K
1w.
+210v.
4.7K
1w.
.001
MICA
CR1
820
R1
CARRIER BALANCE
820
CR2
.001
MICA
C1
V2A
Car. Osc.
½12AU7
240
47K
.0036
L1
.0036
5
OSC TRIM
390
S.M.
RFC
.001
V2B
Phase Inv.
½12AU7
33K
4.7K
1w.
.001
FILTER SECTION 464.5KC
L2
.015
600
1.5-7
Y1
.0015
.0015
Y2
1.5-7
1.5-7
Y3
L3
Y4
1.5-7
T1
V4
Amplifier
6BA6
2.2K
68
T2
33K
.01
.01
1K
+210v.
V5
Mixer
6BA7
27K
68
.001
T3
33
33
18K
1w.
1K
.001
+210v.
4.7K
10
V6
Driver
6CL6
.01
1.5K
10K
EXCITATION
15
L5
4.7K
22K
.01
1K
1w.
+210v.
.01
1000
RFC
0-1
.01
-16v.
V7
Final Amp.
7868
47
PC1
.01
.01
0-200
.01
+360v.
47
PC2
V8
Final Amp.
7868
.002
L6
RFC
.01
+400v.
C3
C4
.003
Transmitter Output
Key
K1
S1
External
TX Control
Local
TX Control
.01
47K
+210v.
V3B
Cathode Follower
½12AU7
470K
130
RFC
470
.005
30
S.M.
V3A
V.F.O.
½12AU7
.01
+210v.
47
S.M.
C2
L4
1500
RFC
220K
6K11
12AU7
12AU7
6BA6
6BA7
6CL6
7868
7868
.005
.005
6.3 v.



Bottom view of the 160 meter s.s.b. rig showing the location of major components. A film can type jack shield is mounted on the balanced modulator shield to accommodate the extra length of the balance capaciter. A larger Minibox can be used if available.

modulator with the upper sideband being rejected by a simple crystal filter. Pivoting of the sideband signal thus obtained, in order to operate either upper or lower sideband, is accomplished in the mixer stage whose frequency output is in the 1800-1825 kc range. The mixer output is fed to the driver and, after amplification, to a pair of receiving type power pentodes in the linear amplifier.

A power supply is included on the same chassis; however, any suitable external supply or supplies can be used to power the transmitter. With the addition of a satisfactory antenna you can operate on 160 with a clean, respectable single sideband signal.

Circuit Description

The complete schematic diagram of the transmitter, less power supply, is shown in fig. 2. As mentioned previously simplicity was a factor in the design of this unit in order not to discourage prospective builders. There is no tapping of coils, rewinding of i.f. transformers and the like to worry about. The only two modifications to standard components is the removal of some plates from the rotor of the v.f.o. tuning capacitor and the cutting to length of the Miniductor coil stock used for the final amplifier plate coil.

Speech Amplifier

The speech amplifier and associated cathode follower output stage is quite basic but provides more than ample audio to the balanced modulator when using typical low level output microphones. The tube used for V_1 is a duode car type containing two high-mu triodes and one medium-mu triode in the same envelope. The electrical characteristics are very similar to one 12AX7 and one-half of a 12AU7. The medium-mu section is used for the cathode follower to effect an impedance transformation without the additional cost of a matching transformer.

Carrier Oscillator

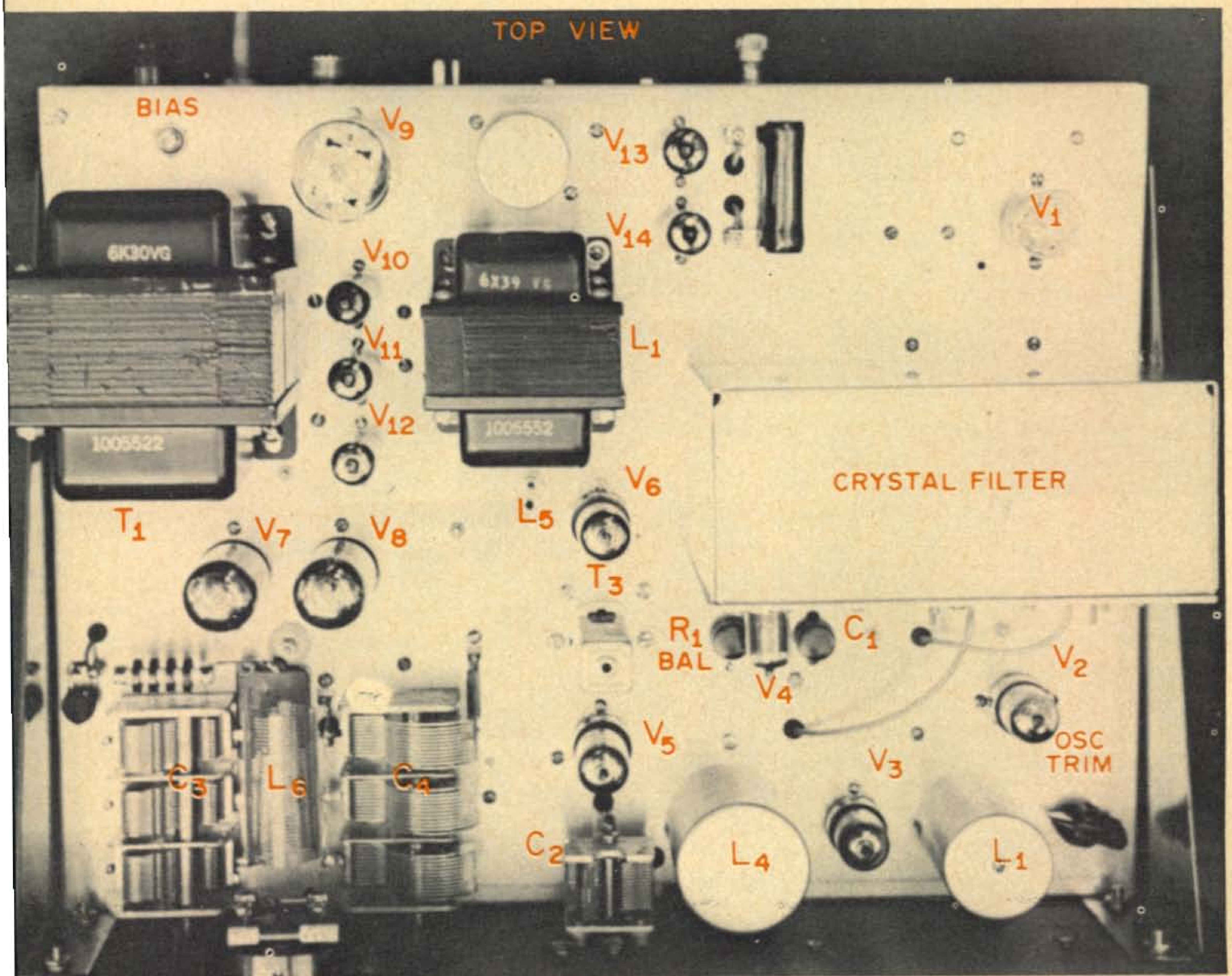
The 12AU7, V_2, is the low frequency r.f. source for the sideband generator with one-half of the tube serving as the oscillator and the other half as a phase inverter to provide push-pull r.f. for the balanced modulator. An inexpensive high-Q ferrite antenna coil is used in the oscillator circuit for improved stability.

Balanced Modulator

The balanced modulator, which generates dual sidebands, uses a 1N35 matched pair of diodes to facilitate balance and carrier nulling. Capacitor C_1 and potentiometer R_1 are used in combination to achieve a satisfactory null. The dual sideband output of the balanced modulator appearing at the junction of the two diodes is fed to a sideband filter where the upper sideband is removed.

Filter

The sideband filter is the heart of the s.s.b. transmitter since it not only provides for the suppression of the unwanted sideband but it also provides further suppression of the carrier frequency as well. The filter was constructed as a separate unit in order to facilitate alignment. All components shown within the dashed lines in fig. 2 are mounted in a 3″ × 5″ × 7″ Minibox. Should the builder be the proud possessor of a mechanical filter this filter can be installed in the space allocated to the ferrite coil and crystal filter, used by the author, with slight circuit modification. The separate filter unit can be readily identified in the top view photograph of the transmitter chassis. Other unique features of the author's sideband filter, besides its portability, is the use of simple high-Q ferrite antenna coils



Top view of the 160 meter s.s.b. transmitter showing the location of the major components

Area	Maximum D. C. Plate Input Power in Watts: 1800 to 1825 Kc		1875 to 1900 Kc		1900 to 1925 Kc		1975 to 2000 Kc	
	Day	Night	Day	Night	Day	Night	Day	Night
Alabama	200	50	No oper.		No oper.		100	25
Alaska	200	50	200	50	No operation			
Arizona	100	25	100	25	100	25	500	100
Arkansas	200	50	No oper.		No oper.		200	50
California	No operation				200	50	500	200
Colorado	200	50	100	25	100	25	500	100
Connecticut	200	50	100	25	No operation			
Delaware	200	50	100	25	No operation			
Dist. of Col.	200	50	100	25	No operation			
Florida	100	25	No oper.		No operation			
Georgia	100	25	No oper.		No operation			
Hawaii	No operation				100	25	100	25
Idaho	100	25	200	50	200	50	500	100
Illinois	200	50	100	25	100	25	200	50
Indiana	200	50	100	25	100	25	100	25
Iowa	500	100	100	25	100	25	200	50
Kansas	500	100	100	25	100	25	200	50
Kentucky	200	50	100	25	100	25	100	25
Louisiana	200	50	No oper.		No oper.		100	25
Maine	500	100	100	25	No operation			
Maryland	200	50	100	25	No operation			
Mass.	500	100	100	25	No operation			
Michigan Up. Pen.	500	100	100	25	100	25	200	50
Michigan Lo. Pen.	500	100	100	25	100	25	100	25
Minnesota	500	100	100	25	100	25	200	50
Mississippi	200	50	No oper.		No oper.		100	25
Missouri	200	50	100	25	100	25	200	50
Montana W. of 111°W	100	25	200	50	200	50	500	100
Montana E. of 111°W	200	50	200	50	200	50	500	100
Nebraska	500	100	100	25	100	25	500	100
Nevada	100	25	200	50	200	50	500	200
New Hamp.	500	100	100	25	No operation			
New Jersey	200	50	100	25	No operation			
New Mexico	200	50	100	25	100	25	500	100
New York N. of 42°N	500	100	100	25	No operation			
New York S. of 42° N	200	50	100	25	No operation			
North Carolina	200	50	No oper.		No operation			
North Dakota	500	100	200	50	200	50	500	100
Ohio	200	50	100	25	100	25	100	25
Oklahoma	500	100	No oper.		No oper.		200	50
Oregon	No operation				200	50	500	100
Pennsylvania	200	50	100	25	No operation			
Rhode Island	200	50	100	25	No operation			
South Carolina	100	25	No oper.		No operation			
South Dakota	500	100	100	25	100	25	500	100
Tennessee	200	50	No oper.		No oper.		100	25
Texas E. of 103° W	500	100	No oper.		No oper.		200	50
Texas W. of 103° W	200	50	100	25	100	25	500	100
Utah	100	25	100	25	100	25	500	100
Vermont	500	100	100	25	No operation			
Virginia	200	50	100	25	No operation			
Washington	No operation				200	50	500	100
West Virginia	200	50	100	25	No operation			
Wisconsin	500	100	100	25	100	25	200	50
Wyoming	200	50	100	25	100	25	500	100
Puerto Rico	No operation				100	25	100	25
Virgin Islands	No operation				100	25	100	25
Swan Island	500	100	No oper.		No oper.		100	25
Serrana Bank	500	100	No oper.		No oper.		100	25
Roncador Key	500	100	No oper.		No oper.		100	25
Navassa Island	No operation				No oper.		100	25
Baker, Canton, Enderbury, Guam, Howland, Jarvis, Johnston, Midway & Palmyra Islands	No operation				500	100	500	100
American Samoa	500	200	500	200	500	200	500	200
Wake Island	500	100	500	100	No operation			

Table I—One hundred and sixty meter operating regulations for the U.S. and Possessions. A copy of the above chart (CQ Form 1063) may be obtained for a self-addressed stamped envelope.

in place of the usual i.f. transformers to reduce the number of filter adjustments and the inclusion of the i.f. amplifier on the same chassis. Coil L_2 and its associated capacitors provide an impedance match between the low impedance output of the balanced modulator and the high impedance input of the first half-lattice crystal filter section. Coupling between the two half-lattice crystal sections is accomplished by the use of another ferrite antenna coil rather than an i.f. transformer. The two 0.0015 mf capacitors across coil L_3 are not critical as to the exact value but should be matched as closely as possible.

A more detailed discussion of the ferrite coil and crystal filter can be found in the June, 1967 issue of Electronics World; however, this detailed information is not required for the construction of the 160 meter s.s.b. transmitter. Filter alignment instructions will be covered later in the section on transmitter alignment.

Mixer

The mixer circuit, V_5, is a common circuit which does a very satisfactory job. The lower sideband output of filter i.f. amplifier tube V_4 is mixed with the signal from the v.f.o. to provide either lower or upper sideband output at the plate circuit of the mixer tube. Keying as well as external and internal transmitter control is accomplished in the cathode of the mixer stage. Transformer T_3 is made to order for the output of the mixer stage since it is specifically designed for use at 1800 kc. providing good selectivity and a bandwidth of 25 kc. Operation in the c.w. mode can be accomplished by driving the mixer with 1800-1825 kc output from the v.f.o. or by setting the v.f.o. for either upper or lower sideband operation and introducing an audio signal of fixed amplitude and frequency into the microphone jack.

V.F.O.

The v.f.o., constructed around tube V_3, and its cathode follower isolation stage are quite standard as far as the circuitry is concerned. A good quality coil was used in the oscillator to help assure satisfactory oscillator stability. Don't forget to remove the ten rotor plates from tuning capacitor C_2 as indicated in fig. 2.

The v.f.o. stage determines the selection of lower sideband, upper sideband or c.w. by the frequency to which it is tuned. For lower sideband operation between 1800 and 1825 kc the v.f.o. must tune across 1337-1359 kc. For upper sideband the v.f.o. range should be from 2266 kc to 2288 kc. For c.w. operation the v.f.o. should tune from 1800 kc to 1825 kc. As may be seen in the front view of the transmitter, a calibration chart is attached to the upper right corner of the panel with the proper dial settings listed for the desired operating frequencies.

Driver

The 6CL6, V_6, is the driver stage which is stable in performance and provides more than enough drive for the final amplifier.

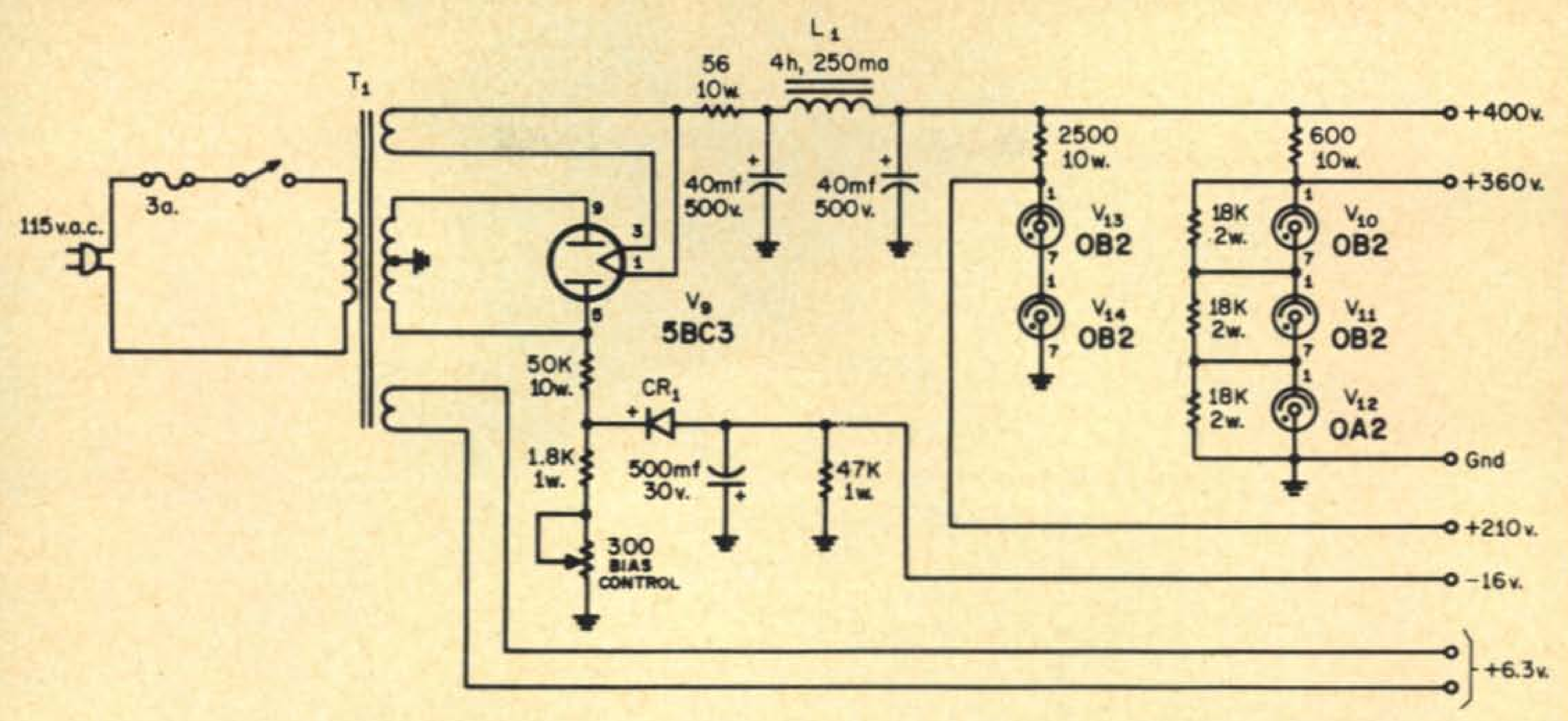


Fig. 3—Circuit of the power supply used for the 160 meter s.s.b. transmitter.
CR1—Silicon or selenium rectifier, 20 ma, p.i.v. 150 v.

L1—Filter choke, 4h, 250 ma. Allied-Knight 54D3991 or equiv.

T1—Power transformer 400-0-400 v.a.c. at 250 ma., 5 v. at 4 a., 6.3 v. at 5 a. Allied-Knight 54D2548 or equiv.

The amount of drive is controlled by the EXCITATION control in the driver cathode.

Final

Final amplifier tubes, V_7 and V_8, are 7868's and were selected because the author liked the operating parameters shown in the tube manual for Class AB1 operation. The use of a lower plate voltage than that normally used for the usual low power transmitting tubes in final amplifier service was particularly attractive in that a replacement type power transformer could be used without resorting to voltage doublers and the like.

The paralleled 7868's fill the bill nicely for the amount of power to be run without being abused. The 7868 is a power pentode of the Novar type designed for use in high-fidelity amplifiers where a relatively large amount of power output is required. The operating values for Class AB1 push-pull operation were used and proved satisfactory for the two tubes operating in parallel. As a matter-of-fact, the final amplifier was the last circuit to be experimented with by the author and was constructed the first time using the components as specified in fig. 2. The values for the pi-network were calculated and the components used were adjusted for these values. The amplifier worked perfectly as soon as power was applied.

The parasitic suppressors were included as a precautionary measure and it is quite possible that these might not be required. Since the investment in the suppressors was small and the amplifier performed so well it was decided to leave well enough alone and not remove them.

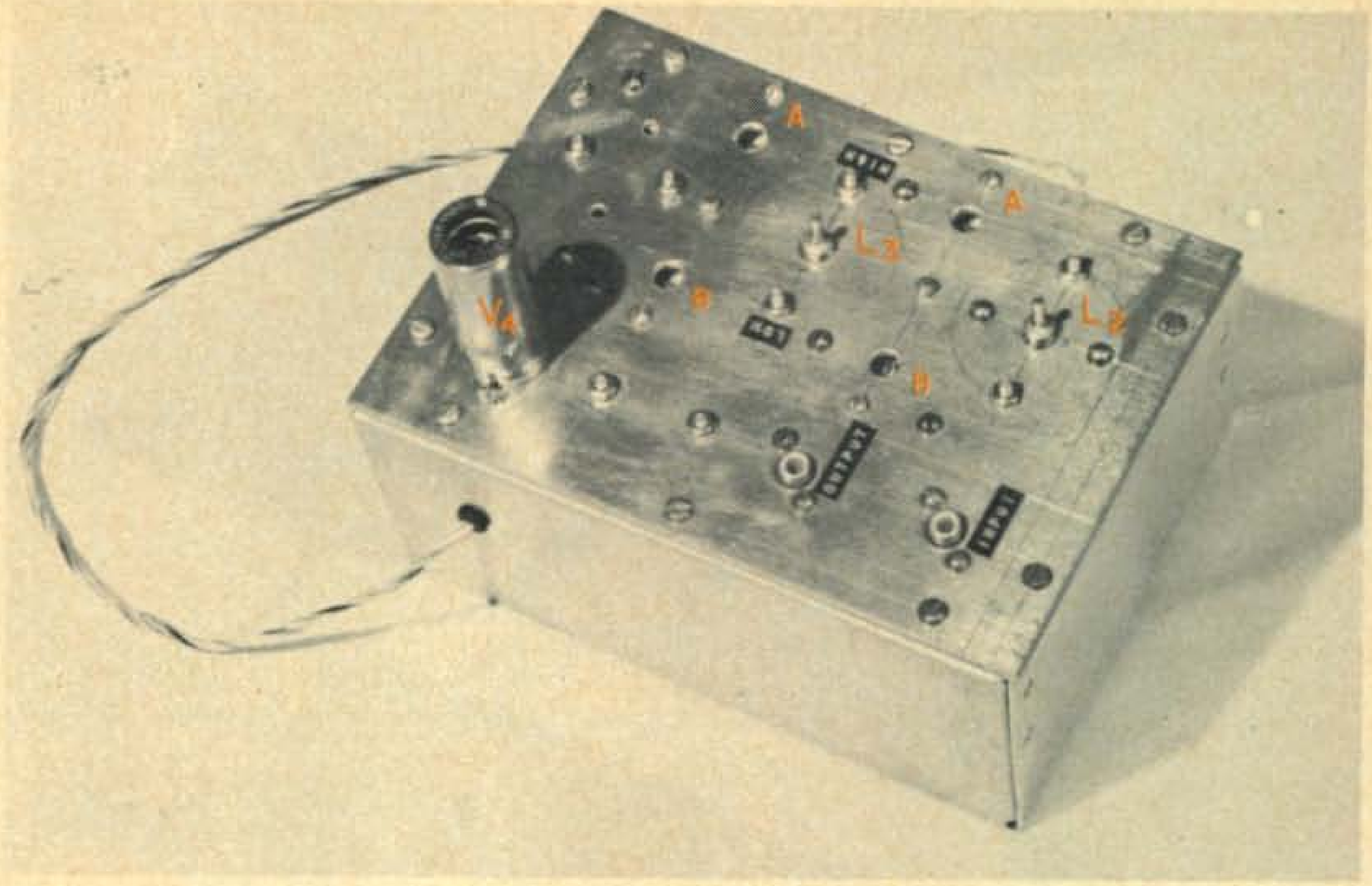
The 7868's are metered in the cathode circuit and therefore the combined plate and screen current is read on the meter. A grid current meter is included to indicate when the grids are being overdriven. The grids should never be driven hard enough to cause more than a few tenths of a milliampere of grid current to flow. Any greater drive will result in distortion of the amplified signal and discouraging comments from the stations with whom you make contact.

Power Supply

Power for the transmitter is obtained from the power supply shown in fig. 3. The 5BC3 rectifier is a Novar type used in television receiver supplies having high d.c. requirements. The supply provides voltages for the various stages as indicated on the schematic diagram. A bias control adjustment is provided for setting the bias at the optimum operating point.

Construction

The transmitter is constructed on a 3″ ×



View of the sideband filter mounted in its enclosure. Holes A are for access to the adjustment capacitors for Y_2 and Y_4. Holes B are for access to the Y_1 and Y_3 trimmers.

13″ × 17″ aluminum chassis with the exception of the sideband filter. Dimensions for the Minibox housing the filter have been given previously. The front panel is ⅛″ × 19″ × 8¾″ in size and also aluminum. Sufficient space is available on the main chassis for the addition of a simple vox circuit if desired. The placement of parts can be determined from the various photographs of the unit. Several photographs of the separately constructed sideband filter have been included to assist the constructor in the assembly of the filter unit. As can be seen in the photographs, the ferrite coils are shielded as well as the input and output phono connector jacks to insure that the input signal goes through the filter and not around it. The crystals are mounted on their respective trimmer capacitors by soldering the crystal holder pins directly to the capacitor leads. This method provides a fairly rigid mounting for the crystals; however, caution should be used when soldering to the crystal holder pins to avoid damaging the crystals by excessive heat. A heat sink on the holder pins during the soldering operation is strongly recommended.

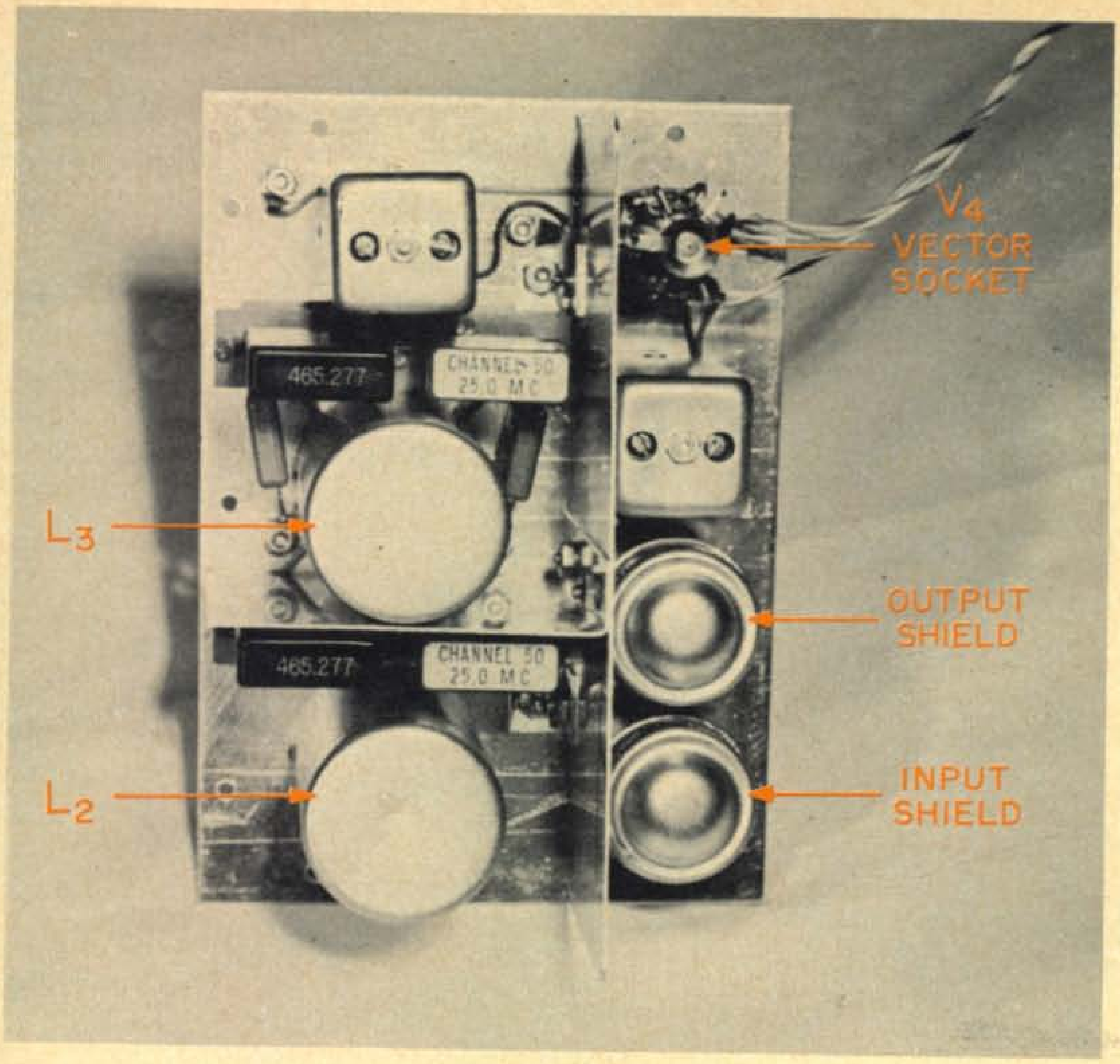
The i.f. amplifier tube socket is of the Vector type which provides mounting and tie points for the various components associated with this stage. Discarded 35 mm film cans are used as shield cans for the input and output jacks. Any photo shop will be happy to give you a bag full of these cans for the asking.

Filter Alignment

The proper alignment of the sideband filter section is a must in order to transmit a top quality sideband signal. The portability of the filter unit makes it convenient to carry the filter to a friend's test bench or to a local radio and TV service shop for alignment should you not have the test equipment necessary to do the job. Many articles on crystal type sideband filter construction suggest the point-by-point method of alignment using an accurately calibrated signal generator and v.t.v.m. or the constructor is evasively directed to the "handbook" for alignment instructions. Since the various filter adjustments interact to a certain degree the point-by-point method can be very tedious and time consuming and can discourage even the most dedicated experimenter. For this reason the author recommends that the alignment be done by the sweep method using a sweep generator with output in the 450 to 475 kc range and an oscilloscope.

Using the sweep method the filter can be aligned properly in a matter of 30 minutes at most. You will also "see" how the various adjustments interact and how the characteristic curve can change severely with incorrect adjustment. The education one gets while watching the oscilloscope pattern change justifies the use of the sweep method alone. The "built-in" i.f. amplifier, besides providing amplification of the sideband signal for the mixer stage, provides sufficient gain to drive even the less sensitive oscilloscopes when the filter is set up on the test bench by itself for alignment.

A word of encouragement is in order at this point since a passable, but by no means the best, alignment can be made by using a signal generator and a v.t.v.m. in the following manner. With voltage applied to the



Interior view of the sideband filter unit used in the 160 meter s.s.b. rig.

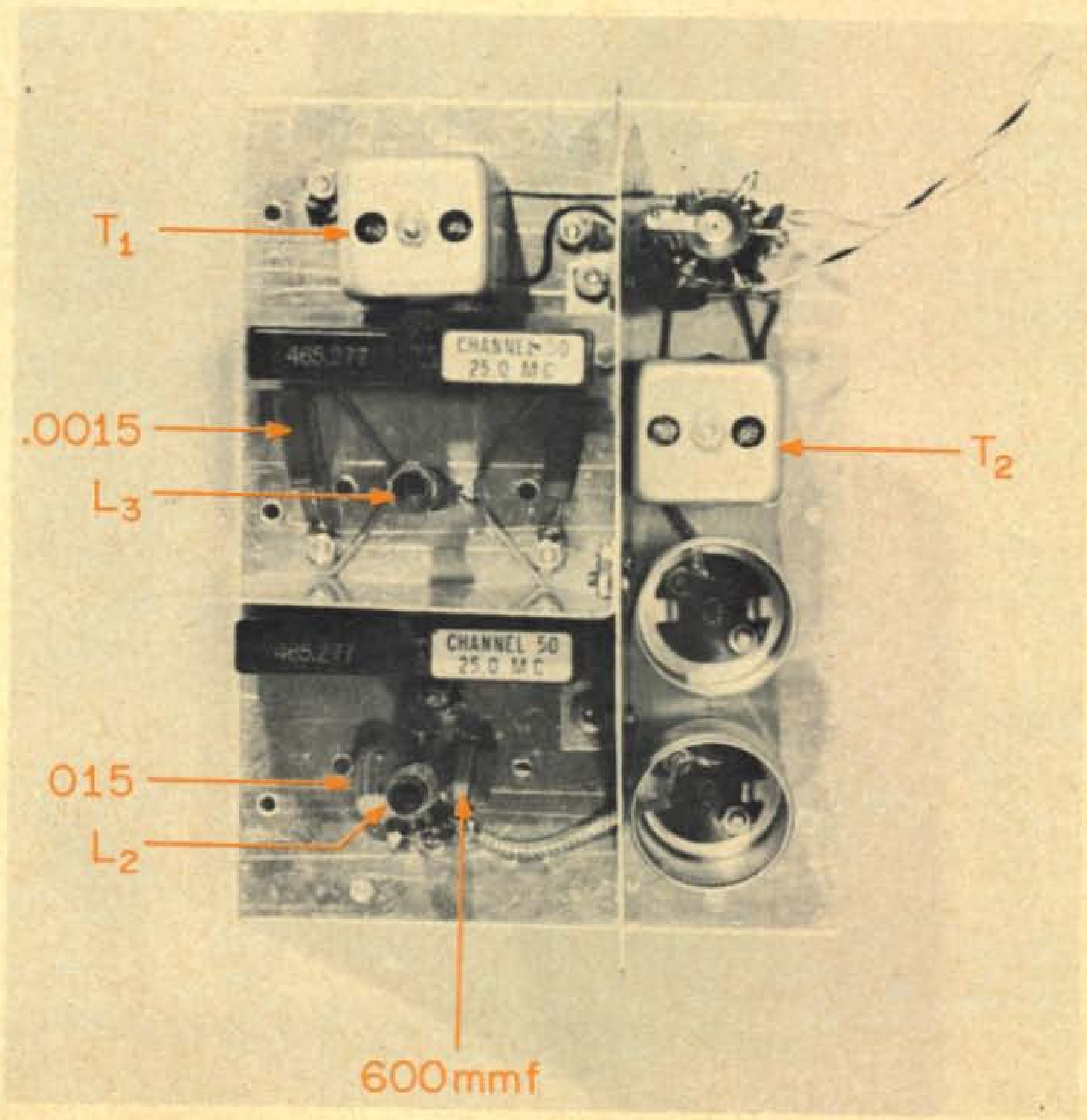
or other sideband transmitters. As can be seen in fig. 4 the basic carrier oscillator frequency will be very close to 466 kc. The method of setting the carrier oscillator frequency will be described later.

i.f. amplifier, adjust the crystal trimmers to minimum capacity, connect the r.f. probe of the v.t.v.m. to the filter output jack, and feed a 464.5 kc signal to the filter input jack. Adjust coils L_2 and L_3 and the screwdriver adjustments on i.f. transformers T_1 and T_2 for maximum output keeping the level of the input signal as low as possible consistent with obtaining a reading on the lowest voltage scale of the v.t.v.m. These adjustments will provide a good starting point for sweep alignment of the filter. When properly adjusted the filter characteristic curve should appear as shown in fig. 4 and the filter will perform quite well in this

Transmitter Alignment

Transmitter alignment from the mixer through to the final amplifier can be accomplished as follows:

1. With the filter installed in the transmitter and the audio gain turned down remove the final amplifier tubes from their



Interior view of the sideband filter with the shields removed.

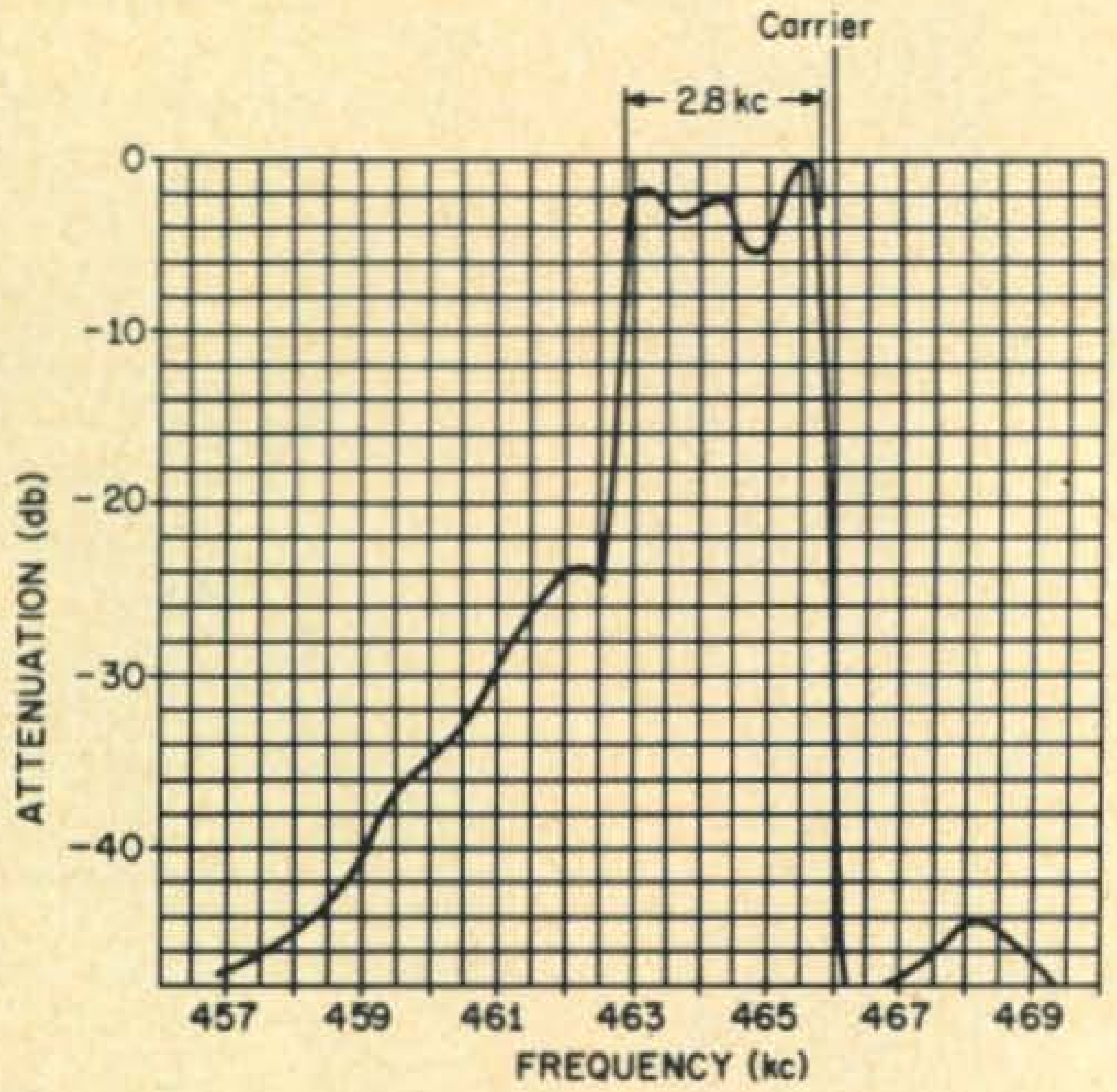


Fig. 4—Response curve of the sideband filter after correct adjustment.

sockets. Apply voltage to the transmitter and adjust the bias control for minus 17 volts at the final amplifier grids.

2. Replace the final amplifier tubes and readjust the bias control so that the cathode current reads approximately 72 milliamperes. Connect a 50 ohm dummy load to the transmitter output jack.

3. Set the plate loading capacitor, C_4, for maximum capacitance and the plate tuning capacitor C_3 at about one-third open. Adjust the excitation control for minimum excitation. (Maximum resistance in the driver cathode)

4. Tune the v.f.o. to approximately 1810 kc by listening on the station receiver. It may be necessary to bring the receiver antenna lead into close proximity of the v.f.o. stage.

5. Operate switch S_1 and look for a slight rise in amplifier cathode current. If no rise is noticed increase the excitation by adjusting the excitation control.

6. Adjust the top and bottom slugs of the mixer i.f. transformer T_3 and the slug of driver plate coil L_5 for a peak in final amplifier cathode current keeping the excitation adjusted so that the amplifier cathode current does not rise above 130 milliamperes. At this point the amplifier plate tuning capacitor should be readjusted to a dip in the cathode current indicating plate circuit resonance. The transmitter may now be operated in the c.w. mode by opening switch S_1 and keying the cathode of the mixer stage.

The next steps will complete the transmitter alignment for s.s.b. operation:

1. Tune the v.f.o. to 1350 kc as described in step 4 of the previous alignment instructions.

2. Set the carrier oscillator frequency to 466 kc by adjusting the slug in oscillator coil L_1. This may be accomplished by listening for the oscillator second harmonic at 932 kc on the broadcast band of the station receiver. The oscillator trimmer capacitor should be set to approximately half capacitance prior to adjusting the slug.

3. Set the audio gain control so that it is about 10 degrees from minimum. Too much gain will result in overloading of the balanced modulator with subsequent distortion.

4. While monitoring the transmitter output in the 1800-1825 kc range on the station receiver in the lower sideband position, talk into the microphone making slight adjustments with the slug of the oscillator coil or the oscillator trimmer capacitor until the s.s.b. signal sounds good on the station receiver. "Walking" of the oscillator frequency in this manner places the carrier oscillator frequency on the steep slope portion of the sideband filter characteristic curve to produce the most satisfactory sounding signal. Moving the carrier frequency away from the slope towards the suppressed sideband side suppresses the lows and accentuates the highs and vice-versa. This adjustment may take a little patience but it can be done by ear with a little practice.

5. After obtaining a satisfactory sounding audio signal turn the audio gain control off and adjust the balanced modulator potentiometer and capacitor for a minimum carrier while listening to the receiver. A definite null should be obtained with the carrier just about disappearing in the receiver noise level.

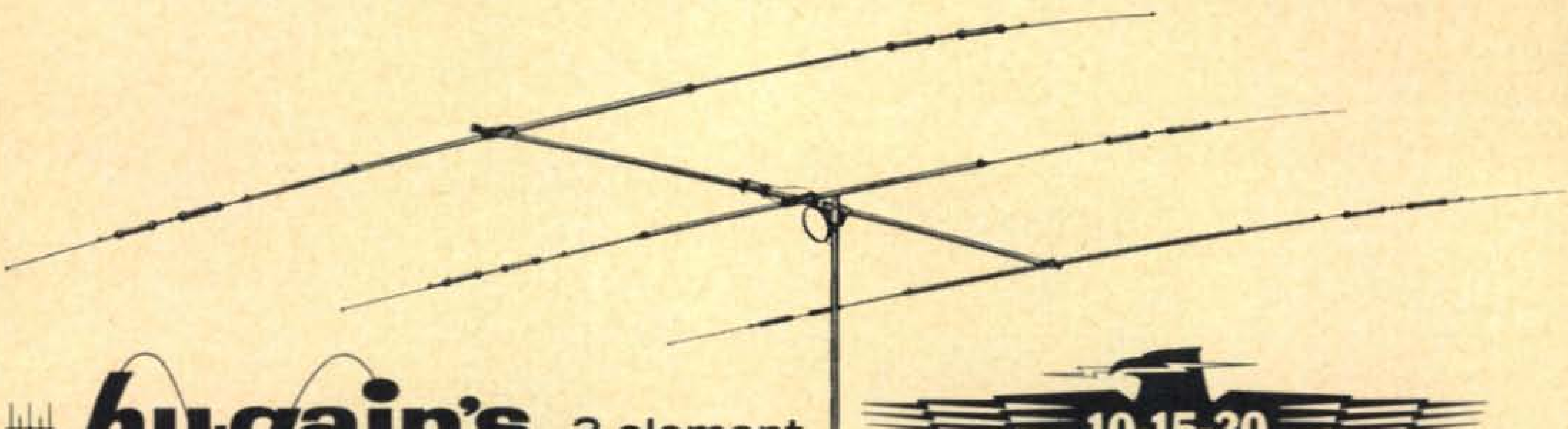
A little time spent in repeating the various adjustments to get the feel of the alignment will pay dividends when you connect up the antenna and go "on-the-air" with the transmitter. The most critical alignment procedures involve the filter and the positioning of the carrier oscillator frequency.

Operation

Front panel controls for the transmitter are AUDIO GAIN, EXCITATION, V.F.O. TUNING, POWER ON-OFF, TRANSMIT-RECEIVE, AMPLIFIER PLATE TUNING, and AMPLIFIER PLATE LOADING. The Microphone and Key jacks are also located on the front panel. The

[*Continued on page 116*]

So good it defies comparison...



hy-gain's 3-element THUNDERBIRD

10-15-20

TRIBANDER MODEL TH3Mk2

- **Delivers uncompromised full-sized performance on 10, 15 & 20 meters**
- **Takes maximum legal power**
- **Exclusive time-proven Beta Match**

Try as you may, you just won't find another three-element tribander for 10, 15 and 20 meters that will even begin to compare with Hy-Gain's Model TH3Mk2. Some say it's the individually tuned, large diameter Hy-Q traps that make the difference by providing full-sized performance on each band. Others say it's the spacing of the elements on the 14 foot boom. Still others claim it's the exclusive, time-proven Beta Matching System that provides the optimum gain and maximum F/B ratio you get with the Model TH3Mk2. Actually, it's a combination of all of these factors plus rugged heavy gauge, taper-swaged seamless aluminum construction...solid aluminum trap housings using air dielectric capacitor...weather impervious molded high impact cycolac insulators... and Hy-Gain's over-all engineering excellence, that makes the Model TH3Mk2 so good it defies comparison. Get the best in 3-element tribanders—get a Model TH3Mk2.

Model TH3Mk2................ **$114.95** Net

Other hy-gain Thunderbird TRIBANDERS...

Hy-Gain's 6-element DX THUNDERBIRD
Provides the very ultimate in tribander performance. Takes maximum power. 24′ boom. Exclusive Hy-Q traps and time-proven Beta Match.
Model TH6DX **$149.50** Net

Hy-Gain's 3-element THUNDERBIRD JUNIOR
Fantastic performance in limited space. Takes 600 watts P.E.P. 12′ boom. Exclusive Hy-Q traps and Beta Match. Rotates with heavy duty TV rotator.
Model TH3Jr. . . . . **$74.50** Net

Hy-Gain's 2-element THUNDERBIRD
Installs most anywhere. Delivers outstanding performance. Takes maximum power. 6′ boom. Exclusive Hy-Q traps and time-proven Beta Match.
Model TH2Mk2 **$74.50** Net

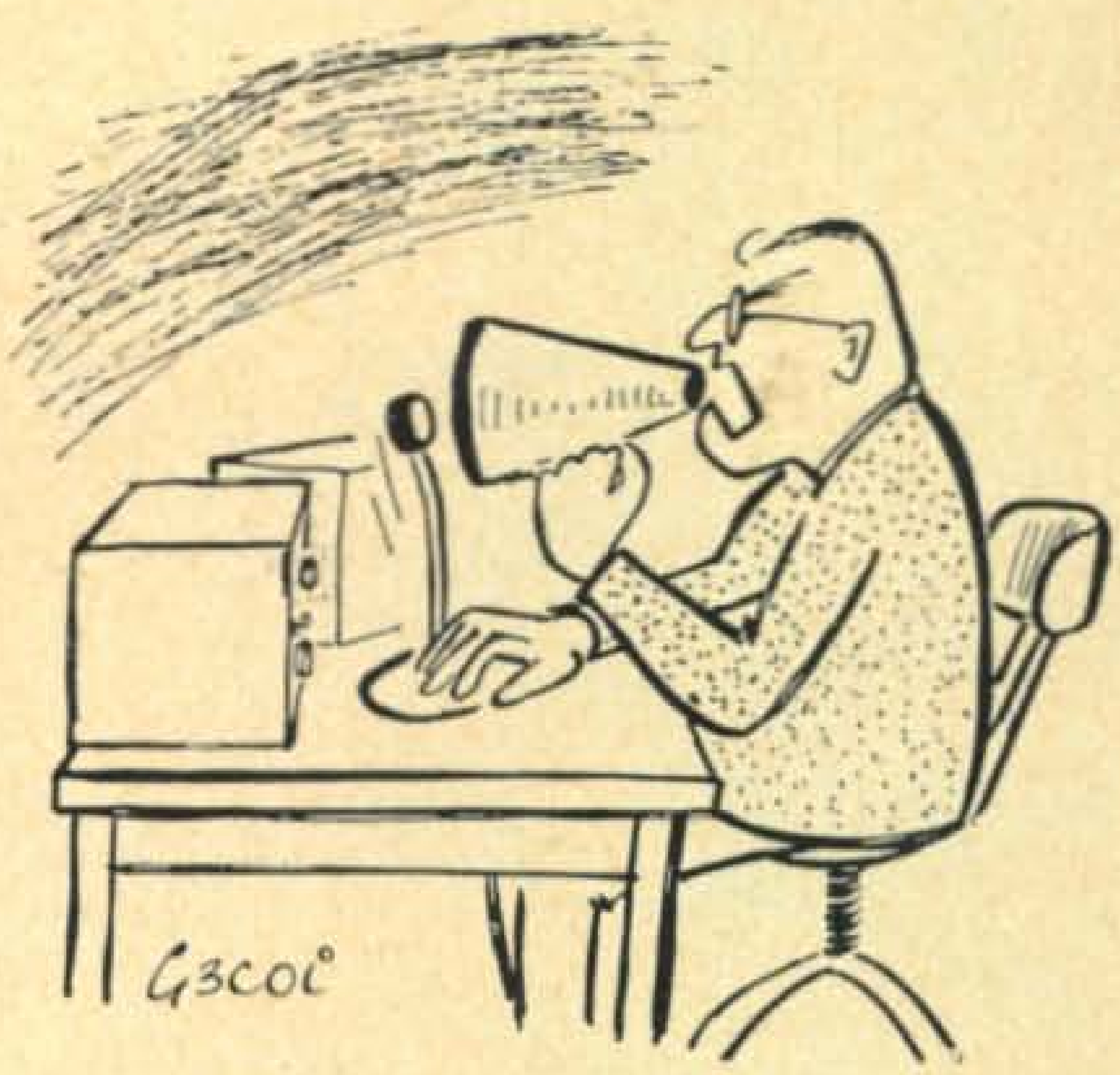
Available now from your Hy-Gain distributor or write...

hy-gain ELECTRONICS CORPORATION
Dept. AC-9 N.E. Highway 6 • Lincoln, Nebraska 68501

For further information, check number 16, on page 126

Grumbles

by Sam



I DON'T like the way things are going—not one little bit.

Time was when I could be the neighborhood hero by performing minor feats of derring-do by patching up all manner of "devices electronique." I was the first one they'd come to when the capacitors stopped capacitating and the resistors began resisting a little too hard.

Countless times I would, like the family doctor, be summoned from my bed in the middle of the night to rush to the aid of a sick Majestic or Farnsworth. One time I had a little lady bend my ear for an hour about a local radio station which had "taken over" her receiver—regardless of where she tuned, it stubbornly "refused to get off the airwaves," setting up a barrage of jamming "over all other broadcasters." I was to be, as an electronics expert, her star witness at the FCC hearing she was cooking up. Before agreeing to do the Perry Mason bit I asked to have a look at the set. She dropped her "case" against the station after I replaced the snapped dial cord. Needless to say, I was almost carried through the streets as a modern-day Marconi for this little trick; I even got a 2 months' supply of stewed rhubarb as "payment."

Today I sit here, soldering gun clenched in my pudgy little fist, awaiting my chance to again prove my worth to the community. I wait in vain since they have long since stopped coming around. "He's lost his touch," they mutter, "poor old guy, I remember when he pulled a dead mouse out of Merton's Radiola."

Well the only things I can remember are the last few times they came around before I "lost my touch."

A guy shows up with a TV set that conked out. I open it up and what do I see but a few fat little tubes with numbers right from Mars. No more the old reliables like 6SK7's or 6BA6's—now they've got something labelled a *"Compactron."* Go look at the tube number for guidance, you say. Forget it! What in the name of Tesla is an 8B10? I checked it out in the latest League *Handbook* I have (I think it's a 1953 or '55—the cover and first 42 pages were used as coffee blotters over the years) and *it simply doesn't exist!*

Pulling the tube (or whatever it is) out of its socket, I was confronted with the awesome sight of no less than 12 (count 'em, *T-W-E-L-V-E*) pins. I had to snip off 3 of the stupid things to even get it into my tube checker. Looking it up on the chart (which concurred with the ARRL that there is no such tube) I was finally reduced to putting it through the tests for a 2A4 and 6A6 (I figure that together they total up to something with the ridiculous handle of "8B10." Well it failed the tests with flying colors and when I replaced it in the TV set it still didn't work! It didn't work even after I "normalized" it by removing the 3 extra pins which were obviously some kind of atomic age mutatations!

Well the guy left in a huff and it was only later that I found out that the basic idea of the *Compactron* is to scrunch a lot of assorted tubes and functions together into one envelope. Why? What was the matter with the 6SK7? Would the BC-348 have won the war without a 6SK7?

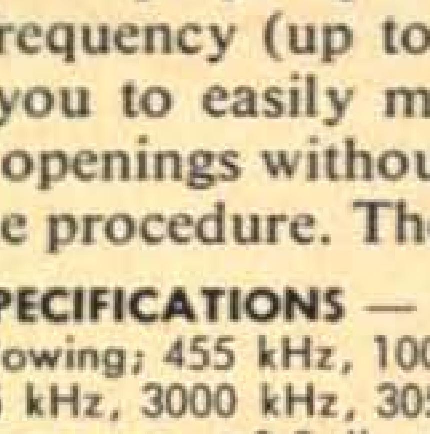
Anyway, it seems as though in the fight for space-saving they've got the one tube

* c/o *CQ*, 14 Vanderventer Ave., Port Washington, L.I., N.Y., 11050.

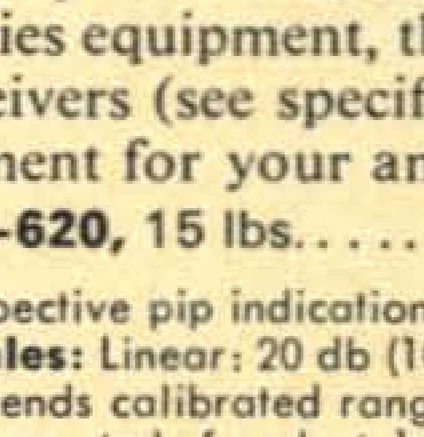
New! The Most Modern Amateur Radio Spectrum Monitor Ever Offered

Heathkit SB-620 "Scanalyzer". . . . Only $119.95

• New narrow fixed sweep function with crystal filter for single signal analysis — 10 kHz, 50 kHz, and variable control to 500 kHz • Increased sweep width capability for monitoring larger band segments — up to 500 kHz for IF's above 455 kHz, and up to 100 kHz for 455 kHz IF's • Matches SB-Series in style and performance • Operates with common receiver IF's up to 6 MHz • Both linear and logarithmic amplitude displays • Long persistance CRT for optimum display • New improved voltage doubler power supply • Mu-metal fully shielded CRT • Simple connection to receiver • Plus all of the versatile performance and operating features already made famous by the HO-13 Spectrum Monitor.



Analyzing Function — 10 kHz preset sweep width — indicate carrier 100% modulated by 2 kHz tone-log scale.



Scanning Function — approximately 250 kHz sweep width — indicates two signals above and three below the received signal, the strongest signal about 30 kHz down the band, down frequency being to the right.

The New Heathkit "Scanalyzer" Boasts Up To A Full 500 kHz Wideband Display — Plus 10 kHz Single-Signal Display. Displays up to 250 kHz either side of receiver tuned frequency (up to 100 kHz for 455 kHz IF's) . . . allows you to easily monitor band activity during contests or openings without going through the tedious hunt-and-tune procedure. The new SB-620 also brings accurate signal analysis to amateur radio . . . allows measurement of carrier, sideband, and distortion product suppression. A quality test instrument. Styled to match the Heath SB-Series equipment, the SB-620 operates with practically all receivers (see specifications). Here is a useful prestige instrument for your amateur station.

Kit SB-620, 15 lbs. **$119.95**

SB-620 SPECIFICATIONS — RF AMPLIFIER: Input frequencies: One of the following; 455 kHz, 1000 kHz, 1600 to 1680 kHz, 2075 kHz, 2215 kHz, 2445 kHz, 3000 kHz, 3055 kHz, 3395 kHz, 5000 to 6000 kHz. **Frequency response:** ±0.5 db at ±50 kHz from receiver IF. **IF frequency:** 350 kHz. **Sensitivity:** Approximately 10 uv input signal provides a visable signal (40 db mark) at full pip gain setting. **Spectrum analyzer:** Test signal input frequencies up to 50 MHz. **HORIZONTAL DEFLECTION: Horizontal sweep generator:** Sawtooth sweep produced by neon lamp relaxation oscillator. **Sweep Rate (Approximate frequencies):** 10 kHz preset: 0.5 Hz. 50 kHz preset; 2 Hz to 2.5 Hz. Variable: 5 Hz to 15 Hz. **Preset sweep width:** 10 kHz preset: 10 kHz. 50 kHz preset: 50 kHz. **Variable sweep width:*** 455 kHz (10 to 100 kHz); 1000 kHz (50 to 100 kHz); 1600 kHz (50 to 500 kHz); 1680 kHz (50 to 500 kHz); 2075 kHz (50 to 500 kHz); 2215 kHz (50 to 500 kHz); 2445 kHz (50 to 500 kHz); 3000 kHz (100 to 500 kHz); 3055 kHz (100 to 500 kHz); 3395 kHz (100 to 500 kHz); 5200 kHz (100 to 500 kHz); 6000 kHz (100 to 500 kHz). **Resolution:** 1 kHz. Note: Resolution is defined as the frequency separation between two equal adjacent signals such that the intersection between their respective pip indications is 30% below the apex amplitude. **Amplitude scales:** Linear: 20 db (10:1) range. Log: 40 db (100:1) range. —20 db Log: (Extends calibrated range to 60 db). **POWER SUPPLY: Type:** Transformer operated; fused at ½ ampere. **Low voltage:** Full-wave voltage doubler circuit, using four silicon diodes. **High voltage:** Full-wave voltage doubler circuit, using two seleium diodes. **Bias voltage:** Full-wave bridge circuit, using four silicon diodes. **Power requirements:** 120 or 240 volts AC, 50/60 Hz, 40 watts. **GENERAL: Tube complement:** (1) 3RP7 CRT, high persistance (yellow trace with screen filter). (1) 6AT6, detector vertical amplifier. (1) 6AU6, IF Log amplifier. (1) 6EA8, sweep oscillator, mixer. (1) 6EW6, RF amplifier. (1) 6EW6, IF amplifier. (1) 12AU7, horizontal, push-pull amplifier. **Diode complement:** (8) Silicon diodes, low voltage rectifier, DC filament rectifier. (2) Selenium diodes, high voltage rectifiers. (1) Silicon diode, voltage-variable capacitor. **Dimensions:** 10" W x 6⅝" H. x 10½" D.

*These sweep widths are minimum values. Actual sweep width ranges will be greater than those listed, depending on the receiver IF frequency for which unit is wired.

FREE 1967 CATALOG

Describes these and over 250 kits for stereo/hi-fi, color TV, amateur radio, shortwave, test, CB, marine, educational, home and hobby. Save up to 50% by doing the easy assembly yourself. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

HEATHKIT®

HEATH COMPANY, Dept. 12-9
Benton Harbor, Michigan 49022

☐ Enclosed is $__________, plus shipping.

Please send model (s)__________

☐ Please send FREE Heathkit Catalog.

Name__________
(Please Print)

Address__________

City__________ State__________ Zip__________

Prices & specifications subject to change without notice. AM-184

For further information, check number 11, on page 126

running as the horizontal deflection amplifier, first audio, high pass filter, and antenna rotor. I think the cathode ray tube was doubling as the local oscillator and high voltage amplifier.

The following week another guy shows up with a little table radio—that was my meat—where I really shine. I have myself trained so well that I barely even twitch when touching the hot chassis in front of the ever present supervising set owner. I open it up and guess what? Yup, another fat little tube.

What happened to the "All American Five"? This was a very un-American "One." Recalling my past experiences with these non-existent tubes I threw this trouble making guy out of the shack amidst a barrage of rather picturesque epithets directed at all of those concerned with subverting the use of tubes listed in my *Handbook*.

Of course that was the last I ever saw of any of the ingrates who used to flock to my door and sing praises to my knowledge; except for the CB'er who once asked me to fix his Viking II which he was using on 11.

My point is, are we going to take this sitting down, gang? I see it all as a definite and concerted subversive plot to belittle the American ham in front of his neighbors and in his community. I'll tell you one thing, Senator MacCarthy would have had plenty to say about this.

I can see it now—a smoke-filled Washington auditorium—marble walls and the whole bit.

"Are you now or have you ever been involved with *Compactrons?*"

"No sir, but once I used a 12AU7 instead of two 6C4's."

"You admit then that you were sympathetic to the cause?"

"Well, no . . ."

"I have here in my briefcase a list of electronic equipment using *Compactrons,* can you swear that you have never purchased any of this equipment or in any other way given support to this insidious plot?"

"But. . . ."

"Point of order! Answer the question."

"Senator, I. . . ."

"Guards, seize this man—this QSL-card carrying fellow traveller—probably has a basement full of *Compactrons!*"

Ah yes, that would have done the trick. Next we would examine the transistor people, maybe take a look into some of the strange doings with FET's and their users. One way or another we'll eventually win. We may have to resort to massive tube manual burnings, a march on Lynchburg, or maybe we can even get Wayne to try again for the Vice Presidency so that we can *really* find out what's going on.

In the mean time, I ask that all of you prepare large signs reading "Bring back the 6SK7" and just wait for the word to mobilize. ■

BY THE WAY...

Here is a shot of Julio R. Ahumada, LU7AEC/W2, probably the first LU authorized by the FCC to operate in the USA as a portable. Julio combines his hobby with his regular job as Chief Engineer at Rochester Radio Supply Co. in Rochester N.Y. He can be found on 15 or 20 meters, usually at 21.300 or 14.270.

Now You Can Get "Transceiver" Performance In A Low-Cost Novice Rig

- A high-performance CW transceiver for the first 250 kHz of 80, 40, & 15 meters
- True "break-in" CW with xtal control transmit & VFO receive, solid-state TR switching & receiver muting
- 75 watts for novice class — 90 watts for general class
- Provisions for VFO transmitter control with HG-10B

New! Heathkit® Novice CW Transceiver . . . HW-16 $99.50

Not Just For The Novice, But a High-Performance 3-Band Transceiver For All CW Operators. Use the HW-16 at your beginning code speed—the built-in sidetone lets you hear what you send, helps you build up speed, helps you develop a near-perfect fist. And through the added gain of the dual conversion circuit, plus an RF amplifier stage, the HW-16 has the high sensitivity you need for working DX. That RF amplifier means excellent image rejection for "clean" reception and superior weak signal capability. Crystal controlled first conversion oscillators and a low frequency VFO provide maximum frequency stability. You'll appreciate the sharp (500 Hz) selectivity for peeling through crowded nighttime amateur bands provided by the built-in crystal lattice filter. Better than 1 microvolt sensitivity plus a solid state TR switch for automatic antenna change over and receiver muting means real performance. You'll never outgrow your HW-16. You can work fast "break-in" rag chews and high speed traffic nets with ease. Your HW-16 will even outperform many of the "expensive" rigs on CW.

Easy Assembly Gets You On The Air Fast! Layout is open, uncluttered. Solder points are easy to get at. The HW-16 goes together with a combination of circuit board construction and rugged chassis mounting of components that makes simple, straight-forward assembly — assures electrical and mechanical stability. It's a rig you'll be proud of, and want to show to your friends. The assembly manual leads you carefully, step-by-step through the assembly and checkout procedures. Checkout requires only a VTVM, dummy load, and crystals for the bands in which you intend to operate. Headphones, a key, and an antenna are all you need to get on the air. Who said getting a good start in amateur radio is expensive? Order your HW-16 today.

Kit HW-16, 25 lbs.	**$99.50**
GD-396, Headphones (not a kit), 1 lb.	**$3.50**
Kit HS-24, Speaker, 4 lbs.	**$7.00**
Kit HD-10, Electronic Keyer, 6 lbs.	**$39.95**
Kit HG-10B, VFO, 2 lbs.	**$37.95**

HW-16 SPECIFICATIONS — TRANSMITTER: RF Power input: 50 to 90 watts (adjustable). **Frequency control:** 80-meter crystal or VFO on 80-meter band. 80 or 40-meter crystal, or VFO on 40-meter band. 40-meter crystal or VFO on 15-meter band. **Keying:** Grid-block. Break-in with automatic antenna switching and receiver muting. **Output impedance:** 50 ohm unbalanced. **Sidetone:** Neon lamp relaxation oscillator. **RECEIVER: Sensitivity:** Less than 1 microvolt for 10 db signal-plus-noise to noise ratio. **Selectivity:** 500 Hz at 6 db down. **Intermediate frequency:** 3396 kHz. **Antenna impedance:** 50 ohm unbalanced. **External speaker impedance:** 8 ohms. **GENERAL: Frequency coverage:** 3.5 to 3.75 MHz. 7.0 to 7.25 MHz. 21.0 to 21.25 MHz. **Power:** 120 VAC 50-60 Hz. **Transmitter tube complement:** 6CL6 Crystal Oscillator; 6CL6 Driver; 6GE5 Final. **Receiver tube complement:** 6EW6 RF amplifier; 6EA8 Heteroydne mixer-oscillator; 6EA8 VFO mixer-oscillator; 6EW6 IF amplifier; 12AX7 Product detector-oscillator; 6HF8 1st audio and audio output. **Transistor complement:** 2N1274 muting circuit. **Dimensions:** 13¾" W. x 11½" D. x 6½" H.

FREE 1968 CATALOG

Describes these and over 300 kits for stereo/hi-fi, color TV, amateur radio, shortwave, test, CB, marine, educational, home and hobby. Save up to 50% by doing the easy assembly yourself. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

HEATHKIT

HEATH COMPANY, Dept. 12-9
Benton Harbor, Michigan 49022

☐ Enclosed is $__________, plus shipping.

Please send model (s)__________

☐ Please send FREE Catalog.

Name__________
(Please Print)

Address__________

City__________ State__________ Zip__________

Prices & specifications subject to change without notice. AM-186

For further information, check number 2, on page 126

A VERSATILE ANTENNA TUNER

BY CHARLES M. FULLINWIDER,* W5PSA

THERE are many articles in radio magazines these days describing antenna tuners. All of the tuners follow the same general circuit with certain variations according to the use the amateur wishes to make of the tuner.

Employing parts on hand, I built a tuner which follows the usual pattern except that the coils are set up somewhat differently from other tuners I have seen described.

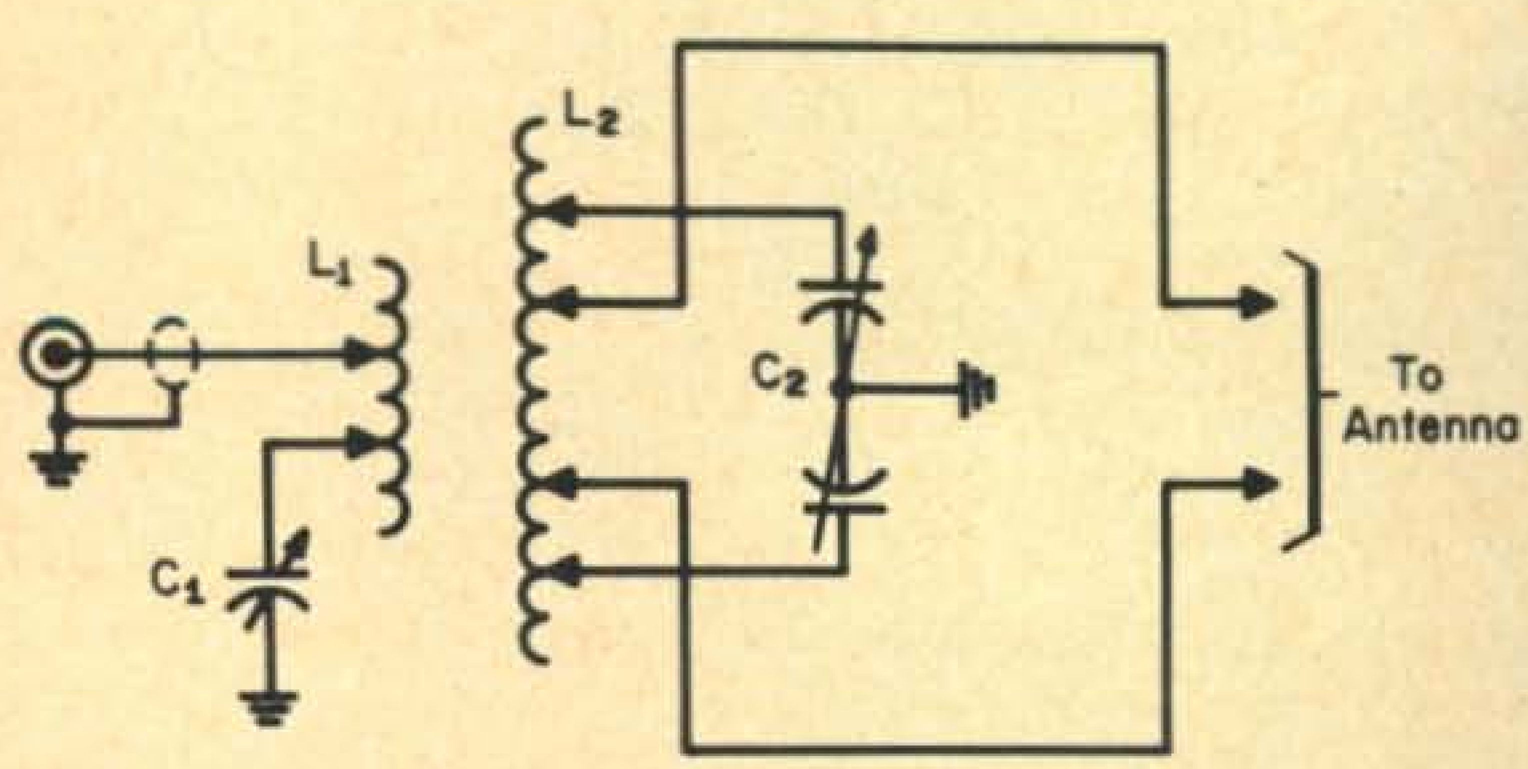
The one antenna at my QTH is a 40 meter inverted V, center fed with 50 feet of 300 ohm twin lead (450 ohm open wire feeder would also work well). With this length of feed line, the standing wave ratio can be brought down on all bands, 80 through 15, with the usual parallel arrangement as seen in fig. 1. Since only a dual capacitor of approximately 70 mmf per section was on hand, this is what was used, but if I had to purchase them, I would have bought two 100 mmf or 150 mmf capacitors, with spacings of 0.125″ to handle maximum power. They should then be mounted in such a way that the stators and rotors would be insulated

* Box 377, Dexter, New Mexico 88230.

Fig. 1—Circuit of a basic parallel antenna tuner that operates from 80 to 15 meters feeding an inverted V antenna with a 50′ length of 300 ohm line.

C_1—365 mmf receiving type variable.
C_2—70 mmf per section 2 gang capacitor. See text.
L_1—22t., #16 e. wound on a 2″ dia., 5″ long porcelain form.
L_2—60t., #12, 3″ dia. 6 t.p.i. Polycoil #1778 or Air-Dux #2406T.

Tap Settings		
Band	**L_1**	**L_2**
80	12t	57t
40	8t	24t
20	4t	16t
15	1t	6t



from each other. This would permit the use of a series circuit arrangement, as well as parallel.

10 Meter Operation

The tuner would not work on ten meters with the 50′ length of feed line. If the tuner is to be used on the 10 meter band, the feed line could be lengthened or shortened until the tuner could handle the impedence.

Some experimenting was done on ten meters with the 50 feet of feed line and a series arrangement, and it was found that the standing wave ratio could easily be brought down. Two variable capacitors of 20 mmf each were all that were on hand for use in the experiment, and variable capacitors of 100 mmf or 150 mmf would have been much better. See fig. 2 for the circuit used.

The Coils

Coil L_2 is 3″ in diameter, 6 t.p.i. and 10″ long. A surplus unit originally designed for use as a loading coil was used, however, commercially available coil stock can be used as indicated in fig. 1.

Coil L_1 is wound with #16 enameled wire on a 2″ diameter 5″ long porcelain ribbed coil form taken from an old BC-375E surplus tuning unit. The coil was wound with 22 turns in order to take advantage of the end feedthrough holes and for experimentation on 160 meters. (More on this later.) Only 12 of the 22 turns are used for operation from 80 meters to 10 meters. Taps were made so that 1, 2, 4, 8, or 12 turns could be used as desired; the tap wires were wrapped with plastic tape so that they would not short against the turns of L_2.

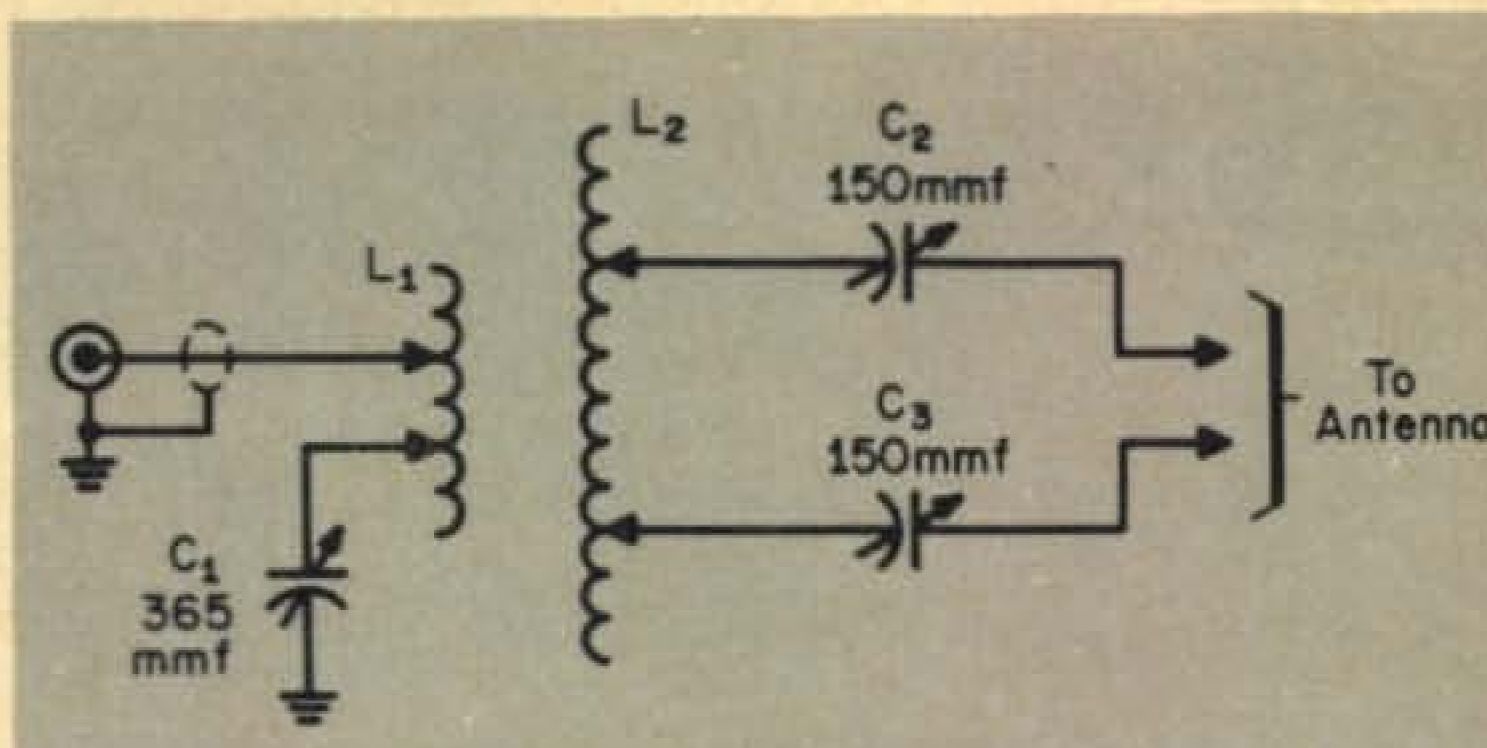


Fig. 2—Circuit of the tuner arranged for series feed on 10 meters. Capacitors C_2 and C_3 may be coupled mechanically if desired but must be separated electrically as shown above.

Construction

Coil L_1 was slid into place inside L_2, and the tap wires were brought down between the winding of L_2. The whole coil assembly was then mounted on a plastic bar.

Care should be taken that the turns used on L_1 are centered between the turns being used on L_2. The writer has put dots of paint and fingernail polish, a different color for each band, on the turns used so that the counting of turns is eliminated. Small alligator clips are used to attach wires to L_2 and to the taps of L_1.

160 Meters

Although it has not been tried with this coil arrangement, there should be no reason why such a parallel tuner could not be built for use on 160 meters, loading an 80 meter dipole antenna. Probably all 22 turns of L_1 would be used (Fig. 1), C_1 would be about 1200 mmf (a three-section variable capacitor with the sections wired in parallel), and C_2 could be a dual section capacitor of approximately 300 mmf per section. ■

THE *NEW* GALAXY V MARK 2

5 BAND TRANSCEIVER MOBILE OR FIXED STATION

Now... even better than ever!

6 NEW Features:

- New 400 Watt Power
- New Precise Vernier Logging Scale
- New Solid State VFO
- New CW Sidetone Audio
- New CW Break-In Option
- New CW Filter Option

6 WAYS BETTER

Yet Still Only $420^{00}

- Smallest of the High-Powered Transceivers. (6"x10¼" x11¼").
- Great for either Mobile or Fixed Station. No compromise in power.
- Hottest Receiver of any Transceiver — Special New Six-Crystal lattice filter.
- Complete 80-10 Meter Coverage. 500 KC on all bands, with 1 Megacycle on 10 Meters.
- Both Upper and Lower Selectible Sideband.
- Highest Stability. Drift less than 100 CY in any 15 minute period after warmup.
- The personal drift chart of every Galaxy that comes off our line goes with the unit to its new owner!

6% FINANCE CHARGE • 10% DOWN OR TRADE-IN DOWN • NO FINANCE CHARGE IF PAID IN 90 DAYS • GOOD RECONDITIONED APPARATUS • Nearly all makes & models. Our reconditioned equipment carries a 15 day trial, 90 day warranty and may be traded back within 90 days for full credit toward the purchase of NEW equipment. Write for bulletin.

TED HENRY (W6UOU) BOB HENRY (W0ARA) WALT HENRY (W6NRV)

Henry Radio Stores

CALL DIRECT . . . USE AREA CODE

Butler 1, Missouri, 64730	816 679-3127
11240 W. Olympic, Los Angeles, Calif., 90064	213 477-6701
931 N. Euclid, Anaheim, Calif., 92801	714 772-9200
6116 N. 27th Ave., Phoenix, Ariz., 85017	602 AM 4-3895

East Coast Rep.: Howard Laughrey, 2 Elizabeth St., Chappaqua, N.Y. 10514, (914) CE 8-3683

"Worlds Largest Distributors of Short Wave Receivers"

For further information, check number 13, on page 126

SAIL TO GLORY

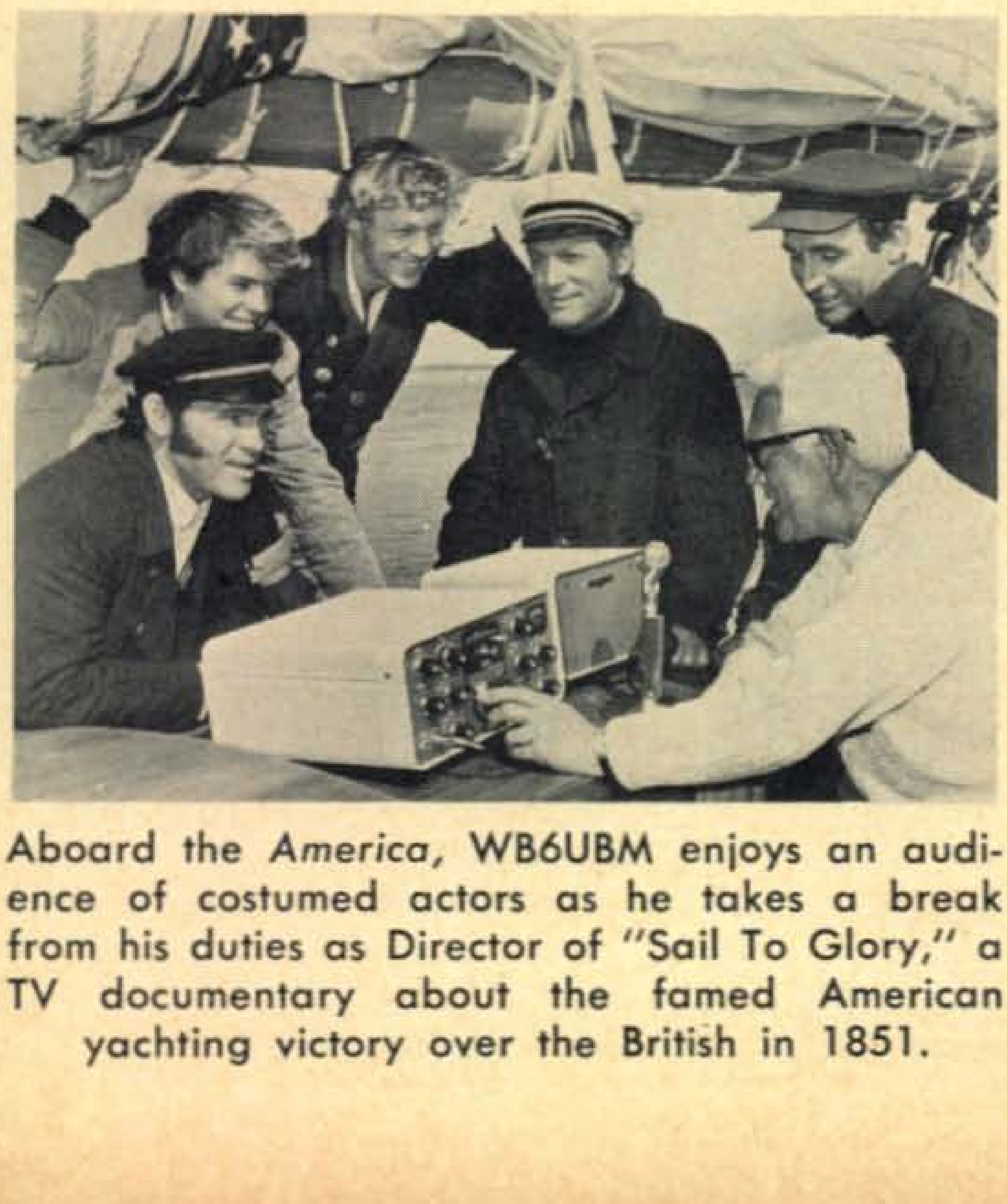
with an SB-101

America—The Incredible Schooner

BY GERALD SCHNITZER, WB6UBM

SURELY the most impatient man in the world has to be a Novice waiting for his new General ticket, and I was no exception during my moments of anxiety last fall when I joined the honorable fraternity of radio amateurs as WB6UBM. In my case, however, it was particularly excruciating. This was more than just anxiety about my ham ticket. I was determined to tie-in my first days as a General with a maritime mobile operation which would take place off the coast of Maine, the following June. The maritime mobile project was to be aboard a schooner called *America*, which would be featured in a documentary movie about the winning of America's Cup in 1851. The film's title is "Sail To Glory."

For bread and butter I am a writer and director of motion pictures, and the filming of the story of *America* was to become a labor of love. The trick was to combine the two: ham radio on board the *America*, and shooting the film. Somebody must have been watching—everything fell in place.



Aboard the *America*, WB6UBM enjoys an audience of costumed actors as he takes a break from his duties as Director of "Sail To Glory," a TV documentary about the famed American yachting victory over the British in 1851.

With the cooperation and guidance of W1ST, Bob Stimpson, we installed a Heath SB-101 on board the 1851 replica of *America*, using the ship's 110 volt a.c. power supply. We worked on 20, 15 and 40. Filming of "Sail To Glory" started and we had a maritime mobile rig going full blast aboard the great schooner. Our antenna (pardon the expression) was a 110 foot stainless steel stay. We tied into a Johnson Matchbox and then into the Heathkit SB-101.

The first tune-up was a dilly—the microphone seared my lips with r.f.! Now I know what is meant by a high s.w.r. W1ST quickly tuned the Matchbox and the SB-101 and it worked magnificently easy from then on. Naturally, we had many interruptions—like working—and actors tripping over the lead-in wire to the stainless steel stay, held on with an alligator clip. The interested members of our cast, dressed in 1851 costumes, looked most contradictory in their pork chop beards and Billy Budd sailor outfits, but I am pretty sure that ham radio has bitten a few of them also. Using minimum power we managed to work the Caribbean, Midwestern and Western U.S. and British stations.

Mixing my work with a little hamming was most enjoyable and kept me from "losing my cool." Having a fellow like W1ST to assist didn't hurt either!

Incidentally, the one-hour color documentary will be seen on TV in early September, coincident with the 1967 running of the America's Cup races off Newport, Rhode Island. ■

MUTUAL RADIO-COMMUNICATION SERVICE INTERFERENCE

BY DANIEL P. COSTA*

This summation of causes of interference in communications is a primer for the Novice. An understanding of the causes of interference often helps to eliminate it or its effects.

WHENEVER one communication system interferes with another, the condition is known as mutual interference. Intelligence can be so badly garbled that it becomes useless. Mutual interference may manifest itself in several ways as:

(1) Noise
(2) Cross talk
(3) Harmonic interactions

*Compartment 285, 217 West 18 Street, New York, 10011.

It originates from many local and distant sources. Frequency relationships, geographical location, faulty adjustment of equipment, improper operating techniques, and weather conditions are important factors contributing to the nature of mutual interference. Equipment and systems that are potential generators are radar, radio, radio aids to navigation, telephones and wire signaling equipment. When checking for the exact source of a given type of interference, it often becomes

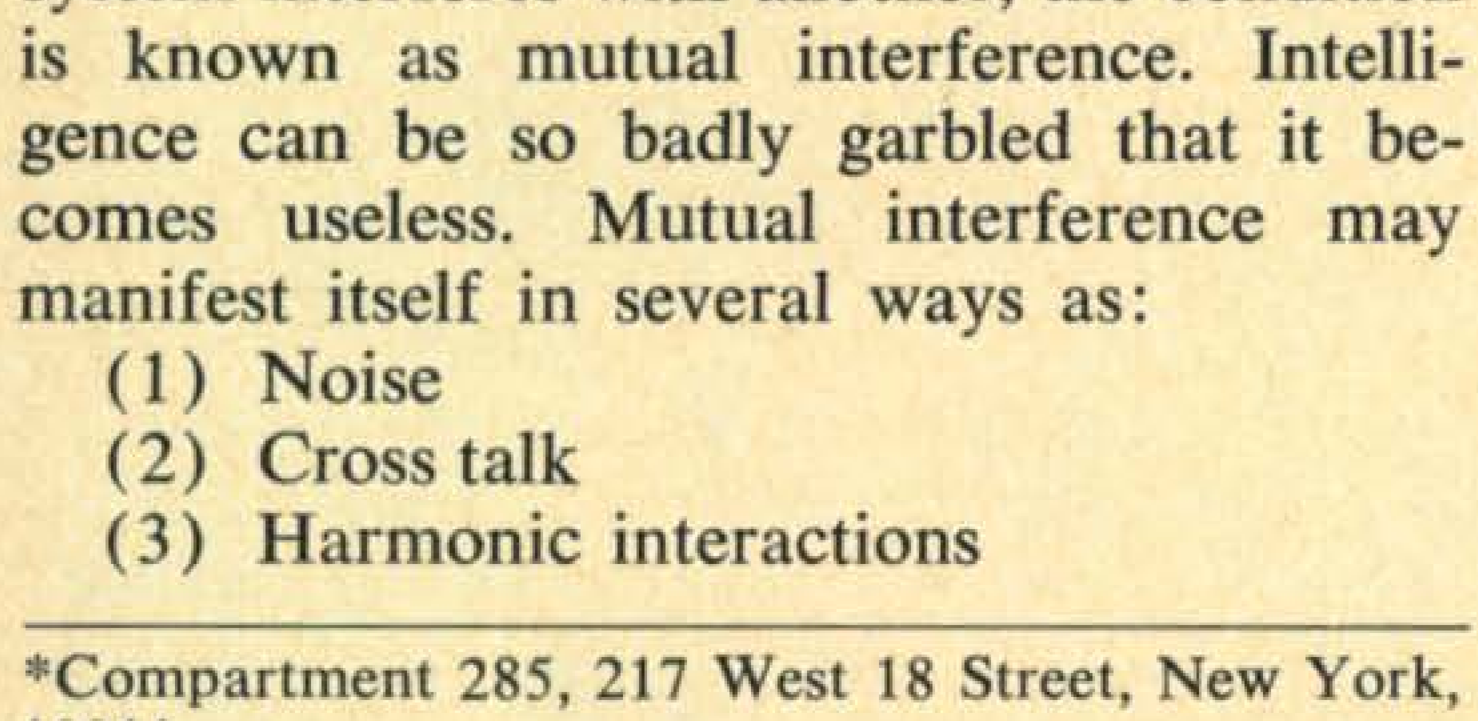
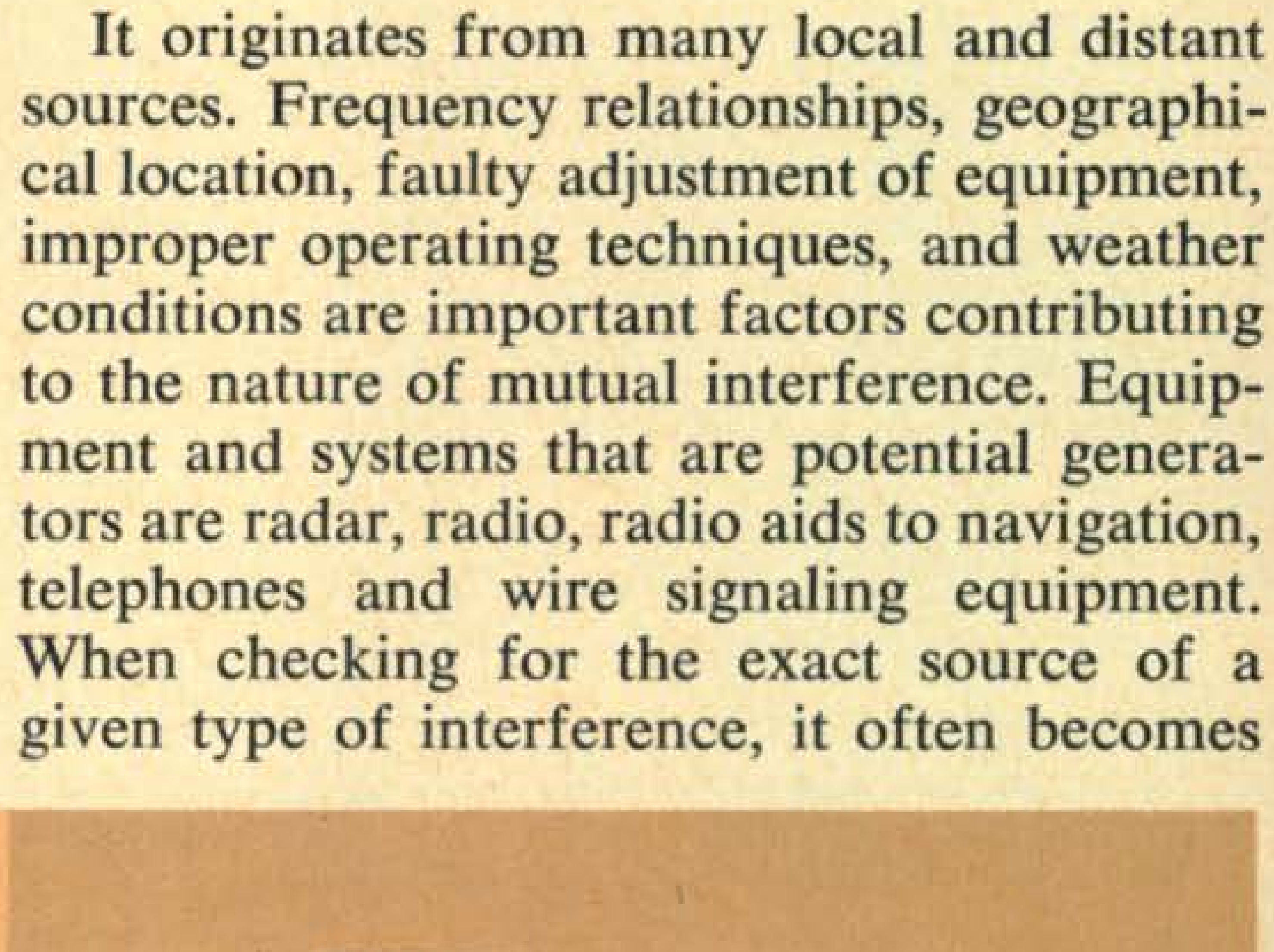
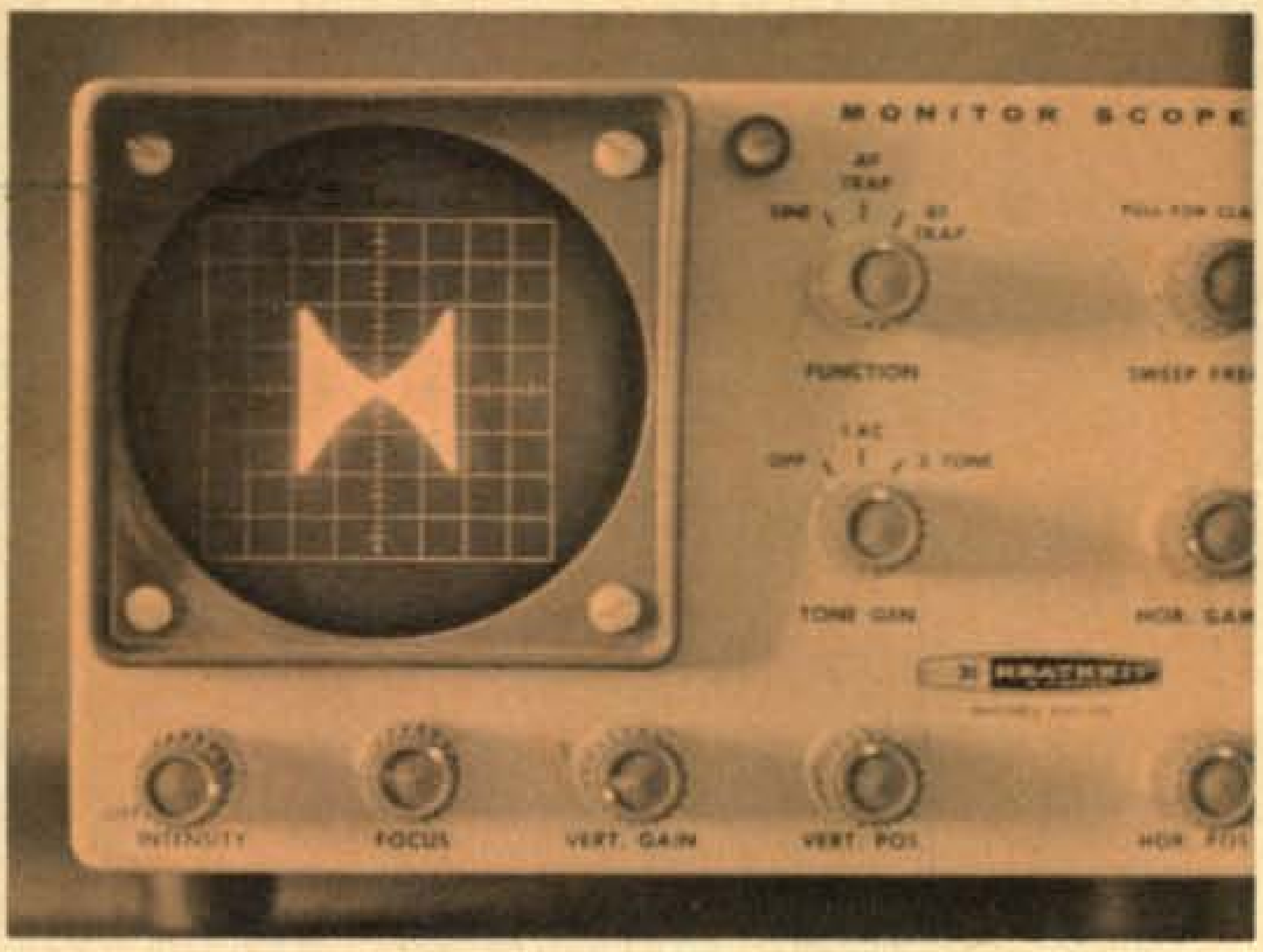


Fig. 1—Simple baluns used to match balanced to unbalanced circuits prevent transmission line radiation and can provide correct impedance matches. The balun shown provides a 4 to 1 impedance increase and matches a balanced antenna to an unbalanced transmission line. (From *"Antenna Handbook, Vol. I"* by Ken "Judge" Glanzer, p. 98.)



Lafayette model HE-73 preselector. A preselector can provide additional gain for increased sensitivity, increased r.f. selectivity for improved image rejection and rejection of interference on the receiver i.f. frequency.



Heathkit HO-10 Monitor Scope used to monitor the transmitter output. This helps to insure a clean signal without distortion or splatter. It can also be used to check c.w. keying characteristics and RTTY operation. Pattern shown on the HO-10 is a "bow tie" used to check s.s.b. transmitter performance.

necessary to suspect other equipment that is not connected to the affected service.

Conditions for Mutual Interference

A crowded band means that the radio operator is hearing other signals on, or close to, the desired frequency. The strength of the unwanted signals may be such that it becomes impossible to distinguish the wanted signals well enough to pick off the intelligence it conveys; this is a particular illustration of mutual interference. Because accuracy is vital to communications, some means must be used to eliminate, or at least reduce to a workable value, this undesirable interference. Some of the common conditions that cause it are:

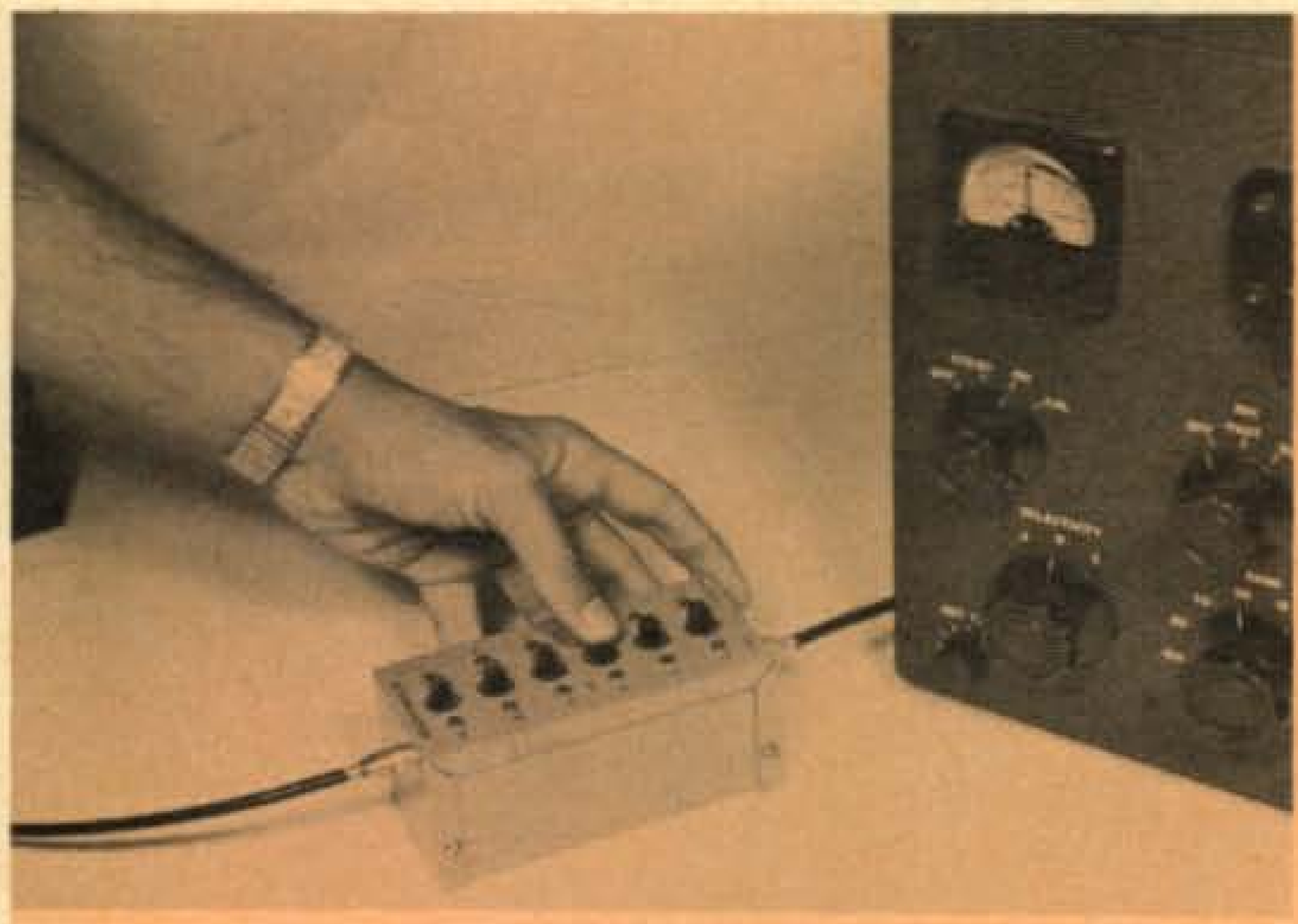
Spurious, undesired signals—These are the signals always radiated by transmitters along with their normal output, but not at the carrier frequency assigned to the equipment. They carry no intelligence and, therefore, are undesirable; they represent a rich source of interference.

Spurious receiver responses—A radio receiver is responsive to signals of many frequencies other than to the one to which it is tuned. Interference may be the result of different frequencies combining in the mixer stage to produce other frequencies that are even more undesirable. The relative efficiency or sensitivity of a particular receiver to interference signals of this variety is a function of receiver design.

R.f. arcing of transmitters—If r.f. arcing occurs in the output circuits of a transmitter, the efficiency of the equipment is reduced considerably and interference is generated.

Impedance mismatch in the antenna system—Improper impedance matching of r.f. transmission lines with directional antennas can cause interference from a transmitter since the transmission lines will radiate signals in undesired directions. Coupling nonresonant lines to an antenna through a quarter wave linear transformer or matching section will correct mismatching. Impedance matching is important for receiving r.f. transmission lines. When interference is present in a receiver, it may be helpful to examine the match between antenna and receiver input, and make it as close as possible.

High voltage pulse interference—Equipment that generates and propagates high energy pulses may interfere with the operation of a



Adjustable attenuator placed in series with the antenna is used to reduce the cross-talk at the receiver due to the presence of strong interfering signals. See Scherer, W. M., "A Step Attenuator," CQ, October 1964, page 43.

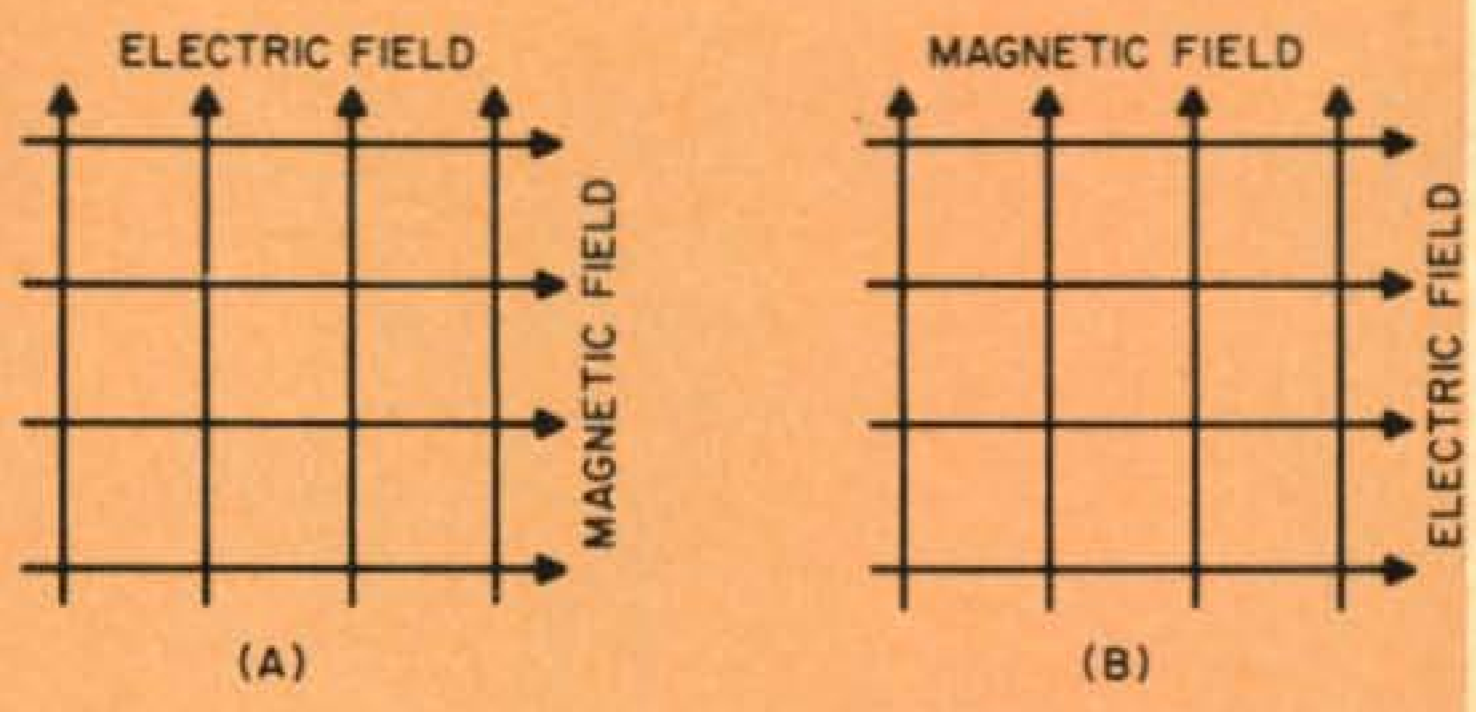


Fig. 2—The polarization of the radiated signal is identified by the electric field. In (A), with a vertically electric field the signal is vertically polarized. In (B) the signal has horizontal polarization.

variety of communications systems. Precautions must be taken to minimize such interference. Radio, radar, radio aids to navigation such as loran and shoran, and wire equipment are affected in this case.

Frequency assignments—Improper frequency assignments for adjacent two-way radio circuits are often a cause of mutual interference.

Remedies for Mutual Interference

There is no general formula for solving mutual interference problems in radio-communication service equipment. The following measures, however, may reduce the chances of serious interference. Antenna polarization is an important consideration. Two methods are horizontal polarization and vertical polarization.

(1) In horizontal polarization, the electric field associated with the electromagnetic energy being radiated is in the horizontal plane.

(2) In vertical polarization, the electric field is in the vertical plane.

Receiving antennas must be properly polarized to sucecssfully pick up a signal. For example, a horizontally polarized receiving antenna will have difficulty in picking up waves transmitted by a vertically polarized transmitting antenna, and vice versa. Vertical polarization will assist in the reception of ground waves, while horizontal polarization is desirable for sky waves.

The amount of power needed for communication is important in avoiding mutual interference and in gaining privacy. Use of more transmitting power than is necessary is not recommended.

Overmodulation of transmitters and excessive grid drive should be avoided to reduce side band splatter, radiation of radio-frequency harmonics, and parasitics.

A regular check of the transmitter frequency is important for equipment which is not frequency controlled. Interfering systems should be separated by distance or by operating frequency. Coordination within any given system is important in alleviating interference problems.

Mutual Interference from Transmitters

Spurious Radiation—Most of the r.f. output of a transmitter is at the operating frequency and its relatively narrow side bands. A transmitter will always radiate small amounts of energy at frequencies other than its carrier frequency. These radiations can cause serious interference in receivers which may be far removed from the transmitter site. Even the best receiver is responsive to some extent to signals of frequencies other than the one to which it is tuned. The problem is further complicated because signals from two transmitters operating on different frequencies may beat against each other in a receiver to produce interfering signals. This type of interference is called heterodyning. Some of the causes of spurious radiation are:

(1) Normal and spurious sidebands.
(2) Parasitic oscillations.
(3) R.f. arcing.
(4) Transmitter noise.

Normal and Spurious Sidebands—When a radio frequency carrier is modulated either in frequency or in amplitude, a group of frequencies are generated around the carrier frequency due to the modulating signal. These frequencies, within the vicinity of the carrier, are called sidebands. They theoretically extend to infinity on either side of the carrier in f.m. sets, but they are of appreciable amplitude only within a limited frequency range. The usable and important range of frequencies necessary to transmit intelligence determines the bandwidth of a signal. Sidebands occurring outside the necessary bandwidth of a signal are undesirable and should be eliminated. If not, they may cause interference. Spurious sidebands may arise from improperly tuned circuits, from overmodulation, or from faulty equipment. Splatter, which is a form of undesirable sideband production, results when the modulation is improperly achieved or poorly controlled. This is eliminated by checking the modulation percentage to insure that the signal is being properly modulated.

Parasitic Oscillations—Parasitic oscillations occur when an unwanted frequency is accidentally generated in the transmitter circuit as a result of poor mechanical or electrical design. Parasitics are generally of high frequency. They reduce the power of the transmitter because each parasitic draws off a small amount of the total power.

R.F. Arcing in Transmitters—Arcing in the output circuits of a transmitter causes interference. Waves are radiated that may be picked up by other equipment, even at a considerably remote point. A buzz or rasping sound will be evident in the receiver output while the transmitter is operating and will cease with the shutdown of transmission.

Cross-Modulation in Transmitters—Two transmitters operating at different frequencies and exposed to the radiation fields of each other generate cross-modulation interference. The two frequencies combine in the power output stage of the respective transmitters and produce new frequencies. The entire spectrum of frequencies can be radiated, giving rise to interference in equipment that would ordinarily be unaffected. This problem can be solved by relocating one of the transmitters. If this is impossible, a suitable filter should be installed in the output stage, that only permits a narrow band of frequencies to be radiated.

Noise in Transmitters—Other possible sources of noise include hum effects, vibration, thermal noise, and rectifier and corona hash. The chief source of hum in a transmitter is the modulation resulting from using an a.c. source for the supply of filament voltage. Hum also may be introduced into a transmitter by improper filtering of the B supply voltage in the power supply. Vibration may be the source of noise when the transmitter is subject to vibration of the type that occurs in aircraft or motor vehicles.

Mutual Interference In Receivers

The input stage of a radio frequency receiver is a tuned circuit that is essentially a bandpass filter. It passes the frequencies within its acceptance band while rejecting others. Even though the transmitted energy is attenuated by the tuned circuit of the receiver, the response is still high within the pass band of the receiver, and "cross-talk" occurs. It is therefore necessary to provide for interference reduction by design techniques.

The selectivity of even the best receiver is not perfect. Selectivity in a receiver is the ability to discriminate sharply between a wanted and unwanted signal.. An unwanted signal may be an actual intelligence-bearing signal from transmitting equipment, or it may be the result of interactions within a receiver. When detected, the effects of cross-modulation are evidenced as distortion in the audio output.

Unwanted signals can originate at distant or local points. Regardless of their source, they can totally disrupt a radio communication circuit if they are of considerable strength or are present on the desired receiving frequency. The problem of suppressing or eliminating interference in a receiver increases as the received frequency increases. This is partly overcome in the superheterodyne receiver by changing the frequency of the received signal to the intermediate frequency (usually much lower).

Interference Caused by Signals at Intermediate Frequency—If a signal is present at the intermediate frequency, it is likely to pass through the converter and become amplified; this will cause considerable interference. The signal will appear in the output regardless of the tuning at the input. Preselection is the best remedy. Most receivers have a built in wave trap tuned to eliminate this type of interference.

Interference Caused by Heterodyning of Signals—The most common interference is a heterodyne effect. This is identified as an audible whistle, which varies as a receiver is tuned. The effect is caused by the carriers of signals close together in frequency beating against one another in the second detector of the receiver. Heterodynes are unavoidable but the objectionable effect can be minimized by careful manipuation of filter and selectivity controls provided on the receiver. Crystal filters or band-pass filters which select narrow bands of frequencies at the exact frequency desired are the most helpful devices provided. ■

NOTICE: The rules for the 1967 CQ World Wide DX Contest appear on page 59. Send in for the log sheets and summary sheets *now*, and be *sure* to have them in time.

LOUD SHORTY ON THE BOTTLE

BY J. W. PADDON,* G2IS

Do you have an antenna site that is wide open and soggy? If so, here is a simple vertical that uses a bottle for the base insulator and irrigation pipe or downspout for the element and it will produce excellent results.

THE amateur dream of an antenna for working long haul DX is consistent. The vision emerges of a commanding hilltop on which stands a one hundred foot steel tower. The tower supports yards of dural tubing fabricated into one of the many beam configurations.

The dream is valid except, perhaps, for the hilltop location. If it brought much benefit on h.f. (as opposed to u.h.f. and v.h.f.) the great communications companies would not site their multi-million dollar complexes on wide, flat acres of good soggy land with low ground resistance.

The type of antenna described in this article is something else again. The 21 mc version has a total height of less than ten feet!

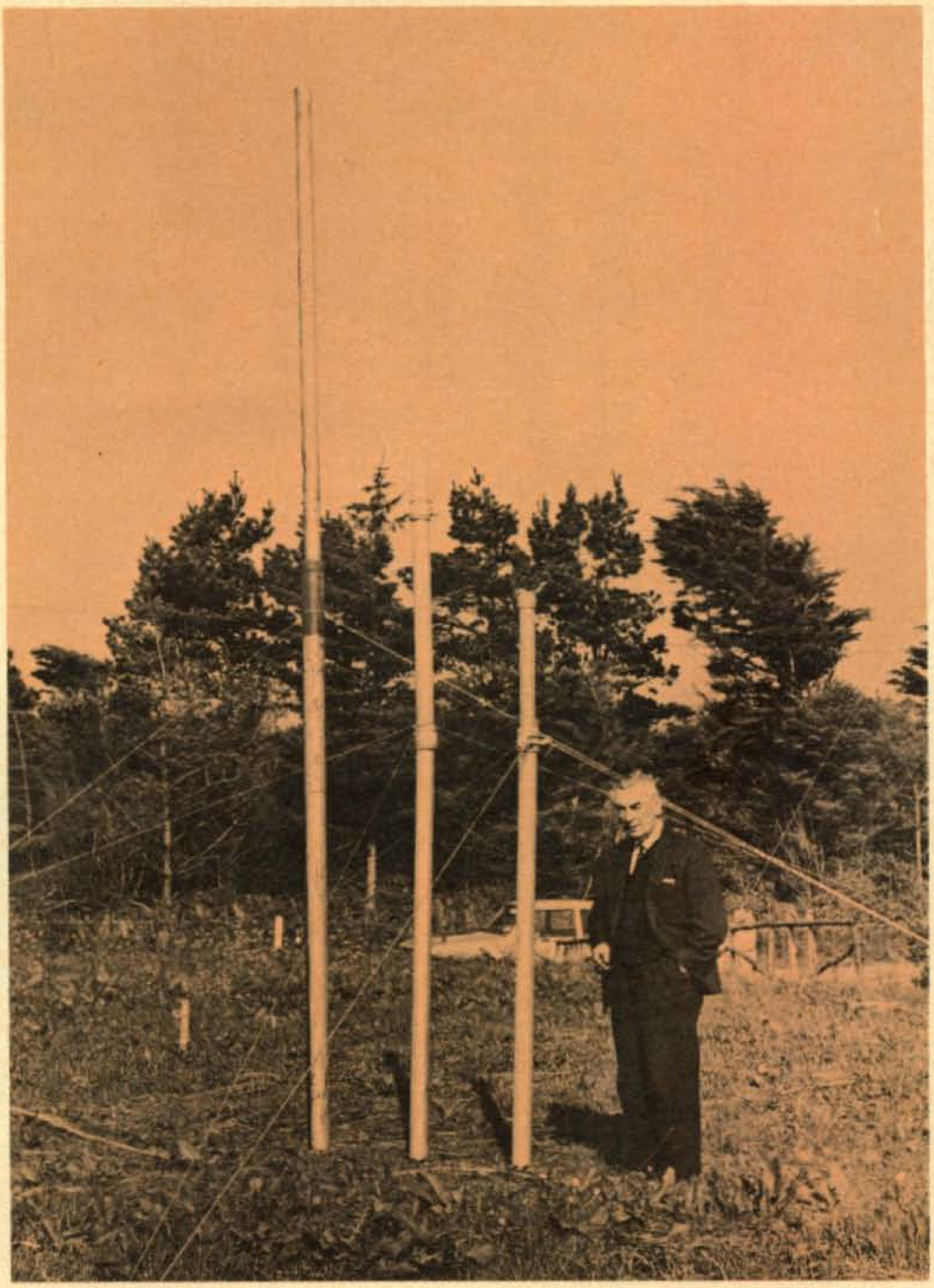
*Stagbury, Furzefield Road, Beaconsfield, Bucks, England.

Comparisons

The 21 mc frequency was chosen as the band for evaluation. Comparison, on various bearings, was made against "ZL Specials" plus directors. Compilation of results over a period of months disclosed that the very low angle of radiation of "Shorty" notably outperformed the beam in the extreme DX case. The gain of the beam is of the order of 6 db whereas "Shorty" has none. On the path EI-W6 the beam averages 2 "S" points above "Shorty". The condition is reversed on the path

View of the base of the three verticals connected to one coax feedline. All are supported by bottles and strapped together.

Full view of the 14, 21 and 28 mc "Shorties" with EI9Q in the foreground.



EI to VK, ZL, KR6, HM and JA.

Comment is frequently made on all bearings that the signal is the first to appear as the band opens up. It has also been observed, with some surprise, that reports of "first skip" signal strength are frequently very high from such areas as LA, UA, OK, YA, ZCH and 4XH.

There is no question but that "Shorty" is a highly efficient radiator but the other major factor is location. Dick Madigan EI9Q has a site anyone can envy. His antenna farm is on the S.E. coast of Eire. It is flat and totally unobstructed on any bearing. The ground is, to say the least, moist. In rainy times there can be an inch of water on the surface! It is bounded by large bays on two sides and the open Atlantic lies 300 feet below on the other.

In the winter great gales smash in from the open ocean and the loss of horizontal antennas was as frequent as it was irritating. "Shorty" was tried because his diminutive stature would stand against the weather and because something with a 360° pattern was wanted for hunting DX.

Materials

Fortunately the bits and pieces needed to put "Shorty" together are readily available, very inexpensive and there is nothing critical in the design.

The bill of material is:

Radiator: Aluminum tubing 3" in diameter 8'6" on 28 mc; 10'6" on 21 mc and, 16'6" on 14 mc, all before pruning.

In EI9Q's case the tubing is down spouting but it is imagined that in North America aluminum irrigation pipe would be used. There is nothing magical about the 3" diameter. Any size can be used but the greater the diameter, within reason, the more broadband the system will be.

Base Insulator: One bottle (empty) for each radiator. The ones at EI9Q bear the name "Guinness," a noble Irish elixir. (Members of the W.C.T.U. can use milk bottles.) Perfectionists thinking in terms of glazed porcelain, Pyrex or quartz at this

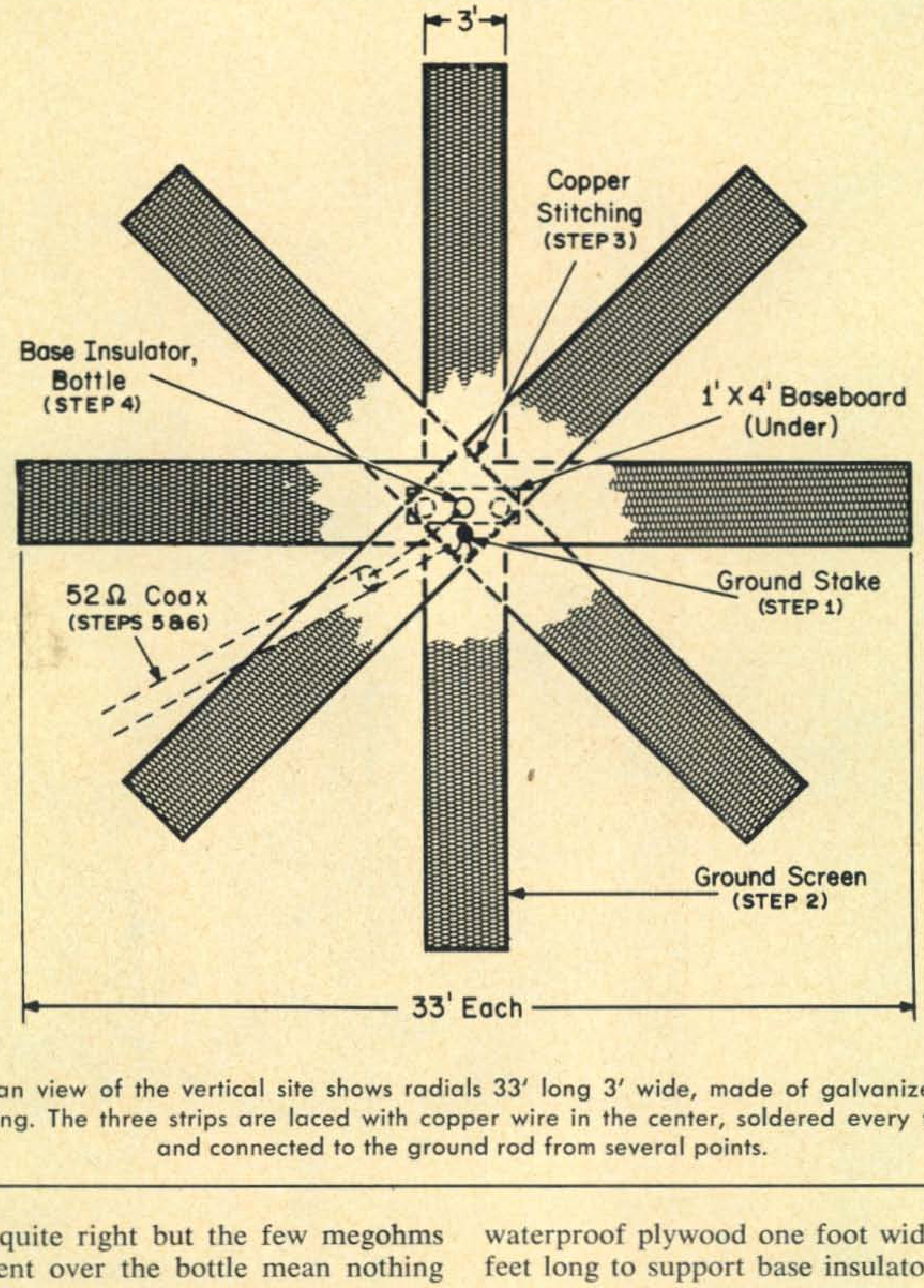


Fig. 1—Plan view of the vertical site shows radials 33′ long 3′ wide, made of galvanized chicken wire fencing. The three strips are laced with copper wire in the center, soldered every few inches and connected to the ground rod from several points.

point are quite right but the few megohms improvement over the bottle mean nothing when shunted across 52 ohms.

Ground Screen: Four lengths of best quality, small mesh, heavily galvanized chicken wire fencing at least 3′ wide and each 33′ long.

Guys: A roll of nylon, glass line or monofilament cord with a breaking strain of 200 pounds or more.

Ground: A length of scrap copper piping about 1″ in diameter and 4 or 5 feet long.

Feeder: Best quality 52 ohm coax capable of being buried or exposed to the weather.

Odds and Ends: Aluminum strap, nuts and bolts (preferably Dural), soft drawn copper wire, a bundle of tent pegs or simply whittled stakes to tie off guys, a piece of ¾″ waterproof plywood one foot wide and four feet long to support base insulators.

Installation Procedure

1—Locate the position of radiators, and put down the waterproof plywood support board—after giving it several coats of outdoor paint. Drive in a ground stake leaving a couple of inches above ground (fig. 1).

2—Lay out ground screen (it would be wise to spray it with paint first) per fig. 1. It can be held in place with a row of bricks along the edges of the strips or secured with pegs. If the XYL dislikes the appearance, it can be covered with sod.

3—Stitch copper wire through all elements of the ground screen and tack every

[*Continued on page 114*]

Rules: 1967 *CQ* World Wide DX Contest

October 21-22, November 25-26

I. CONTEST PERIOD

Phone: Oct. 21-22. **C.W.:** Nov. 25-26.
Starts: 0000 GMT Saturday. Ends: 2400 GMT Sunday in each instance.

II. OBJECTIVE

The object of the contest is for Amateurs around the world to contact as many other Amateurs in as many different Zones and Countries as they can during the 48 hour contest period.

III. BANDS

The 10, 15, 20, 40, 80 and 160 meter amateur bands may be used in the contest.

IV. TYPE OF COMPETITION

1. Single Operator:
   - (a) Single Band.
   - (b) All Band.
2. Multi-Operator: all band operation only:
   - (a) Single Transmitter. (only one signal permitted)
   - (b) Multi-Transmitter. (only one signal per band permitted)

V. NUMBER EXCHANGE

1. Phone stations exchange 4 numerals, RS report plus their Zone number. (Example: 5805/5723)
2. C.W. stations exchange 5 numerals, RST report plus their Zone number. (Example: 58905/57923)

VI. MULTIPLIER

Two types of multiplier will be used:
1. A multiplier of one (1) for each different Zone contacted on each band.
2. A multiplier of one (1) for each different Country contacted on each band.

Stations will be permitted to contact their own Country and Zone for multiplier credit.

The *CQ* Zone map, DXCC country list and the WAE country list are the standards.

VII. POINTS

1. Three (3) points will be earned for each complete QSO between stations on different continents.
2. One (1) point will be earned for each complete QSO between stations on the same continent, but in different countries.

(Exception: Contacts between stations in the North American continent will count two (2) points. This applies to N.A. *only*)

3. Contacts between stations in the same country are permitted for Zone or Country credit but have Zero (0) point value.

Only one contact with the same station on the same band is permitted.

The WAC continental boundaries will be the standard.

VIII. SCORING

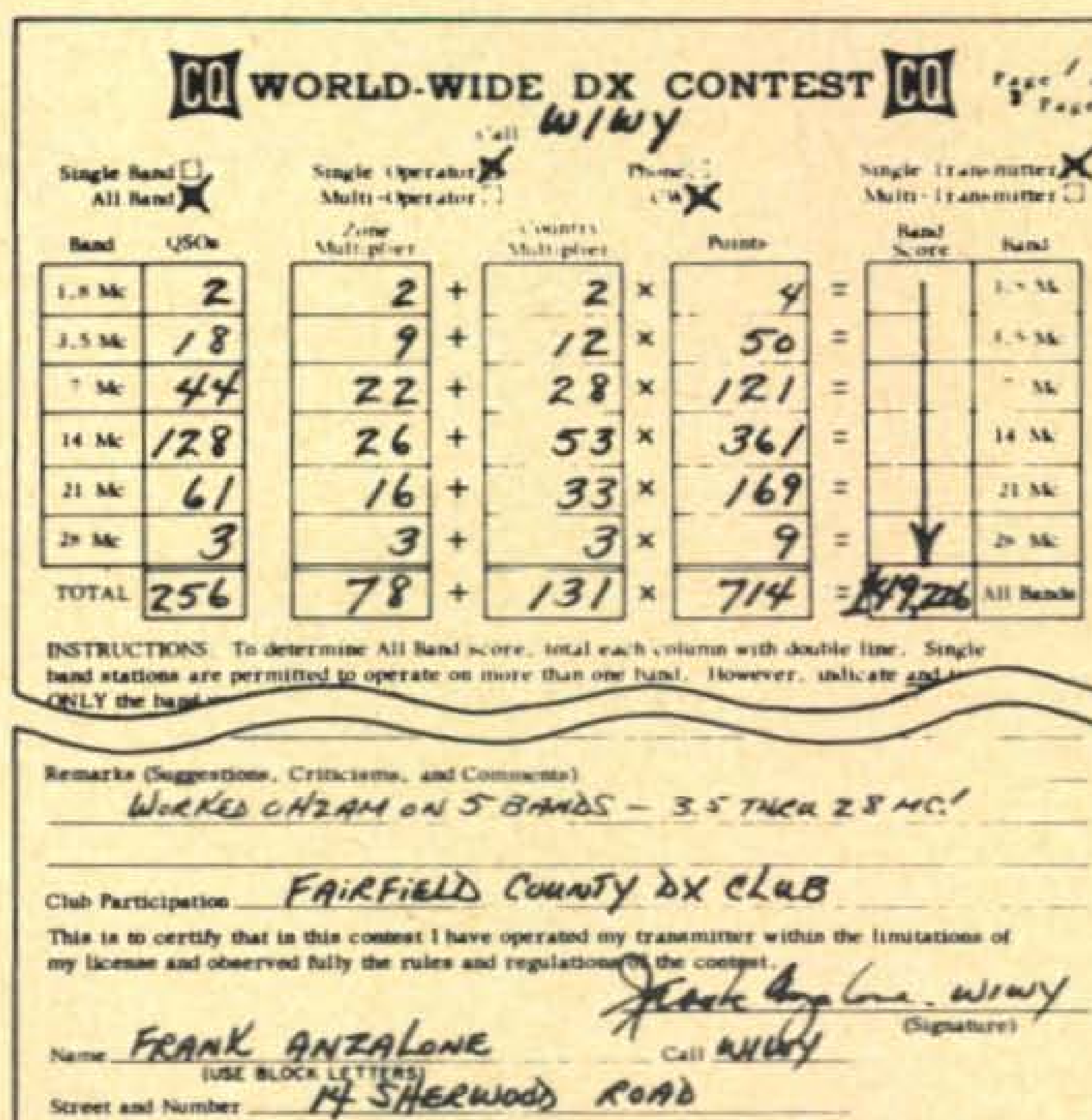
1. Single Operator Stations.
   - (a) Single Band—Final score, total QSO points on the particular band multiplied by the sum of the Zone and Country multiplier.
   - (b) All Band—Final score, total QSO points from all bands multiplied by the sum total of Zones and Countries from all bands.
2. Multi-Operator Stations.
   Scoring in both these categories are the same as the All Band scoring for Single Operator Stations. (Multi-Operator stations are judged for all band operation *only*.)

IX. AWARDS

First place certificates will be awarded in each category listed under Sec. IV.

1. In every participating country.
2. In each call area of the United States and Australia.
3. In each Zone of Canada and the USSR.

All scores will be published. To be eligible for an award, a Single Operator station must show a minimum of 12 hours of operation. A Multi-Operator station must operate a minimum of 24



CQ WORLD-WIDE DX CONTEST CQ

Page 1 of 1 Pages

Call W1WY

Single Band ☐ All Band ☒ — Single Operator ☒ Multi-Operator ☐ — Phone ☐ CW ☒ — Single Transmitter ☒ Multi-Transmitter ☐

Band	QSOs	Zone Multiplier		Country Multiplier		Points		Band Score	Band
1.8 Mc	2	2	+	2	×	4	=		1.8 Mc
3.5 Mc	18	9	+	12	×	50	=		3.5 Mc
7 Mc	44	22	+	28	×	121	=		7 Mc
14 Mc	128	26	+	53	×	361	=		14 Mc
21 Mc	61	16	+	33	×	169	=		21 Mc
28 Mc	3	3	+	3	×	9	=		28 Mc
TOTAL	256	78	+	131	×	714	=	149,226	All Bands

INSTRUCTIONS. To determine All Band score, total each column with double line. Single band stations are permitted to operate on more than one band. However, indicate and ... ONLY the band ...

Remarks (Suggestions, Criticisms, and Comments) WORKED CH2AM ON 5 BANDS — 3.5 THRU 28 MC!

Club Participation FAIRFIELD COUNTY DX CLUB

This is to certify that in this contest I have operated my transmitter within the limitations of my license and observed fully the rules and regulations of the contest.

Frank Anzalone, W1WY (Signature)

Name FRANK ANZALONE (USE BLOCK LETTERS) Call W1WY

Street and Number 14 SHERWOOD ROAD

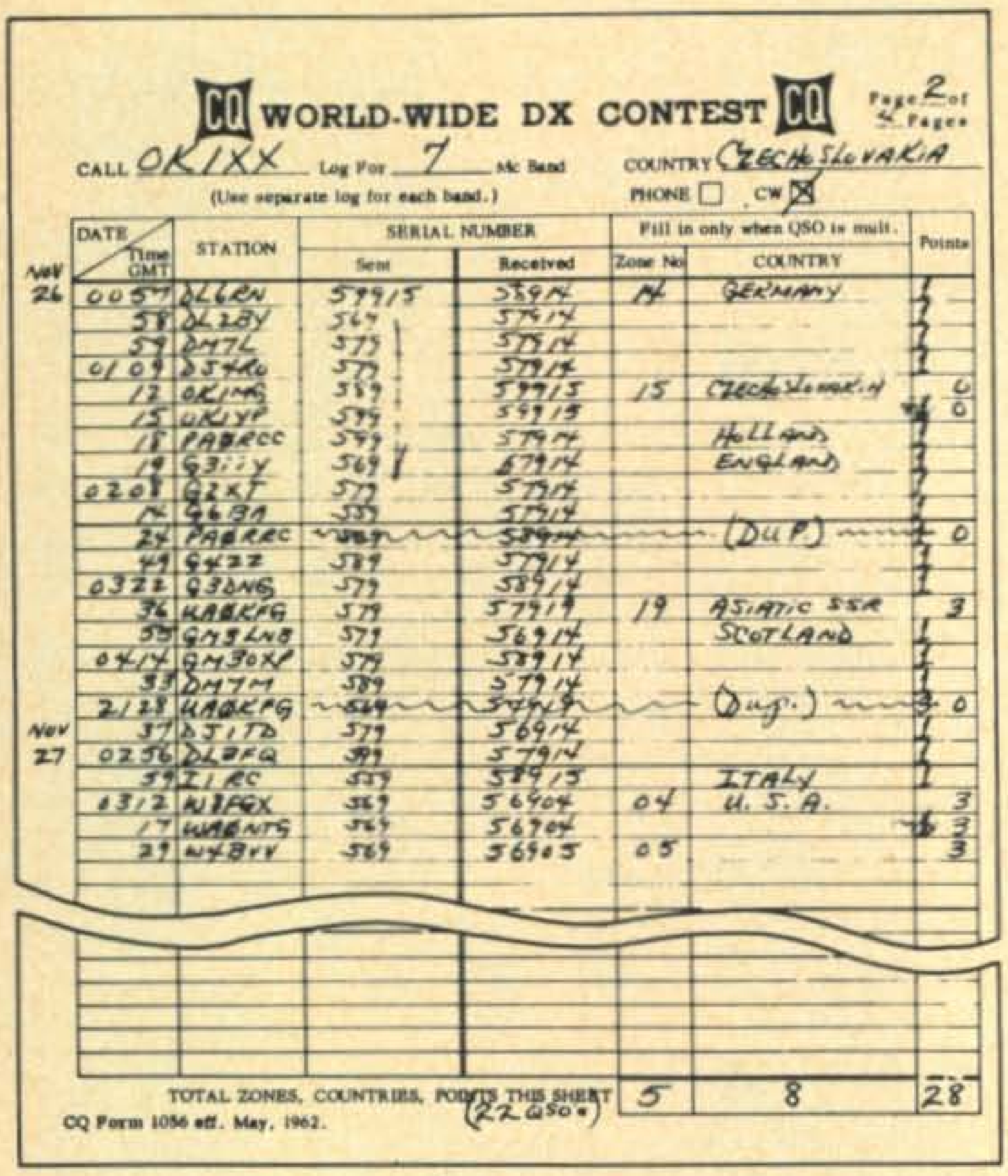
City STAMFORD Country CONNECTICUT, U.S.A. 06905

Logs must be postmarked not later than December 1, for Radiotelephone section and January 15, for Radiotelegraph section.

Submit logs to: CQ Contest Committee, 14 Vanderventer Ave. Port Washington, L.I., N.Y. 11050

CQ Form 1057 eff. August, 1966.

A sample summary sheet. Free summary sheets, log pages and zone maps may be obtained upon receipt of a large s.a.s.e. or, if outside the U.S., sufficient IRC's. When you send in your score . . . include photos.


CQ WORLD-WIDE DX CONTEST CQ — Page 2 of 4 Pages

CALL OK1XX — Log For 7 Mc Band — COUNTRY CZECHOSLOVAKIA

(Use separate log for each band.) — PHONE ☐ CW ☒

DATE / Time GMT	STATION	SERIAL NUMBER Sent	SERIAL NUMBER Received	Zone No	COUNTRY	Points

TOTAL ZONES, COUNTRIES, POINTS THIS SHEET (22 QSOs) — 5 — 8 — 28

CQ Form 1056 eff. May, 1962.

A sample log page—40 QSO's to a page. You may work your own country for multiplier credit, but receive NO QSO points. Logs must be checked for Correct QSO point credit and duplicate QSO's.

hours. A single band log is eligible for a single band award *only*. If a log contains more than one band it will be judged as an all band entry, unless specified otherwise.

In countries or sections where the returns justify, 2nd and 3rd place awards will be made.

X. SPECIAL AWARDS

A handsome Trophy will be awarded to each of the following highest scoring stations:

1. WORLD—Single Operator, Single Band, Phone. (*Stuart Meyer, W2GHK, donor*)
2. WORLD—Single Operator, Single Band, C.W. (*Dr. Harold Megibow, K2HLB, donor*)
3. WORLD—Single Operator, All Bands, Phone. (*Bill Leonard, W2SKE, donor*)
4. WORLD—Single Operator, All Bands, C.W. (*Larry LeKashman, W9IOP, donor*)
5. WORLD—Multi-Operator, Single Transmitter, Phone. (*John Knight, W6YY, donor*)
6. WORLD—Multi-Operator, Single Transmitter, C.W. (*Dr. Anthony Susen, W3AOH, donor*)
7. WORLD—Multi-Operator, Multi Transmitter, Phone. (*Radio Club Venezolano, donor*)
8. WORLD—Multi-Operator, Multi Transmitter, C.W. (*Hazard Reeves, K2GL, donor*)
9. USA—Single Operator, All Bands, Phone. (*Potomac Valley Radio Club, donor*)
10. USA—Single Operator, All Bands, C.W. (*North Jersey DX Assoication, donor*)
11. EUROPE—Single Operator, All Bands, (*Operators of Station W4BVV, donors*)
12. EUROPE—Single Operator, All Bands, C.W. (*Operators of Station W3MSK, donors*)
13. WORLD—A Plaque to the DX Club submitting the highest aggregate score of the scores submitted by its members. (*Donated by CQ*)

Trophy winners cannot win the same award for a period of three years. However *CQ* will award appropriate championship Plaques each year.

There are no restrictions to the winning of the *CQ* Club Plaque.

XI. CLUB COMPETITION

1. The club must be a local group and cannot be a national body.
2. Participation is limited to active club members operating within the local geographic area. (Except for DX-peditions specifically organized for operation during the contest.)
3. To be eligible for an award, an officer of the club must submit a list of all participating members and their scores, both phone and c.w.
4. Each participating member must clearly indicate the name of his club on his Summary Sheet.

XII. LOG INSTRUCTIONS

1. All times must be kept in GMT.
2. Use a separate log for each band.
3. Zone and Country multipliers should be entered only the FIRST TIME they are contacted on each band.
4. Logs must be checked for duplicate contacts and correct QSO points and multipliers. Recopied logs must be in their original form, with corrections clearly shown.
5. Each entry must be accompanied by a Summary Sheet listing all scoring information, the category of competition and the contestant's name and mailing address in BLOCK LETTERS.

Also a signed declaration that all contest rules and regulations for amateur radio in the country of the contestant, have been observed.

6. Official log and summary sheets, and Zone maps are available from *CQ*. A large self-addressed envelope with sufficient postage or IRCs must accompany your request.

If official forms are not available you can make up your own by following the attached sample, with 40 contacts to the page on 8½ × 11 inch paper.

XIII. DISQUALIFICATION

Violation of the regulations of amateur radio in the country of the contestant, or the rules of the contest, or unsportsmanlike conduct, or taking credit for incorrect QSOs or multipliers, or duplicate contacts in excess of 3% of the total made will be deemed sufficient cause for disqualification.

Actions and decisions of the Committee are official and final.

XIV. DEADLINE

All entries must be postmarked NO LATER than December 1, 1967 for the Phone section, and January 15, 1968 for the C.W. section. In rare isolated areas the deadline will be made more flexible. Logs go to:

CQ WW Contest Committee
14 Vanderventer Avenue
Port Washington, L.I. N.Y.
U.S.A. 11050
(Indicate Phone or C.W.)

(Please circulate this information to your DX friends and radio clubs.)

THE MAN FROM H.U.N.G.E.R.[1]

BY SUMNER WEISMAN,* W1VIV

The chief, generally known by his code name OM, was pacing back and forth in front of his desk. Hands behind his back and head down, he mumbled something about "blasted agents who are never on time . . ."

Just then the large filing cabinet in the corner swung noiselessly aside on oiled bearings, and in stepped a raven-haired beauty. Without a word, she stood there expectantly.

"Glad you're here, 88, although you are exactly ninety-four seconds late!" said the chief, examining the tiny timepiece disguised as a wart on his thumb. "Tell me, OM," said the glamourous 88, "why don't you use your wristwatch?" "Well you see," he answered ruefully, "with the camera, compass, homing device, 2-way radio, and lock pick in there, there's no room left for the watch. But enough of this chit-chat! Where's agent 73?"

"He's parking the car. They won't let him in the parking lot any more, ever since the attendant pushed the wrong button and shot holes in 12 other cars," explained the girl.

Just as the chief started to mumble something about "occupational hazards," the door of the grandfather's clock against the wall swung open, and out stepped the battle-scarred veteran, Agent 73. "Who told you to use my private entrance?" asked OM. "Sorry about that, Chief, it won't happen again. Now that we're all here, OM, what's the problem?" asked 73 expectantly. "I'm double parked."

Between puffs on his old briar pipe, which also contained a .38 calibre pistol, the chief explained. "We've just received word that in this very city, unknown to all of us, is the main communications center of our arch-enemy."

"You mean . . ." exclaimed 73.

"Yes. F.I.N.K. The Foundation for the Increase of Nasty Killing. We must infiltrate their headquarters and learn their plans, at all costs."

A short time later, agents 73 and 88 were walking out of the building. "I think I know where to start, 88. For some time, I have had some odd interference in my belt buckle television set. A strange voice calling someone named CQ. It must be a Fink agent, using a code name. With a direction finder,

*43 Agnes Drive, Framingham, Massachusetts

[1] Heroic United Network for Getting Even with Rascals.

I have narrowed it down to a house a few blocks away. They are so over-confident that they didn't even attempt to conceal the large antenna tower," explained 73, as they approached the Aston-Volkswagen, which was speedy but economical, and had a horde of hidden weapons. Ignoring the parking ticket, they roared away. "Sorry about that, Officer!" 73 called, as the policeman contemplated the tire marks on his shoes.

Soon, 73 and 88 were examining a well-equipped radio room. A microphone and key were on the operator's desk, and high powered equipment was everywhere. Odd cards adorned the walls. "Look 73, obviously code messages!" said the beautiful 88. "Yes," said 73, holding up a schematic diagram, "and look here—secret plans."

Just then a footstep was heard in the hall. "Quick, 88, behind these curtains," said 73, quietly but calmly. They stood breathlessly as the door opened, and then closed. Agent 88 readied the miniature dart gun in her earring, just in case. A click was heard, and soon the room was filled with strange noises. "They're talking in code," whispered 73. "This must be Fink agent CQ himself."

Suddenly, 88 exclaimed excitedly, "Listen, they're calling him!" Sure enough, the strange sounds were replaced by just one voice, that of a woman, calling "Hello CQ, hello CQ . . ." 73 reached down and silently actuated a tiny switch in the heel of his shoe.

Several hours later, the secret agents stood once again before the massive desk of the chief. ". . . Fortunately, OM, I was able to tape the entire message with my shoe recorder. Then, after the Fink agent left, so did we." "Good work!" said the chief as he threaded the tape into the instrument on his desk. "Go ahead to lunch, and I'll see you in an hour."

He listened expectantly. "Hello CQ, hello CQ, hello CQ . . . This is W3XYL calling," the voice said.

"W3XYL, this is W1VIV. How copy, Gert?"

"W1VIV from W3XYL. Good morning! You're 20 over, as usual . . . DX is great today. Just came down from 15. I had a fine contact with a station in Asia . . ."

The fact that the rest of the conversation was in unrecognizable technical terms didn't phase the chief in the least—he would have his scientists decode it later. He listened patiently, until the tape was nearly over.

"There must be a thousand people here in Washington in the contest. It's almost impossible to hold a decent ragchew, so I'll sign now. They're all finks!" the voice said.

"They've infiltrated the government!" cried the chief.

"Yes, they sure are finks," the man's voice answered. "73, and 88 too. See you later. W1VIV clear."

The chief's eyes brightened as the tape went silent. He slowly and thoughtfully tapped the ashes out of his beloved old briar pipe. Then he released the safety, pointed it at the door, and waited. ■

M.A.R.C. AWARD

Dr. Alson E. Braley, Professor of Opthalmology of the University of Iowa, was presented with the 1st annual achievement award of the Medical Amateur Radio Council for the founding of the Eye Bank Network, at the associations first annual meeting in Atlantic City. The Eye Bank

[*Continued on page 119*]

Dr. Alson E. Braley, (left) Professor of Opthalmology of the University of Iowa is presented the 1st annual achievement award of the Medical Amateur Radio Council by it's outgoing president, Charles H. Gray, M.D., of New York.

VP9FV ONLY YL IN BERMUDA

LOUISA B. SANDO,* W5RZJ

HAVE you ever wondered what it would be like to be the *only* licensed YL in a country? Such a YL is VP9FV, Sister Marion Edward, in Bermuda. Although she is the only licensed YL, Sister Marion is much too busy to miss any eyeball QSOs with other YLs and she finds plenty of opportunity for the conventional kind via 20 and 15 DX.

Sister Marion teaches science in the high school at Mount Saint Agnes Academy in Hamilton, a private school owned and operated by the Sisters of Charity of Halifax. They have about 600 students, of all races and faiths, and this spring dedicated a new school plant. Sister Marion has been with the school in Bermuda for ten years, having been assigned there from Seton Hall High School at Patchogue, Long Island. Her home QTH was Boston, Mass.

It was through her science classes that Sister Marion became interested in radio. She was first licensed in July '64, although the school club station, VP9FQ, was licensed in 1963 when one of her pupils, Ted Pitman, VP9EP (now in RCA school) received his license before she did.

VP9FV operates 15 and 20 DX, using a Collins KWM2 transceiver with a Moseley T-30 vertical with traps. She is a member of YLRL and YL SSB'ers, secretary of the Bermuda Schools Sports Federation and secretary of the Bermuda Astronomical Society. She would like to combine her interests and get into the field of radio astronomy.

Last fall Sister worked with the International Hurricane Net passing on weather reports to small craft in that part of the Atlantic Ocean. She adds, "I'd like to take this opportunity to say what a wonderful job those hams do who work in this net, and any similar one for any good purpose. Their self-sacrifice for the sake of humanity is tremendous. The more contacts I make in my ham work the more I realize what a wonderful fraternity the hams have built up all over the world. Each one considers it a privilege to help out someone else through radio."

Look for VP9FV from 1800 to 1900 GMT around 14,300 or 21,370. ■

*4417 - 11th St., N.W., Albuquerque, New Mexico 87107.

VP9FV, Sister Marion Edward

CQ World-Wide DX Contest
ALL-TIME C.W. RECORDS

In the records listed below, boldface listings denote world records. Number groups after calls are: year of operation, total score, contacts,

Single Operator/Single Band

WORLD RECORD HOLDERS

1.8	VO1FB ('66)	4,165	92	4	13
3.5	UC2AA ('66)	83,496	714	20	64
7.0	5A1TW ('64)	227,814	918	22	64
14	1G5A ('66)	792,370	1594	37	133
21	ZS6IW ('65)	440,213	1081	36	103
28	DL4AAP ('57)	253,680	728	36	84

AFRICA

1.8	No Entrant				
3.5	No Entrant				
7.0	**5A1TW ('64)**	**227,814**	**918**	**22**	**64**
14	**1G5A ('66)**	**792,370**	**1594**	**37**	**133**
21	**ZS6IW ('65)**	**440,213**	**1081**	**36**	**103**
28	9J2BC ('66)	140,760	563	24	61

ASIA

1.8	JA3AA ('64)	3	6	1	2
2.3	4X4DH ('64)	55,440	301	14	49
7.0	4X4FA ('64)	174,505	781	25	60
14	HL9KH ('63)	339,920	910	37	103
21	4X4TP ('66)	162,104	640	25	67
28	JA3IS ('58)	87,685	423	24	47

EUROPE

1.8	OK1ZC ('64)	3,060	167	5	15
3.5	**UC2AA ('66)**	**83,496**	**714**	**20**	**64**
7.0	OK1ZQ ('66)	125,130	783	28	69
14	G2LB ('57)	213,112	701	36	100
21	G3HCT ('66)	233,988	821	30	81
28	**DL4AAP ('57)**	**253,680**	**728**	**36**	**84**

NORTH AMERICA

1.8	**VO1FB ('66)**	**4,165**	**92**	**4**	**13**
3.5	W8NBK ('65)	20,800	126	20	45
7.0	W6AM ('64)	161,991	468	37	86
14	W4KFC ('64)	266,631	644	34	107
21	W4KFC ('66)	211,106	609	32	87
28	K8AEK ('58)	166,270	520	37	93

OCEANIA

1.8	VK5KO ('64)	6	1	1	1
3.5	KH6EPW ('66)	7,068	132	9	10
7.0	VK3ADB ('66)	84,456	435	22	46
14	VK3ADB ('65)	295,596	788	35	91
21	KH6DLF ('59)	156,658	720	31	43
28	VK2BKM ('66)	32,040	242	19	26

SOUTH AMERICA

1.8	No Entrant				
3.5	PY7VNY ('66)	105	5	4	3
7.0	PY4AP ('64)	81,673	421	22	45
14	PY2BGL ('66)	495,450	1124	36	114
21	CX1AAC ('66)	438,616	1353	31	78
28	PY1HQ ('56)	39,944	225	18	34

Single Operator/All Band

AF	ZD8J ('66)	1,597,726	1668	103	223
AS	HL9KH ('62)	1,142,748	1554	103	221
EU	SVØWP ('58)	878,000	1384	77	194
NA	KZ5TW ('66)	1,105,190	1738	96	194
O	**VR2EW ('65)**	**2,499,536**	**2215**	**126**	**268**
SA	PY2SO ('66)	1,499,020	1642	102	209

WORLD RECORD

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
VR2EW (1965) 2,499,536	1.8	—	—	—	—
	3.5	101	19	36	287
	7.0	514	27	54	1441
	14.0	834	37	93	2391
	21.0	737	37	73	2146
	28.0	29	12	12	79
	TOTAL	2215	126	268	6344

Multi-Operator/Single Trans.

AF	CR6DX ('66)	1,306,860	1608	85	172
AS	**4L7A ('66)**	**2,209,266**	**1832**	**112**	**305**
EU	UA3KAS ('65)	990,943	1162	112	307
NA	W3MVB ('62)	905,472	801	110	283
O	VK5NO ('63)	945,248	1199	86	185
SA	CX2CO ('66)	2,199,694	2278	104	225

WORLD RECORD

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
4L7A (1966) 2,209,266	1.8	—	—	—	—
	3.5	226	11	44	643
	7.0	493	21	54	1429
	14.0	458	31	86	1307
	21.0	484	28	72	1423
	28.0	171	21	49	496
	TOTAL	1832	112	305	5298

Multi-Operator/Multi-Trans.

AF	CN8IF ('57)	773,640	1244	58	152
AS	4X9HQ ('62)	1,681,988	1975	84	224
EU	OH2AM ('66)	2,837,133	2619	142	389
NA	**K2GL ('66)**	**3,760,848**	**2352**	**152**	**394**
O	KG6FAE ('57)	691,601	1321	76	105
SA	YV9AA ('65)	1,865,208	2236	90	192

WORLD RECORD

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
K2GL (1966) 3,760,848	1.8	8	5	5	17
	3.5	210	20	49	596
	7.0	615	33	79	1815
	14.0	696	37	107	2052
	21.0	557	33	94	1628
	28.0	266	24	60	780
	TOTAL	2352	152	394	6888

CQ World-Wide DX Contest
ALL-TIME PHONE RECORDS

zones, and countries. All-band and Multi-Operator records include a band-by-band breakdown of the world leader in each category.

Single Operator/Single Band

WORLD RECORD HOLDERS

1.8	GW3PMR ('65)	360	70	1	5
3.5	YV5BTS ('66)	69,471	296	21	62
7.0	DJ5BV ('66)	53,664	337	23	63
14	YV5BIG ('66)	840,252	1929	36	111
21	DL6EN ('66)	410,256	1254	35	77
28	LU1DAB ('66)	314,056	1051	26	76

AFRICA

1.8	No Entrant				
3.5	No Entrant				
7	No Entrant				
14	9L1HX ('66)	479,460	1216	33	98
21	ZD8WZ ('66)	378,200	1076	31	91
28	VQ4RF ('56)	154,453	520	27	82

ASIA

1.8	No Entrant				
3.5	4X4AS ('64)	29,392	227	11	33
7	JA2BTV ('66)	26,585	146	26	39
14	HL9KH ('63)	318,960	826	37	107
21	JA3JXJ ('66)	248,045	880	30	65
28	JA1RJO ('66)	118,109	488	30	53

EUROPE

1.8	GW3PMR ('65)	360	70	1	5
3.5	ON4UN ('66)	61,523	616	19	58
7	DJ5BV ('66)	53,664	337	23	63
14	F7BL ('65)	703,056	1637	38	115
21	DL6EN ('66)	410,256	1254	35	77
28	DL4AAP ('57)	248,745	745	31	84

NORTH AMERICA

1.8	No Entrant				
3.5	W1FZJ/KP4 ('66)	26,270	152	18	53
7	W3PHL ('66)	37,825	174	24	61
14	KP4CL ('66)	337,792	1147	35	93
21	WA8CZH ('66)	199,320	516	33	99
28	W2OKM ('66)	123,072	442	28	68

OCEANIA

1.8	No Entrant				
3.5	KH6EPW ('66)	5,040	82	10	11
7	ZL4BO ('65)	11,232	106	17	22
14	KX6BQ ('65)	449,306	1125	36	107
21	ZL1AGO ('66)	95,680	514	25	41
28	ZL1KW ('58)	63,729	299	28	45

SOUTH AMERICA

1.8	No Entrant				
3.5	YV5BTS ('66)	69,471	296	21	62
7	PY7APS ('66)	12,298	101	12	31
14	YV5BIG ('66)	840,252	1929	36	111
21	CX8CZ ('66)	231,462	847	30	69
28	LU1DAB ('66)	314,056	1051	26	76

Single Operator/All Band

AF	VQ9AA/D ('66)	3,624,942	2518	133	369
AS	4X4GB ('59)	829,864	977	84	209
EU	DJ6QT ('66)	1,519,823	1521	116	273
NA	WA2SFP ('66)	908,628	871	111	262
O	WØGTA/8F4 ('66)	1,306,842	1351	112	234
SA	CX2CO ('65)	1,815,288	1849	106	238

WORLD RECORD

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
VQ9AA/D (1966) 3,624,942	1.8	—	—	—	—
	3.5	29	11	22	79
	7.0	96	20	40	271
	14.0	1075	37	125	3122
	21.0	620	33	92	1768
	28.0	678	32	90	1981
	TOTAL	2518	133	369	7221

Multi-Operator/Single Trans.

AF	ET3WH ('66)	2,139,696	2306	98	226
AS	VS6AJ ('66)	1,049,436	1261	106	218
EU	IØRB/4U ('66)	2,141,150	2053	126	332
NA	KL7WAH ('66)	785,180	1972	62	110
O	KG6AAY ('66)	1,042,245	1378	89	176
SA	CX2CO ('66)	2,600,923	2413	114	263

WORLD RECORD

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
YV9AA (1966) 6,195,211	1.8	2	1	2	2
	3.5	142	15	38	382
	7.0	349	22	64	976
	14.0	1196	38	123	3478
	21.0	1620	32	79	4562
	28.0	923	28	75	2584
	TOTAL	4232	136	381	11983

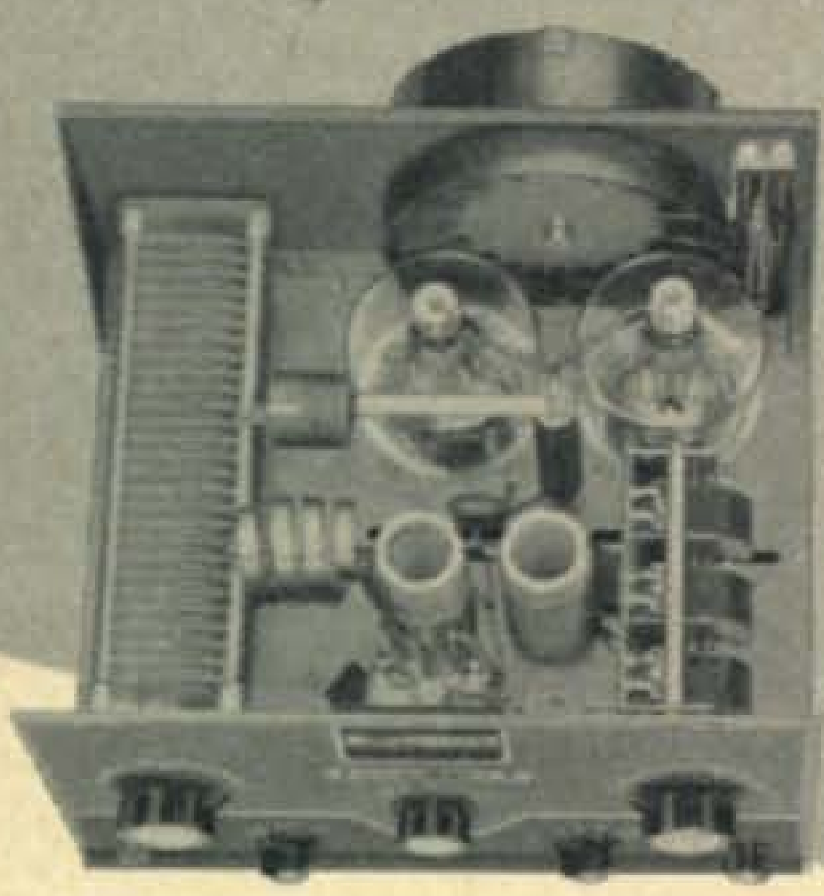
Multi-Operator/Multi-Trans.

AF	ZD8AR ('65)	2,839,005	2873	103	242
AS	KA2MA ('57)	359,040	711	66	104
EU	OH2AM ('66)	5,465,610	3972	153	405
NA	K2GL ('66)	4,128,215	2587	144	415
O	KX6AF ('58)	306,642	711	59	88
SA	YV9AA ('66)	6,195,211	4232	136	381

WORLD RECORD

STATION	BAND	CONTACTS	ZONES	COUNTRIES	POINTS
CX2CO (1966) 2,600,923	1.8	—	—	—	—
	3.5	18	7	15	27
	7.0	35	13	18	63
	14.0	769	36	76	2202
	21.0	597	31	82	1736
	28.0	944	27	72	2871
	TOTAL	2413	114	263	6899

PRESENTING THE COMPLETE



SWANTENNA 5 BAND MOBILE ANTENNA

500 watt power rating
10-15-20-40-75 meters

MANUAL SWITCHING
MODEL 45 . . . . $65

REMOTE CONTROL
MODEL 55 . . . . $95

MARK II LINEAR AMPLIFIER

Five band, 2000 watts PEP input. Uses two Eimac 3-400Z grounded grid triodes.

MARK II AMPLIFIER
with tubes $395

MATCHING POWER SUPPLY $235

SWAN 250 SSB-CW-AM TRANSCEIVER FOR 6 METERS. 240 WATTS PEP

Engineered to provide the same excellent voice quality, power, and performance that have become the trademark of all Swan transceivers. With the Swan 250, there is practically no limit to the operating pleasure you can find in the 6 meter VHF band.

$325

MATCHING AC SUPPLY

with speaker,
MODEL 117-XC $95

MODEL 230-XC
for 230 volts $105

DC MODULE Converts AC supply to 12 volts DC for portable or emergency operation.
MODEL 14X $65

12 VOLT DC SUPPLY

For mobile or portable operation. Negative ground standard. Positive ground available on special order.
MODEL 14-117 . . . . $130

SWAN SPEAKS YOUR LANGUAGE

ASK THE HAM WHO OWNS ON

SWAN LINE

MARS OSCILLATOR

Five crystal controlled channels with vernier frequency control. May be used with Models 500, 350 & 250 transceivers.

MODEL 405X, less crystals . . . $45

MOBILE VFO

Miniature size for use with Model 500 or 350. Covers phone bands only. Makes it possible to trunk mount the transceiver.

MODEL 406B $75

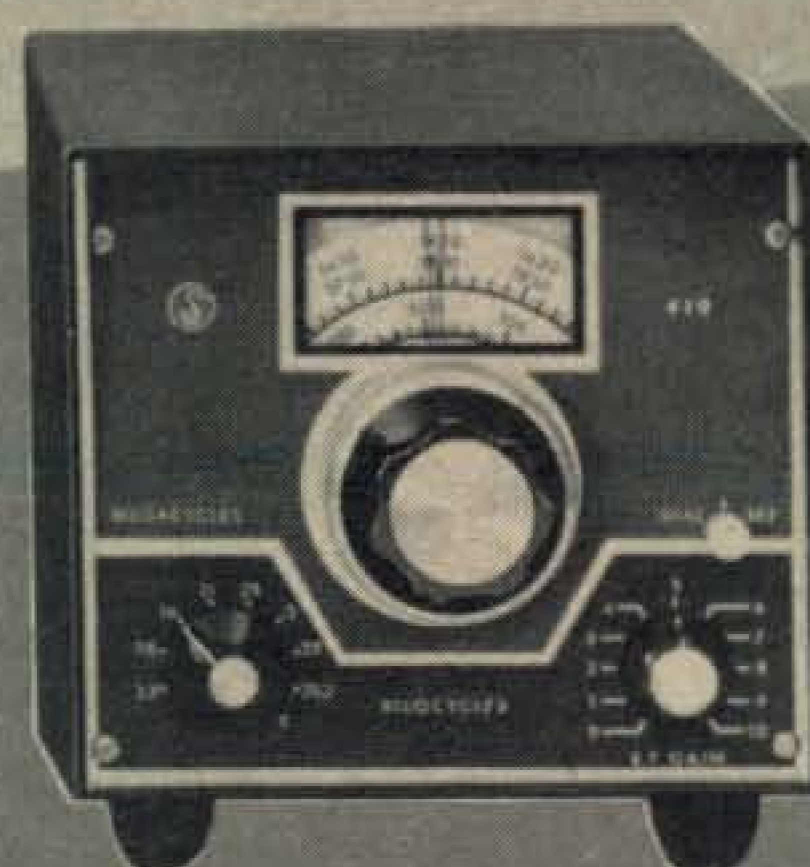
REMOTE CONTROL KIT

For trunk mounting of transceiver.

MODEL RC2 . . . . $25

MODEL 500 SSB-CW-AM TRANSCEIVER 5 BANDS 480 WATTS

Deluxe model offers many extra features including selectable upper and lower sideband, 100 kc crystal calibrator, automatic noise limiter, and factory installed accessory socket for addition of Model 410 external VFO. **$495**



FULL COVERAGE EXTERNAL VFO

for Model 500 and 350 transceivers. 8 ranges, 500 kc each, 5 kc calibration.

MODEL 410 . . . . $95

DUAL VFO ADAPTOR

Provides for the addition of second VFO for separate control of transmit and receive frequencies. May be plugged into either 350 or 500 transceiver.

MODEL 22 . . . . $25

EXTERNAL VFO for MODEL 250

Same as Model 410 in size and appearance. 50 to 54 mc coverage. Includes switching relay for VFO selection. (Model 22 adaptor not required.)

MODEL 210 . . . . $120

PLUG-IN VOX UNIT

for use with Models 250, 350 or 500.

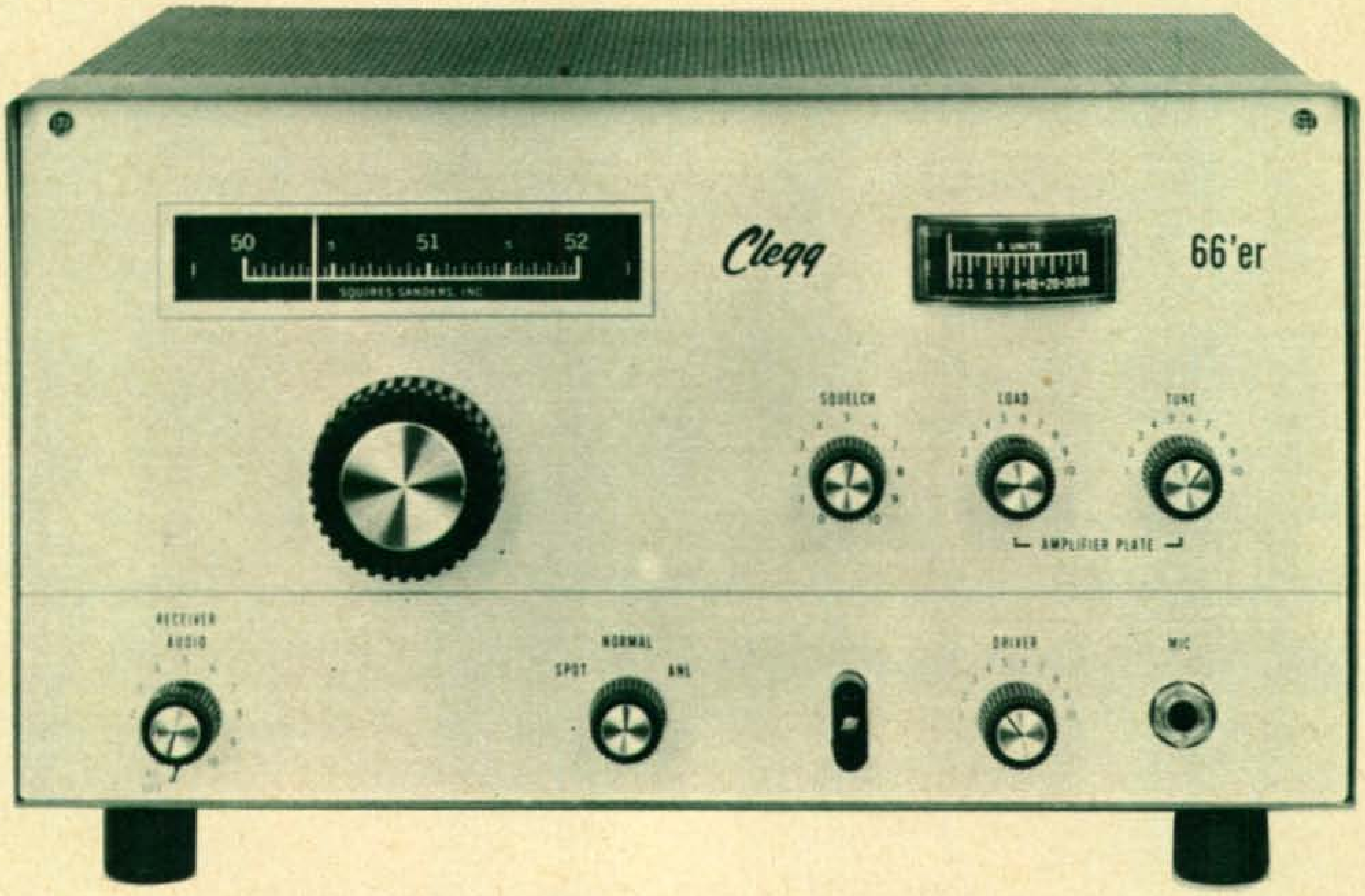
MODEL VX-1 . . . . $35

SWAN 350 SSB-CW-AM TRANSCEIVER

Standard model 5 band transceiver. **$420**

FOR COMPLETE INFORMATION SEE YOUR DEALER

SWAN ELECTRONICS
Oceanside, California



CQ Reviews: The Clegg 66'er

a 6-Meter A.M. Transceiver

BY WILFRED M. SCHERER,* W2AEF

THE Clegg 66'er, a product of Squires-Sanders, Inc., is a 6-meter a.m. transceiver with a tunable-receiver section and a crystal-controlled 22 watt input transmitter. It is designed for the operator who desires high-quality fixed-station or mobile performance along with operating convenience and flexibility. The basic concept of the unit is the same as that of the Clegg 22'er reviewed here some time ago.[1] Both models are alike in appearance, as are some of the technical aspects, except for some minor changes and for circuitry dictated by the different frequency-band of operation.

*Technical Director, *CQ*.

[1] *CQ* Reviews the Clegg 22'er, *CQ* June '65, page 62.

Whereas the 22'er covered the entire 144 mc band, the receiver in the 66'er covers only the 50-52 mc portion of the 50 mc band where most operation is conducted.

Otherwise the operating features of the 66'er are the same as on the 22'er as will be brought out in the following description. Reference to the review on the 22'er will fill in other details.

Receiver Section

A block diagram for the Clegg 66'er is shown at fig. 1. Double conversion is used in the receiver section with a 1st i.f. of 10.7 mc for high image rejection and a 456 kc 2nd i.f. for good selectivity. The h.f. front-end consists of a 6EH7 high-conductance

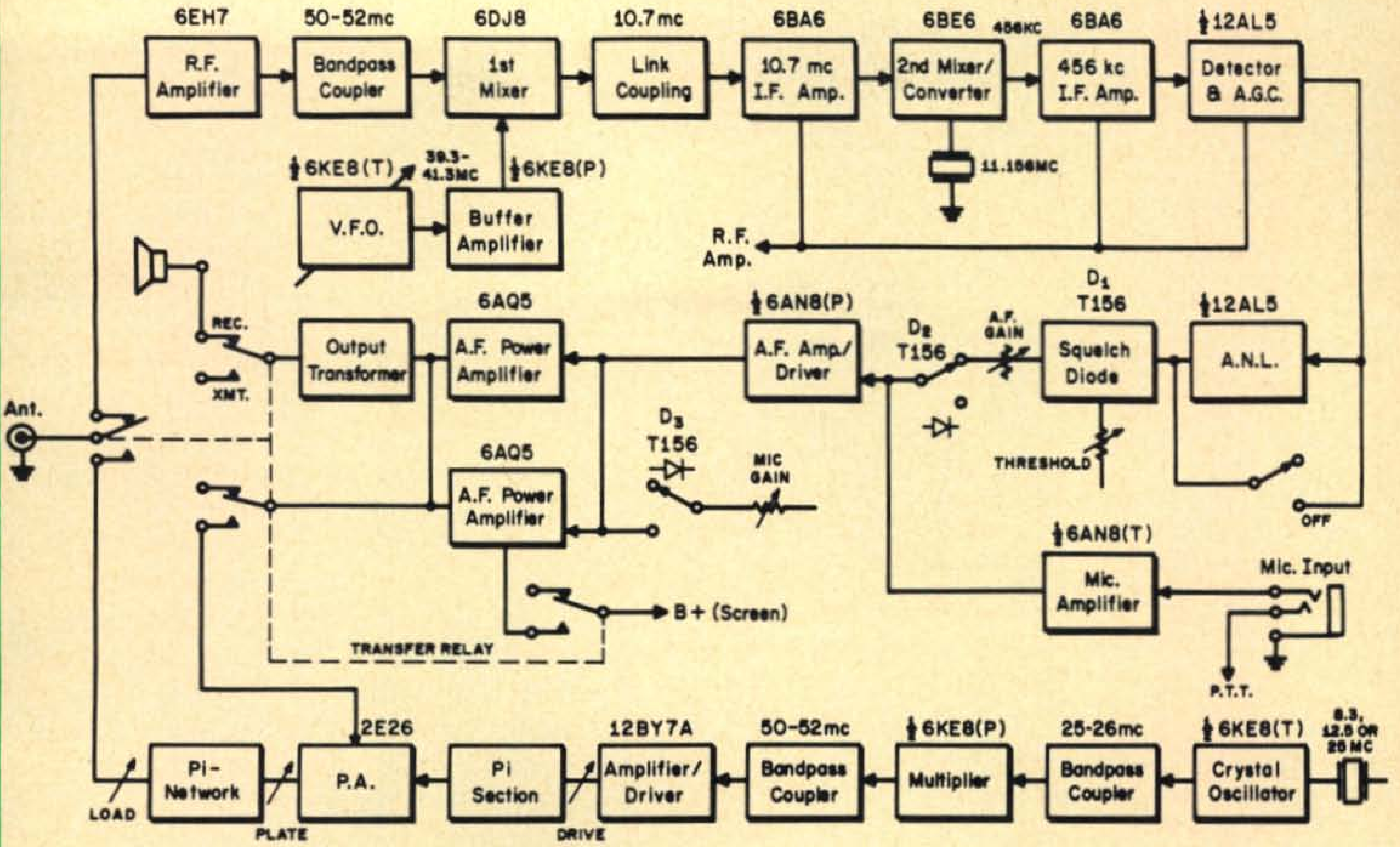


Fig. 1—Block diagram for the Clegg 66'er. Unless otherwise indicated, interstage r.f. coupling circuits for receiver are conventional double-tuned transformers. See text for special details.

pentode r.f. amplifier with a fix-tuned input circuit. A bandpass-coupled circuit is used between this stage and the mixer which is a 6DJ8 dual triode set up as a cathode-coupled affair. The whole arrangement provides good sensitivity with low noise and good signal-handling capabilities. Its circuitry is shown at fig. 2.

The h.f. oscillator is a tunable one which covers 39.3-41.3 mc to provide an i.f. of 10.7 mc with r.f. input signals of 50-52 mc. The triode section of a 6KE8 functions in a series-tuned oscillator circuit with the pentode portion of the tube used as an isolation buffer to enhance stability. The buffer plate is broadly tuned to obtain a relatively uniform output for injection to the mixer.

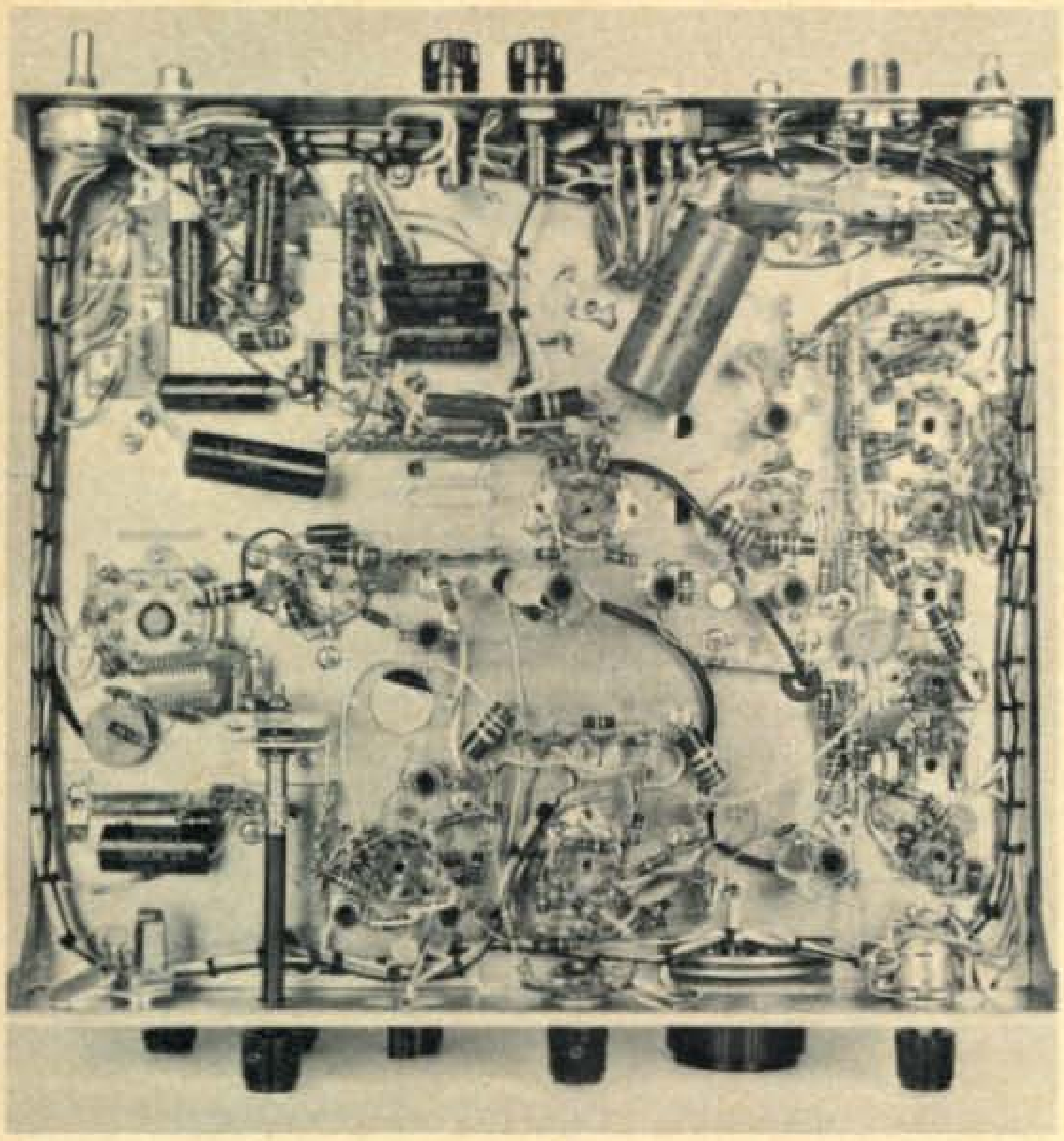
A 10.7 mc amplifier precedes the 2nd mixer which is a 6BE6 pentagrid converter wherein the 10.7 mc signal is heterodyned with a crystal-controlled freq. of 11.156 mc (obtained from the oscillator section of the tube) to produce an i.f. of 456 kc (11.156 mc −10.7 mc).

Ordinarily one might expect the h.f. oscillator to be crystal-controlled and the 2nd mixer oscillator to be a tunable one (for operation at a lower frequency where stability is more readily achieved) to produce a variable i.f.; however, in order to cover a 2 mc spread, this would necessitate wide-band circuits or gang tuning with the v.f.o. at the 1st i.f. At the same time, the wide i.f. range might introduce the possibility of unwanted spurious responses or signals. As is, the setup, through proper design and thermal compensation of the tunable oscillator, provides the stability required for a.m. operation and also virtually eliminates unwanted signals as we'll see later.

The rest of the receiver setup is pretty much the same as found in the 22'er. A single 456 kc i.f. stage is followed by a detector and a.g.c. diode, a series-type noise limiter (with fixed threshold and ON-OFF switch), a squelch solid-state diode and the a.f. amplifiers. A.g.c. voltage is applied to the r.f., the i.f. amplifier and 2nd mixer stages.[2]

There are two parallel-connected power tubes in the a.f. output stage which is also used to modulate the transmitter. On re-

[2]The manual supplied with the set stated that the a.g.c. voltage applied to the r.f. stage is delayed through a Zener diode; however, examination of the circuit diagram indicated no such an arrangement, a fact confirmed by the manufacturer.



Bottom view of the Clegg 66'er. All components are readily accessible.

ceive, both tubes are not needed, so as a power-conservation step, one tube is disabled by removal of its screen voltage and by the application of additional bias to cut down residual noise from it.

The squelch is a simple setup that operates with a series-connected diode switch that cuts the a.f. feed from the detector in or out. When no signal is present, the diode is reverse-biased into non-conduction with a positive potential applied to its cathode via a threshold control, and with a slightly less-positive potential applied to its anode from the screen-grid of the a.g.c. operated 456 kc i.f. stage. When a signal appears, the a.g.c. voltage causes the potential at the screen of the i.f. tube to go more positive than the threshold potential applied to the diode cathode, thus making the diode conduct and pass on the a.f. signal. For circuitry, see fig. 3.

Transmitter Section

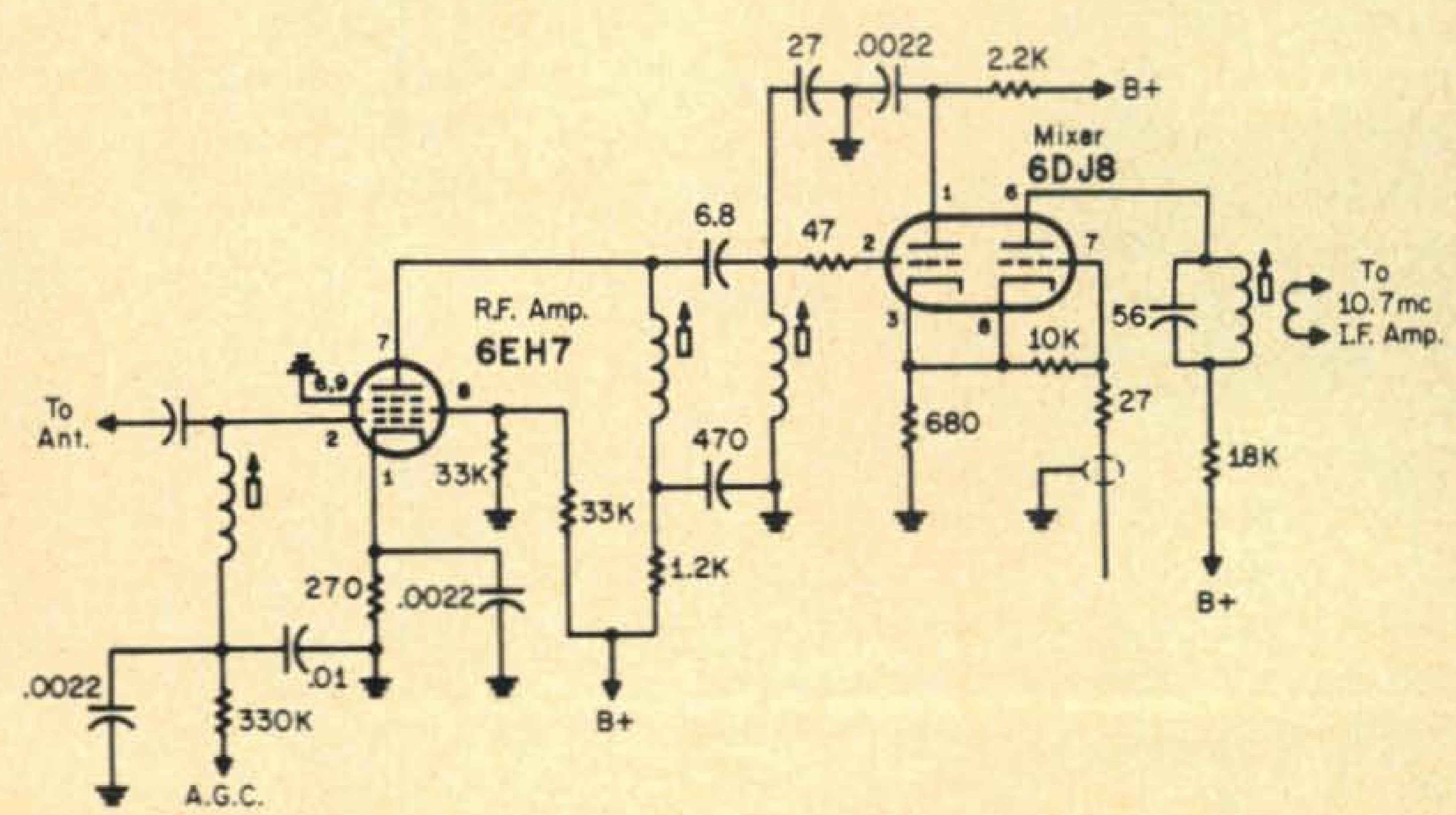
Except for the omission of one 12BY7, the tube lineup for the transmitter is the same as that of the 22'er. The triode section of a 6KE8 functions as a Colpitts crystal oscillator with which 8.3, 12.5 or 25 mc crystals may be used.

Harmonics (or the fundamental when 25 mc crystals are used) which appear at the plate of the oscillator are transferred by means of a 25-26 mc double-tuned band-pass-coupled circuit to the pentode section of the 6KE8 which acts as a multiplier with a 50-52 mc bandpass circuit link-coupled to a straight-through 12BY7 amplifier. This stage drives the final p.a., a 2E26, through a Pi-circuit that provides a measure of harmonic attenuation and optimum impedance matching for maximum drive. The driver circuit is tuned with a panel control. The p.a. is neutralized and its output circuit employs a Pi-section with panel controls for plate tuning and adjustable loading for low impedances.

The incorporation of the bandpass-coupled circuits, the Pi-sections and the straight-through driver amplifier ensure a very high degree of spurious-signal or harmonic attenuation.

The p.a. is plate and screen modulated by the a.f. power-output amplifier using the Heising method as described for the 22'er. The mic amplifier is the triode section of a 6AN8 that is fed to the 6AN8 pentode section which is the amplifier/driver for the

Fig. 2—Circuitry for r.f. front-end in the 66'er. The r.f. amplifier is bandpass-coupled to the mixer which is a dual triod. The signal is applied to the first triode from which it is cathode coupled to the second triode where mixing takes place with the v.f.o. output which is applied to the grid of this triod. The 10.7 mc i.f. output is obtained from the plate.



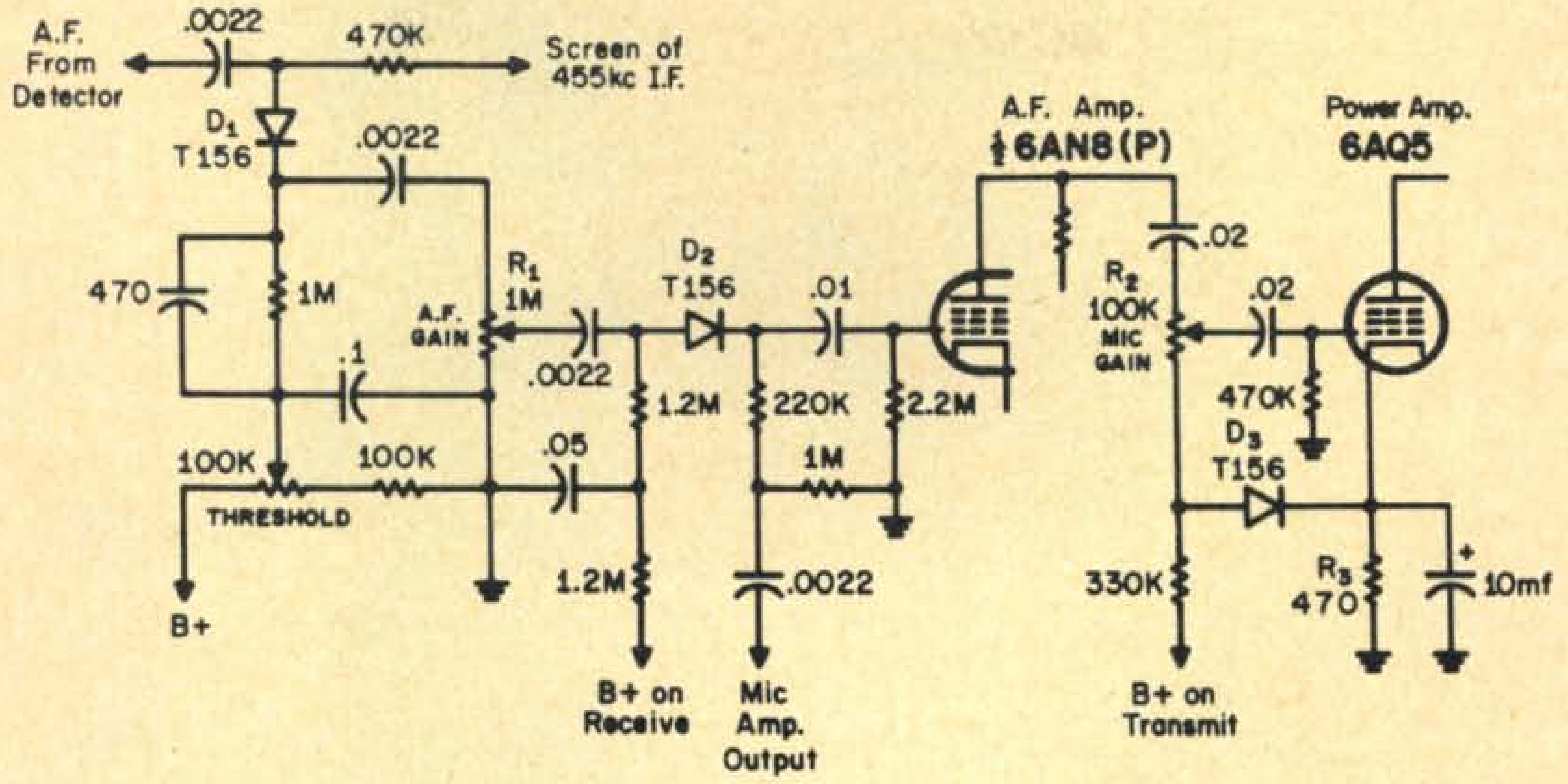


Fig. 3—Circuitry for the squelch (D_1) and for the diode switches (D_2-D_3) used to isolate the a.f. and mic gain controls. Squelch operation is explained in the text. On receive, B-plus from the transfer relay causes D_2 to conduct and complete the output circuit from R_1. D_3 is nonconductive due to reverse bias from R_3. This ungrounds the bottom end of R_2 which then simply becomes a series resistor in the a.f. line, with no significant effect on the a.f. level. On transmit, B-plus is removed from D_2, which then ceases to conduct and effectively opens the circuit from R_1. The B-plus also makes D_3 conduct, thus grounding the bottom end of R_2 and allowing it to function as a level-control.

a.f. power stage. Inverse feedback is employed between the pentode plate and the triode cathode. Unlike the 22'er, there is no feedback loop at the modulator output where the mic gain control was installed, so this control is now located at the grid of the power tubes.

Interaction between the receiver a.f. and the mic gain controls is prevented by the use of diode switches which cut the controls in or out as needed. The setup is shown at fig. 3.

Crystal Spotting

A crystal-spotting position is furnished on the set and in order to prevent overloading the receiver when this feature is engaged, only the oscillator functions, in which case plate voltage for the oscillator is obtained from the B-plus line of the receiver.[3] Since the B-plus feed for the oscillator is also tied in with that for the multiplier and driver, a diode switch opens the common line to the two latter stages to prevent their operation. The principle was described in more detail in connection with the 22'er.

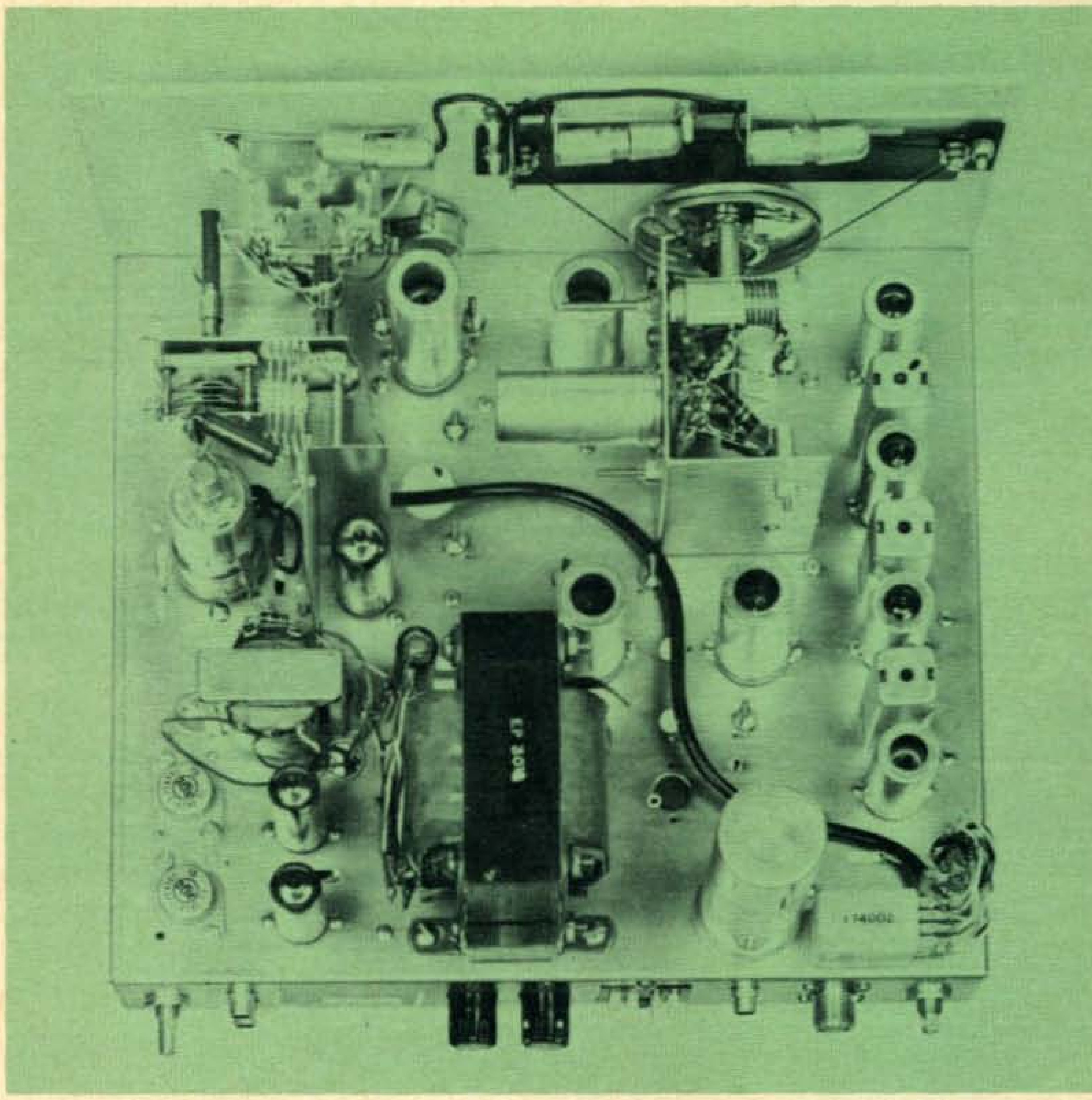
[3] The receiver B-plus is deactivated during transmit by the p.t.t. operated xmt-rec transfer relay which also switches the antenna.

Power Supply

The 66'er operates from either 117 v.a.c. or 13 v.d.c. (position or negative ground systems) using a built-in power supply the same as that employed in the 22'er. This is a solid-state setup using power-switching transistors during 13 v.d.c. operation. Silicon diodes are for high-voltage rectification. A.c. or d.c. operation is selected by use of separate power cables and plugs.

The type of construction and appearance of the 66'er is the same as that of the 2-meter model, using an open-ended chassis on which a simply styled ⅛" thick panel is mounted. The receiver v.f.o. is mounted on a vertical bracket above the chassis and it is tuned by means of a planetary drive that is mounted directly on the variable-capacitor frame rather than on the panel, providing better mechanical stability and a lesser chance of backlash. A slide-rule dial is string driven from a large wheel on the drive. The dial is calibrated, slightly non-linearly, in 50 kc increments spaced an average of 1/16" apart. The receiver may be tuned an additional amount past each end of the calibrated range where there is simply one calibration marker at the 0.5 mc point. This will allow reception on MARS frequencies.

Top view of the Clegg 66'er. The p.a. is at upper left. The v.f.o. is built on the bracket next to the string-drive wheel. The plate cap of the 2E26 along with the terminals of the power transformer (center foreground) and of the relay (lower right corner) are exposed. Bodily contact with high voltage at these points must be avoided, in the event servicing is conducted while power is applied.



The power switch is on the a.f. gain (there is no r.f. gain control). Another switch has the crystal-spotting position and turns the a.n.l. on or off. A single crystal socket is on the panel for convenience in rapidly changing crystals. An external v.f.o. for the transmitter also may be plugged into the crystal socket. The v.f.o. r.f. output requirements are 1-3 v. r.m.s.

An edgewise-mounted meter indicates receiver S-units or transmitter output, functions which are automatically switched. A 3-circuit mic jack on the panel provides p.t.t. operation using a switch on the mic. Separate external control may be obtained through a phono jack on the rear of the set.

The 66'er may also be used to drive a linear amplifier, such as the Clegg Apollo, for which control may be obtained from auxiliary contacts on the transfer relay. These are connected to a phono jack. The circuit is normally open on receive, grounded on transmit.

The mic gain is a screw-driver-adjust control on the rear. A 3-inch loudspeaker is mounted on one side of the perforated cabinet on the rear of which is a phono jack through which a jumper connects the speaker to the receiver output through another jack at the rear of the chassis. A larger size external speaker may therefore be easily substituted if desired.

Operation and Performance

On the performance side, the receiver sensitivity measured up to the rating of 0.6 μv for 10 db S/N (checked with 30% modulation at 400 c.p.s.); Selectivity, rated at 8 kc at the 6 db points, was 7 kc; Spurious responses, rated at more than −60db, were over −70 db; Primary image rejection, not rated, was 74 db; I.f. signal rejection (at 10.7 mc), not rated, was 76 db; A.g.c. characteristic was as rated with 10 db a.f. output change for 40 db r.f. input variation (10-1000 μv); Squelch threshold, range rated at 0.5-500 μv, could be set for signal levels as low as 0.2 μv. An S-9 meter reading was equivalent to 30 μv.

Stability, rated at 10 kc during warmup and less than 3 kc per hour after 20 minute warmup, starting cold at an ambient of 72°F, was 5 kc drift during first 5 minutes, 3 kc the next 5 minutes, 2 kc following 5 minutes, 2 kc next hour and 1 kc or less per hour thereafter (readings are average of several test runs made at 50.5 mc). Banging the cabinet produced no evidence of instability due to vibration. Except at the

[*Continued on page 117*]

LAFAYETTE RADIO ELECTRONICS

Value Leader in Amateur Gear Since 1923

LAFAYETTE 400 SERIES 6 AND 10 METER AMATEUR TRANSCEIVERS

COMPLETELY WIRED

149^{95}

99-2575WX—Model HA-410 for 28-29.7 MC

99-2579WX—Model HA-460 for 50-52 MC

- 2E26 Final—20 Watts DC
- Nuvistor RF Amplifier
- Dual Conversion
- Built-in 117 VAC and 12 VDC Power Supplies

LAFAYETTE MOBILE LINEAR AMPLIFIERS FOR 15 THROUGH 2 METERS

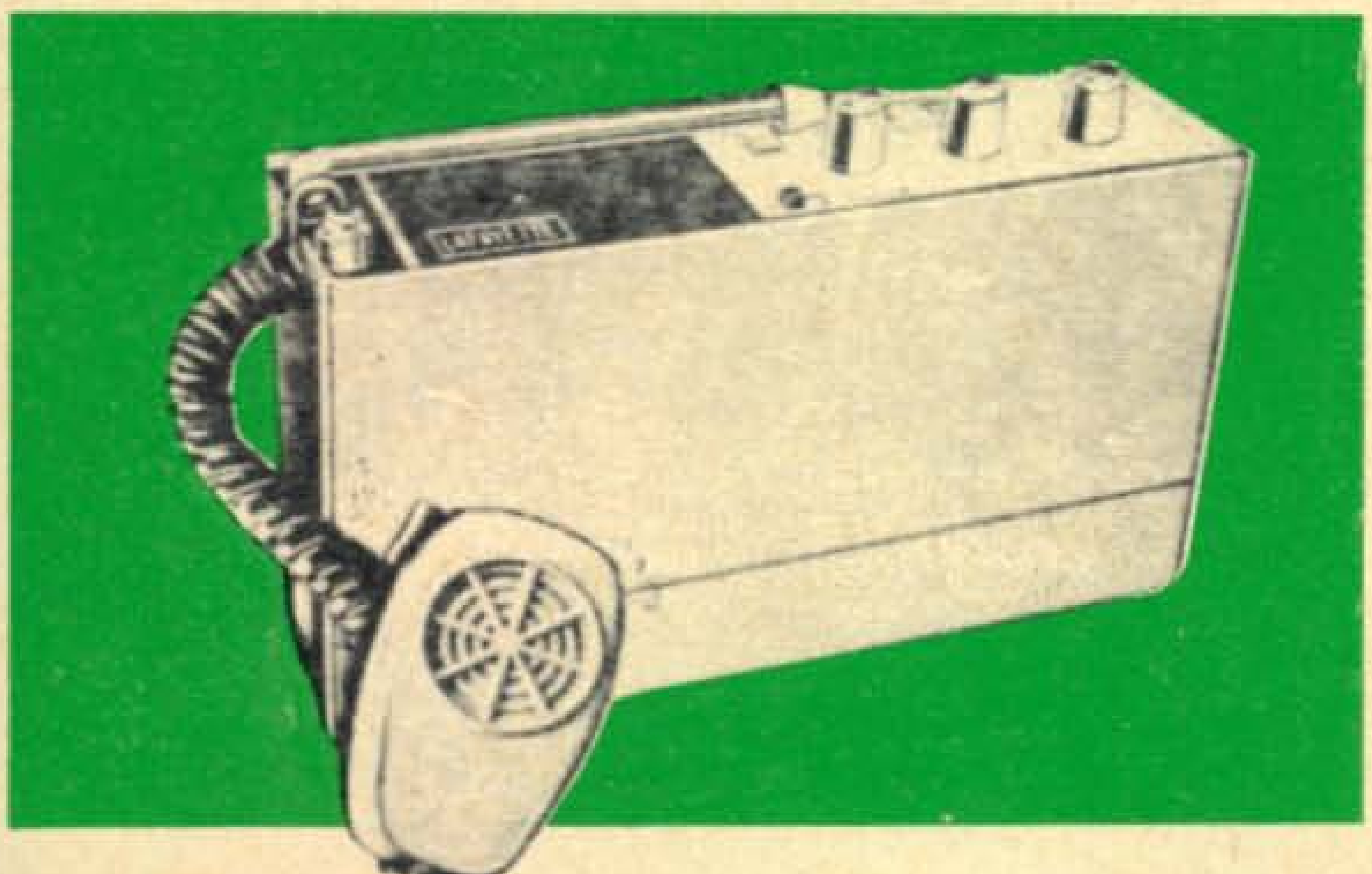
- Built-in 12 VDC Toroid Power Supply
- Built-in RF Switching
- Built-in Metering Circuit for Exciter Or Linear RF Power Output

Made In U.S.A.

40-0106WX HA-250 For 15-6 Meters **$79.95**

40-0108WX HA-260 For 2 Meters **$139.95**

As Low As **79^{95}**



LAFAYETTE PORTABLE AND MOBILE 6 AND 2 METER 2.5 WATT TRANSCEIVERS

- Efficient Solid-State Circuitry.
- Crystal Controlled Transmit Positions.
- Tuneable Superheterodyne Receiver.
- Uses Standard 8 MC Crystals.
- Complete With Leather Carrying Case And Batteries.

As Low As **89^{95}**

99-2570WX HA-650 **$89.95**

99-2581WX HA-144 **$189.95**

FREE! *Just Off Press!* **1968 CATALOG 680**

OVER 500 PAGES

Write: P.O. Box 10, Syosset, L.I., N.Y. 11791
Lafayette Radio Electronics Corp., Dept. CJ-7

For further information, check number 30, on page 126

YOU WILL NEVER FULLY APPRECIATE WHAT A SUPERB AMPLIFIER THE 2K-2 REALLY IS*

**that is... until you own one!*

THE 2K-2 FLOOR CONSOLE OR DESK MODEL $675.00

It's true. We keep telling you about the inspired simplicity of the 2K-2 design, about its rugged reliable mechanical construction. We've told you many times about the 2K-2's high quality components, its enormous power output, its exceptionally low distortion figure and attendant signal sharpness. Other amateurs have been telling you these same things too! And you have been hearing those BIG, BIG 2K-2 signals on the air. But it's still true, you will never fully appreciate what a superb amplifier the 2K-2 really is until you have owned one for yourself.

And now good news! The 2K-2 is available for immediate delivery. We have expanded production and have amplifiers in stock. Pick up your telephone today. Find out how easy it is for you to own the 2K-2. If you live near a metropolitan area air freight can deliver one to you by tomorrow. Of course if you live in the country you may have to wait an extra day.

If you are still not sure let us send you our descriptive brochure. Remember you are dealing with the world's oldest and most reliable amateur distributor. You can count on the same responsible merchandising program that amateurs all over the world have been relying on for forty years.

ATTENTION! Military, commercial, industrial and scientific users . . . please write for information on our custom line of high power communication linear amplifiers and RF power generators.

6% FINANCE CHARGE • 10% DOWN OR TRADE-IN DOWN • NO FINANCE CHARGE IF PAID IN 90 DAYS • GOOD RECONDITIONED APPARATUS • Nearly all makes & models. Our reconditioned equipment carries a 15 day trial, 90 day warranty and may be traded back within 90 days for full credit toward the purchase of NEW equipment. Write for bulletin.

Henry Radio Stores

CALL DIRECT . . . USE AREA CODE

Butler 1, Missouri, 64730	816 679-3127
11240 W. Olympic, Los Angeles, Calif., 90064	213 477-6701
931 N. Euclid, Anaheim, Calif., 92801	714 772-9200
6116 N. 27th Ave., Phoenix, Ariz., 85017	602 AM 4-3895

East Coast Rep.: Howard Laughrey, 2 Elizabeth St., Chappaqua, N.Y. 10514, (914) CE 8-3683

"Worlds Largest Distributors of Short Wave Receivers"

 For further information, check number 9, on page 126

voltmeter circuit loading

BY JOSEPH P. FINCUTTER,* K3STU

Part I

How good are your voltage measurements? What is the accuracy of your voltmeter? Do you use your voltmeter in such a way that its accuracy really means something? Do you make precision measurements with your voltmeter? How much trouble do you have with voltage measurements in troubleshooting your equipment? Do these measurements agree with those listed in the Instruction Book? If you're interested in the answers to these questions, and the explanation thereof, read on. Part I of this two part series explains the nature of the measuring instruments and how the circuit loading problem is created. Part II of the series will explain how the accuracy of your measurements can be improved if the inherent characteristics of your meter are considered.

ONE quick look at the various electrical and electronic trade journals indicates the emphasis that is being placed on the accuracy of measurements, the technological developments in measurement techniques and the need for traceability of the accuracy of measurements to the National Bureau of Standards. The number of manufacturers of test equipments has increased tremendously in the last ten years, and, these manufacturers have increased the accuracy specifications by at least one order of magnitude, if not more. The accuracies quoted are sometimes hard to believe unless one is actively engaged in the field of measurement and/or calibration. Specifications of accuracies such as "$\pm 0.001\%$," "rise time of 0.5 nanoseconds," "+1 part in 10^{10}," *etc.*, are commonplace. The demands of complex electronic equipment and circuitry of the space and weapons age are responsible for increased emphasis on better methods for assurance of a quality product. Fortunately great improvements in test equipment and awareness of the value of good measurements have been the products of this electronic age.

*5620 Alta Vista Road, Bethesda, Maryland 20034.

Now, what does this mean to us as radio amateurs? Well, past history has revealed that many of us have been, in one way or another, involved in many of the developments in the field of electronics (radio, in bygone days), and one of the prime reasons

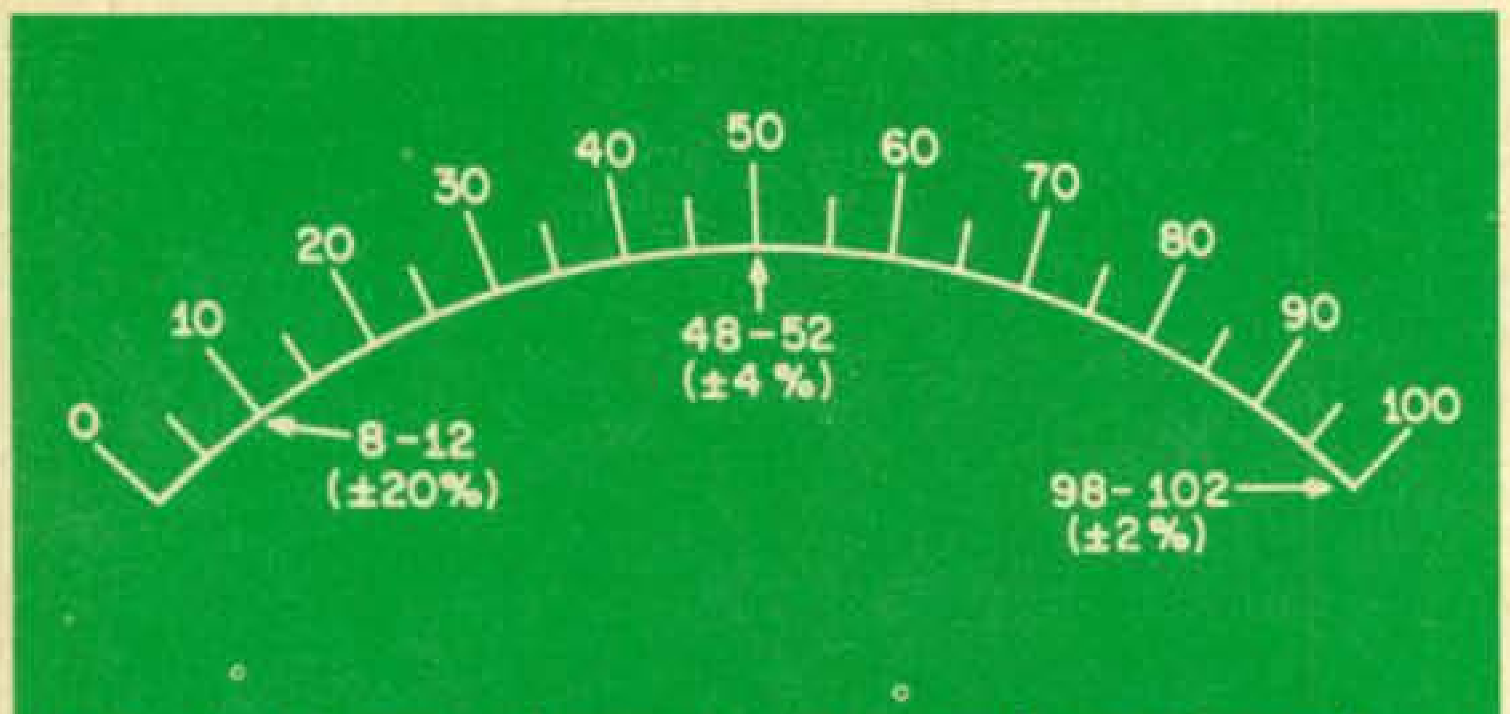


Fig. 1—Shown above is a typical meter scale as described in the text. The meter has an accurracy of ± 2% Full Scale. As shown, at half scale the accuracy of the same meter drops to ± 4% and at one tenth scale the accuracy is ± 20%.

for our existence as amateurs is as a ready source of operators and technicians, yes, even engineers, in times of national disaster or emergency. Therefore we should be doing our best to keep abreast of the state of the art of measurement and to constantly improve our ability to make good measurements.

Meter Characteristics

Probably one of the most useful and most used measuring equipments is the Volt-Ohm-Milliameter (v.o.m.) or the Vacuum Tube Voltmeter (v.t.v.m.). Although this article could be written around any piece of test equipment, I feel that if you understand the ramifications of making good d.c. voltage measurements you can easily apply similar principles to any other measurement with equal success. Therefore, let us examine the electrical specifications of the meter, 100 volts full-scale, forgetting the physical size aspects, the type of case, and other physical characteristics. We should be interested in the range, full-scale (*FS*) or indicated value (*IV*) accuracy, meter movement resistance (R_m), full scale current (I_{fs}), *etc.* Typical specifications for a meter are given in Table I below:

Full Scale Voltage	100 volts
Full Scale Current	1 milliampere
Meter Resistance	100 ohms
Sensitivity	1000 ohms/volts
Accuracy	±2% *FS*

Table I—Typical meter specifications.

Accuracy

Let us examine what the accuracy specification in Table I really means. Figure 1 depicts the accuracy specification as "±2% *FS*" which applies over the entire range of the scale. First of all, the "±2% *FS*" tells us that the best knowledge we have of the measured voltage is that it lies somewhere between 2 volts above and 2 volts below the indicated value. For example, if the meter indication is 100 volts, we only know that the voltage applied to the meter is somewhere between 98 and 102 volts. This "±2 volts" is applicable across the entire range of the scale; but the "±2%" is applicable only at *full scale*. Further, if the meter indication is 50 volts, we only know that the true value is somewhere between 48 and 52 volts, or ±4% of the indicated value. Again, if the meter indicates 10 volts, the voltage is somewhere between 8 and 12 volts, or ±20% of the indicated value. You can easily pick out other points on the scale, or choose other accuracies, and evaluate your readings accordingly. Figure 1, therefore, very readily points out the reason for using the upper 50% (or even better, the upper 25%) of the scale when making voltage measurements because the accuracy decreases by 50% between full and half scale.

Let's recall at this point that according to Ohm's Law, $E = I \times R$, *etc.* Some are probably wondering why I recalled one of the first basic laws of electricity which we learned in our early years. Well, permit me to delve into those basic laws and equations so that I can (a) refresh your memory, and (b) develop your ability to be completely knowledgeable about measurement of d.c. voltages with a v.o.m. or a v.t.v.m.

Parallel Effects

I'm sure that at one time or another we have been confronted with the problem of not having the right value of resistance and we resorted to an old familiar equation and a handful of resistors that would provide the

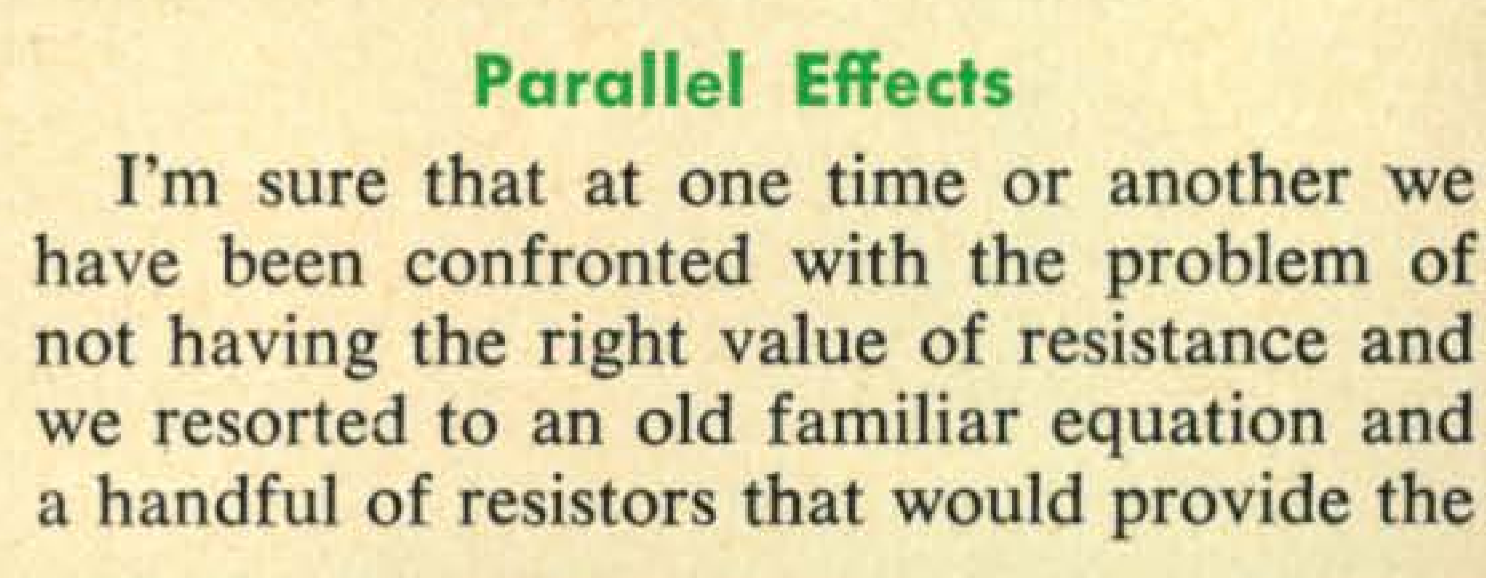


Fig. 2—Typical circuit of the voltmeter portion of a volt-ohm-milliameter. The total resistance, R_{in} is equal to $R_M + R_m$. Since R_M changes on each range R_{in} must change for each range.

proper value of resistance when connected in parallel. Equation (1), one of several used for parallel resistance problems, is simple and easy to solve:

$$R_{equiv} = \frac{R_1 \times R_2}{R_1 + R_2} \qquad (1)$$

It is a formula that can show us why we don't make good measurements, or in more proper terminology, why we should evaluate each measurement we make, looking at the circuit in which the measurement is made and at what the measuring instrument is "doing" to the circuit. I'm sure that we all use that time worn axiom that when two resistors are connected in parallel that the equivalent resistance is less than the value of the smaller of the two resistors. *But do we think about it when we place the leads of a v.o.m. or a v.t.v.m. across a resistor to measure the voltage drops?* Let's evaluate this question first by examining the circuit of a typical v.o.m. and a typical v.t.v.m. as shown in figs. 2 and 3, respectively. First, we must know the input resistance (R_{in}) and/or the sensitivities of the meters. The sensitivity (ohms/volt) of a v.o.m. is given by Equation (2):

$$Sensitivity\ (Ohms/volt) = \frac{1}{I_{full\ scale}}$$

And Equation (3) gives the input resistance of a v.o.m. for each range:

$$\text{Input Resistance} = E_{full\ scale} \times \text{Sensitivity} \qquad (3)$$

From Equation (3) it follows that the input resistance of a v.o.m. changes as we switch from range to range. However, the design of a v.t.v.m., as seen in fig. 3, is such that the input resistance, R_{in}, is constant for all ranges. No matter which of the two meters we consider, we must determine the resistance that exists between the points of the test leads (R_{in}) because this is the resistance that is paralleled with the circuit that we are measuring. Table II depicts typical values of input resistance for different ranges on a

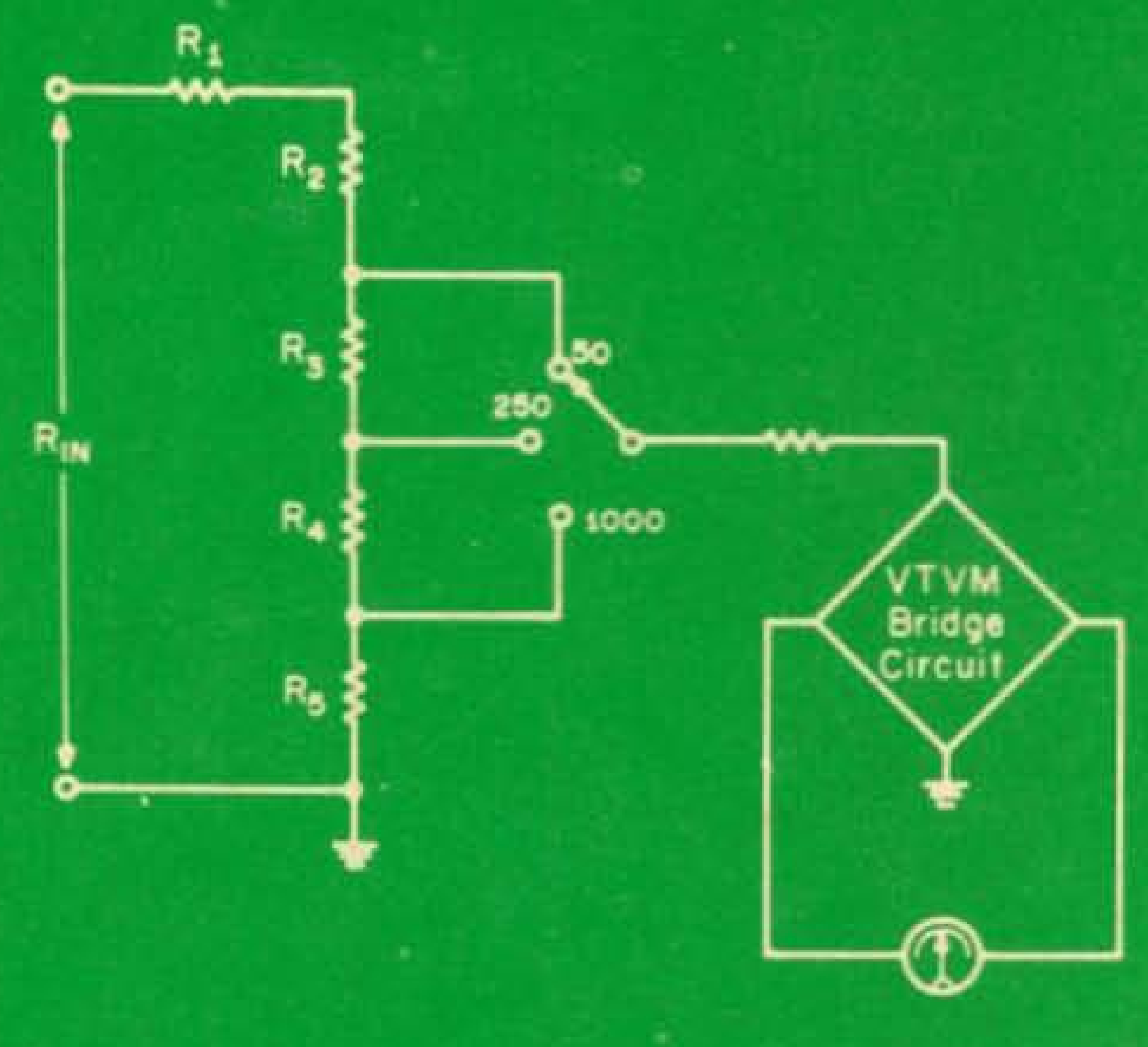


Fig. 3—Typical input circuit of a v.t.v.m. in the voltmeter function. The input resistance R_{in} is equal to $R_1 + R_2 + R_3 + R_4 + R_5$ and remains the same for all ranges. Resistor R_1 is usually at the head of the probe and is most commonly 1 megohm.

v.o.m. and a v.t.v.m.

From table II, what happens to the resistance between the points of the test leads of a 20,000 ohms/volt v.o.m. as we switch from range to range? It varies from 50,000 to 20 megohms! For a v.h.v.m.? It remains *constant* at 11,000,000 ohms. We must, therefore, take a good liik at the parallel resistances formed by the input resistance of the meter and the resistance across which we are measuring the voltage, and further, the resultant effect on the associated circuitry. Since the resistance of the v.o.m. changes from range to range, the value of the parallel combination will change and this will definitely alter the circuit being measured and give us an erroneous reading (erroneous from the standpoint of a circuit diagram value but not from an accuracy standpoint because the meter will indicate the value of the *altered* circuit.) Furthermore, we will not read the same value of

20,000 ohm/volt v.o.m.	
Voltage Range	**Input Resistance**
0–2.5	50,000
0–10	200,000
0–50	1,000,000
0–100	2,000,000
0–250	5,000,000
0–1000	20,000,000

Typical v.t.v.m.	
Voltage Range	**Input Resistance**
0–1.5	11,000,000
0–5	11,000,000
0–15	11,000,000
0–50	11,000,000
0–150	11,000,000
0–500	11,000,000
0–1000	11,000,000

Table II—Typical values of input resistance for different ranges on a v.o.m. or v.t.v.m.

voltage as we switch from range to range, and rightly so. *There is nothing wrong with the meter.* Each time we switch ranges we are "looking at" a different circuit and the meter indicates the voltage of each of these circuits.

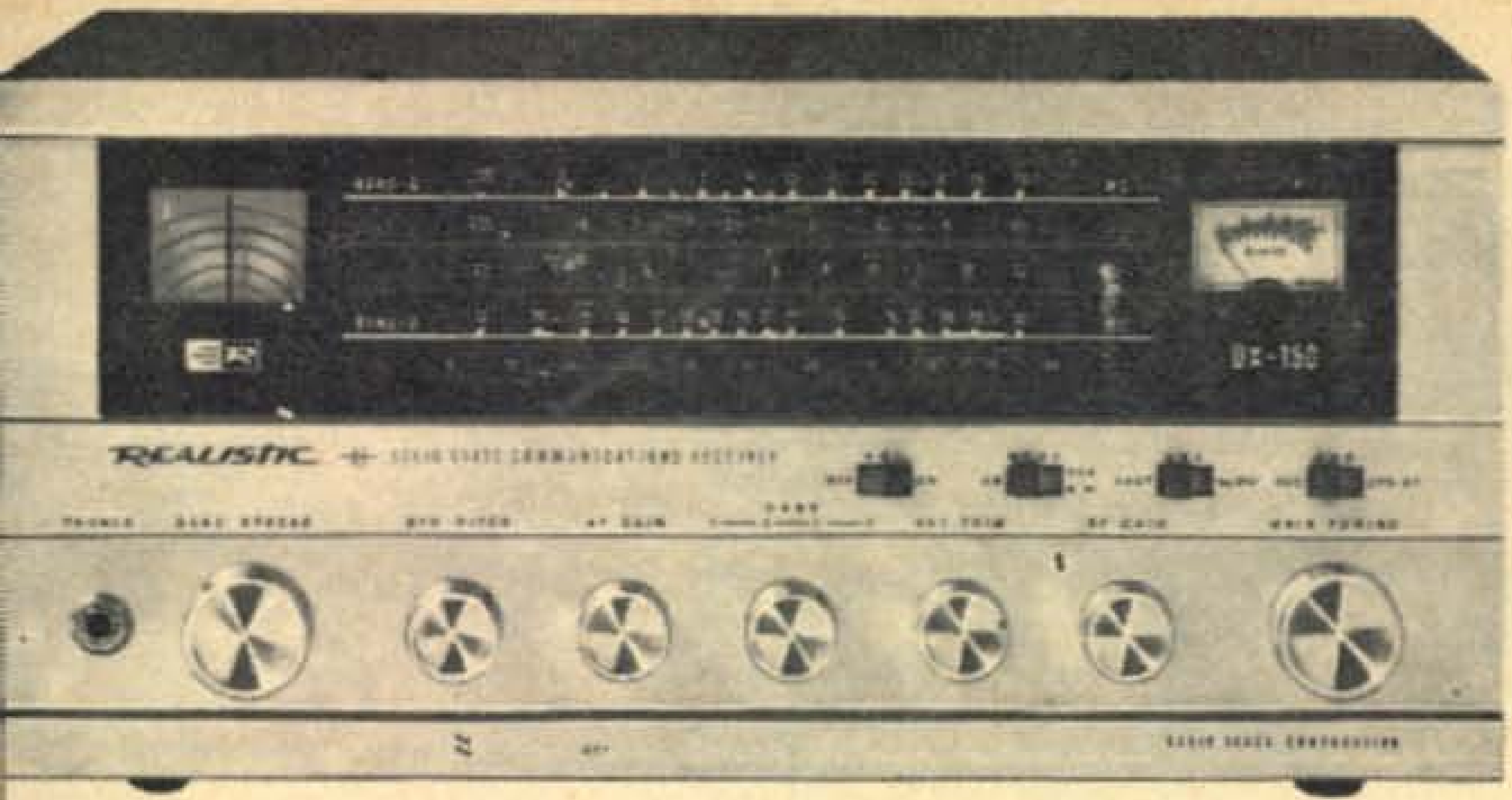
Measuring Voltages

Now what happens when we use a v.t.v.m. to measure voltages? Table II shows that regardless of what range we use, the input resistance of the meter is a constant 11,000,000 ohms. If the resistance across which we are measuring the voltage is less than 1,000,000 ohms we should be able to switch from range to range and read approximately the same voltage on each range, providing the voltage divider network in the input circuit of the v.t.v.m. is within its limits of accuracy and the vacuum tube bridge circuit is linear over the range of voltage applied to it. However, we still have the problem of reading the low end of the scale of the meter. (See fig. 1 again.)

We cannot say that there is a hard and fast rule which can be used when making voltage measurements with any measuring instrument other than to make sure that the circuit we are measuring is not disturbed or altered by the measuring instrument. And, therefore, we cannot make the broad and general statement that a v.t.v.m. is more accurate than a 20,000 ohm/volt v.o.m. unless we know many facts about the measurement. I'm also sure that someone is now asking himself how I correlate what I have just explained with the fact that instruction books for equipment list voltage charts for various test points in the equipment, sometimes specifying a 20,000 ohm/volt meter and at other times a v.t.v.m. and in some cases even listing voltages for both types of meters. First it is necessary to explain how these lists are prepared. Once the equipment is determined to be in proper operating condition (operating at designed efficiency), the measurements are taken at the assigned test points with either, and/or both types of meters. These readings are tabulated without regard to how much the circuit has been changed by the measurement. These charts are valuable tools in trouble-shooting the equipment, but they do not necessarily indicate the true value of voltage at these points. If you are conscientious about the manner in which you make these measurements, you can trouble-shoot the equipment; identical readings to those in the chart (at least within reasonable limits of the values) would indicate no trouble, but any large variance with the tabulated readings would indicate trouble.

In Part II we will show how the variation in R_{in}, the meter input resistance, affects actual readings obtained and why, if instructions are not followed closely, the obtained results will not correlate with the manufacturers voltage charts.

(To be continued)



RADIO SHACK

BREAK THRU!!

ALL SOLID STATE

The World's First 117V/12V All-Transistor Communications Receiver Is Available Now In 150 Radio Shack Stores Coast to Coast!

THE REALISTIC® DX-150

- *Over 30 semiconductors — no tubes, no nuvistors — the DX-150 is 100% solid state!*
- *SSB/CW/AM reception, covering 535KC through 30MC in 4 slide-rule bands!*
- *Product detector for SSB/CW, plus fast and slow AVC; variable-pitch BFO!*
- *Illuminated electrical bandspread fully calibrated for the Amateur and CB bands!*
- *Cascade RF stage; ANL for RF and AF; zener-stabilized; OTL audio; illuminated "S" meter!*
- *Built-in monitor speaker plus front-panel jack for external (optional) matching speaker!*

ONLY 119⁹⁵

New, big, exciting, professional — the Realistic DX-150 obsoletes tube receivers and warm up, banishes forever your dependence on house current to stay in operation. For example: **the DX-150 will run 100 hours on 8 D-cells** if current fails, or isn't available, or on field day. Additionally, it will operate from a car's cigarette lighter or any other mobile or base 12VDC source! Of course a 117VAC power supply is built in. DX-150 is a husky brute: 14⅛ x 9¼ x 6½", with a massive silver extruded front panel, solid metal knobs, grey metal cabinet, 14 pounds of quality.

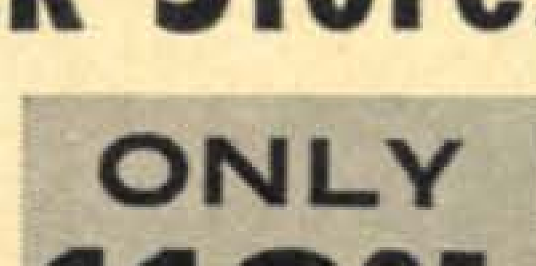
A NEW STANDARD OF RECEIVER VALUE!

Priced Radio Shack's way (factory-to-you) the DX-150 saves you about $100 off traditional pricing methods. Yet it offers 11 front controls; dual power supply; 12¼" slide-rule dial in 5 colors; **continuous coverage** from 535KC through 30MC, including 160 through 10 meters; separate detector circuits for AM (diode) and SSB/CW (4-diode bridge); sensitivity good to 0.5μv at 30MC. Nobody **but nobody** but 44-year-old Radio Shack could have created this unique product for $119.95. You better believe it!

THERE'S A STORE NEAR YOU!

RIZONA — Phoenix
RKANSAS — Little Rock
ALIFORNIA — Anaheim, Bakersfield, Covina, Downey, Garden Grove, Inglewood, La Habra, Long Beach, Los Angeles, Mission Hills, Mountain View, Oakland, Pasadena, Pomona, Reseda, Sacramento, San Bruno, San Diego, San Francisco, Santa Ana, Santa Monica, Torrance, West Covina
OLORADO — Denver
ONNECTICUT — Hamden, Manchester, New Haven, New London, Orange, Stamford, West Hartford
ORIDA — Jacksonville, Orlando
EORGIA — Atlanta
LINOIS — Chicago
NSAS — Wichita
UISIANA — New Orleans
AINE — Portland
ARYLAND — Langley Park
ASSACHUSETTS — Boston, Braintree, Brockton, Brookline, Cambridge, Framingham, Lowell, Medford, Natick, Quincy, Saugus, Springfield, Waltham, West Springfield, Worcester
MICHIGAN — Detroit
MINNESOTA — Minneapolis, St. Paul
MISSOURI — Kansas City, St. Joseph, St. Louis
NEBRASKA — Omaha
NEW HAMPSHIRE — Manchester
NEW JERSEY — Pennsauken
NEW MEXICO — Albuquerque
NEW YORK — Albany, Binghamton, Buffalo, New York, Schenectady, Syracuse
OHIO — Cincinnati, Cleveland
OKLAHOMA — Oklahoma City, Tulsa
OREGON — Portland
PENNSYLVANIA — Philadelphia, Pittsburgh
RHODE ISLAND — Providence, East Providence
TENNESSEE — Memphis, Nashville
TEXAS — Abilene, Arlington, Austin, Brownsville, Corpus Christi, Dallas, Fort Worth, Houston, Lubbock, Midland, San Antonio, Sherman, Waco
UTAH — Salt Lake City
VIRGINIA — Arlington, Virginia Beach
WASHINGTON — Seattle

REALISTIC DX-150 CUSTOM ACCESSORIES



Exact-match external Voice-Frequency speaker cuts out built-in monitor, includes lead and plug. 20-1500: $7.95 (4 lbs.)

12VDC portable pack with all cables, plugs, 8-long-life batteries; includes plug-to-plug and plug-to-lighter cord sets. 20-1501: Only $7.95 (wt. 4 lbs. w/batteries)

ORDER BY MAIL! IN PERSON! FREE FOLDER!

RADIO SHACK East: 730 Commonwealth Ave., Boston, Mass. 02215
West: 1515 So. University Dr., Ft. Worth, Tex. 76107

Dept. SX

Please rush me the item I've checked below.
I enclose $________, plus 50¢ for postage and handling:

☐ FREE 1968 Catalog
☐ FREE DX-150 Folder
☐ Receiver, 20-150, $119.95*
☐ Matching Speaker, 20-1500, $7.95*
☐ 12 VDC Power Set, 20-1501, $7.95*

** Plus Shipping Cost: 14 lbs., 4 lbs., 4 lbs.*

Name (print)________________
Street________________
City________________ State________ Zip________

For further information, check number 12, on page 126

PRACTICAL USES OF VOLTAGE VARIABLE CAPACITORS

BY JOHN J. SCHULTZ,* W2EEY/1

Voltage variable capacitor diodes have become as inexpensive as air variable capacitors for low-power applications. The author discusses their principle of operation and shows several practical examples of their use as tuning elements in place of air variable capacitors.

VOLTAGE variable capacitors, or varactors,[1] have been available for several years although, so far, they have rarely been used in home-brew amateur equipment. They have been used extensively in commercial equipment as well as amateur equipment made by Collins, Hallicrafters, Heathkit and others. Perhaps many amateurs feel that the use of such capacitor diodes is complicated or expensive. This article is meant to demonstrate how easy it is to employ these diodes for a variety of circuit applications.

Price originally might have discouraged many amateurs from using these diodes but now units with a capacity range and Q to fit most circuit applications are available at prices from $1 to $3. This price range certainly makes them competitive with air variable capacitors for low-power circuit applications. High-power diodes are still relatively expensive although one can buy types for $12 that will work with transmitters having 10-20 watts input up to 2 meter frequencies.

Applications

Even in spite of their cost, which is bound to decrease during the next few years as they are more commonly used, the diodes open up several exciting possibilities for amateur usage. For instance, a preselector can be mounted directly on an antenna and tuned from the shack via a d.c. control circuit on the transmission line thereby avoiding the loss and noise which the transmission line

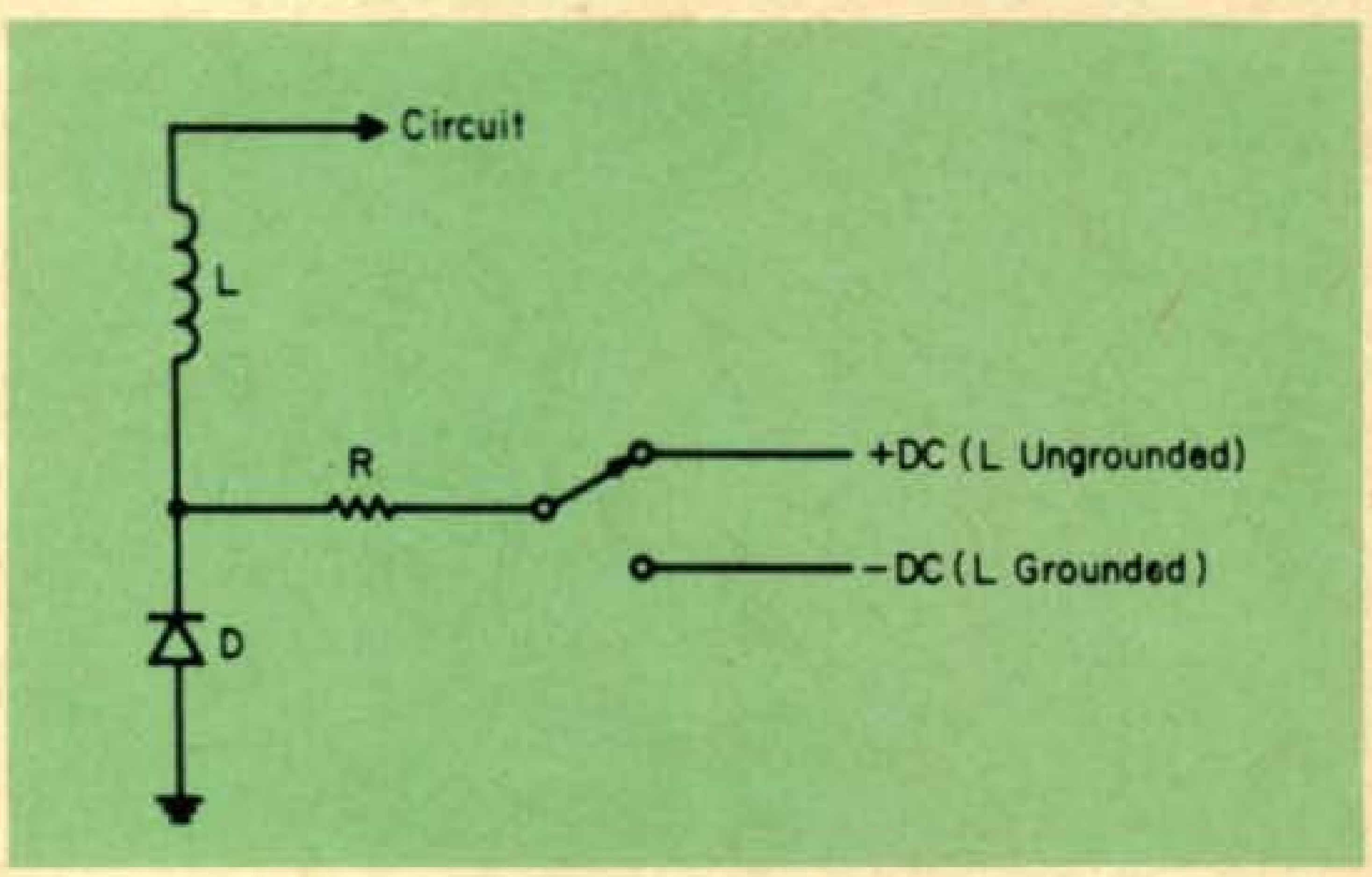


Fig. 1—Operation of the voltage variable capacitor diode is basically similar to that of simple diode switch shown. However, with voltage variable capacitor diodes, the capacitance the diode presents to circuit varies with its back-bias potential.

*40 Rossie Street, Mystic, Connecticut 06355.

[1] Voltage variable capacitor diodes, varactor diodes and step diodes all work on the same basic principle. The operation was described in two articles: Thorpe, D., "Varactor Multipliers for V.H.F.," CQ, January 1965, p. 44. Kolb, R. J., "V.H.F.-U.H.F. Passive Multipliers," CQ, July 1966, p. 66. Varactors and step diodes are generally used for harmonic generation at v.h.f., u.h.f. and microwave frequencies while voltage variable capacitor diodes are used for circuit tuning applications.

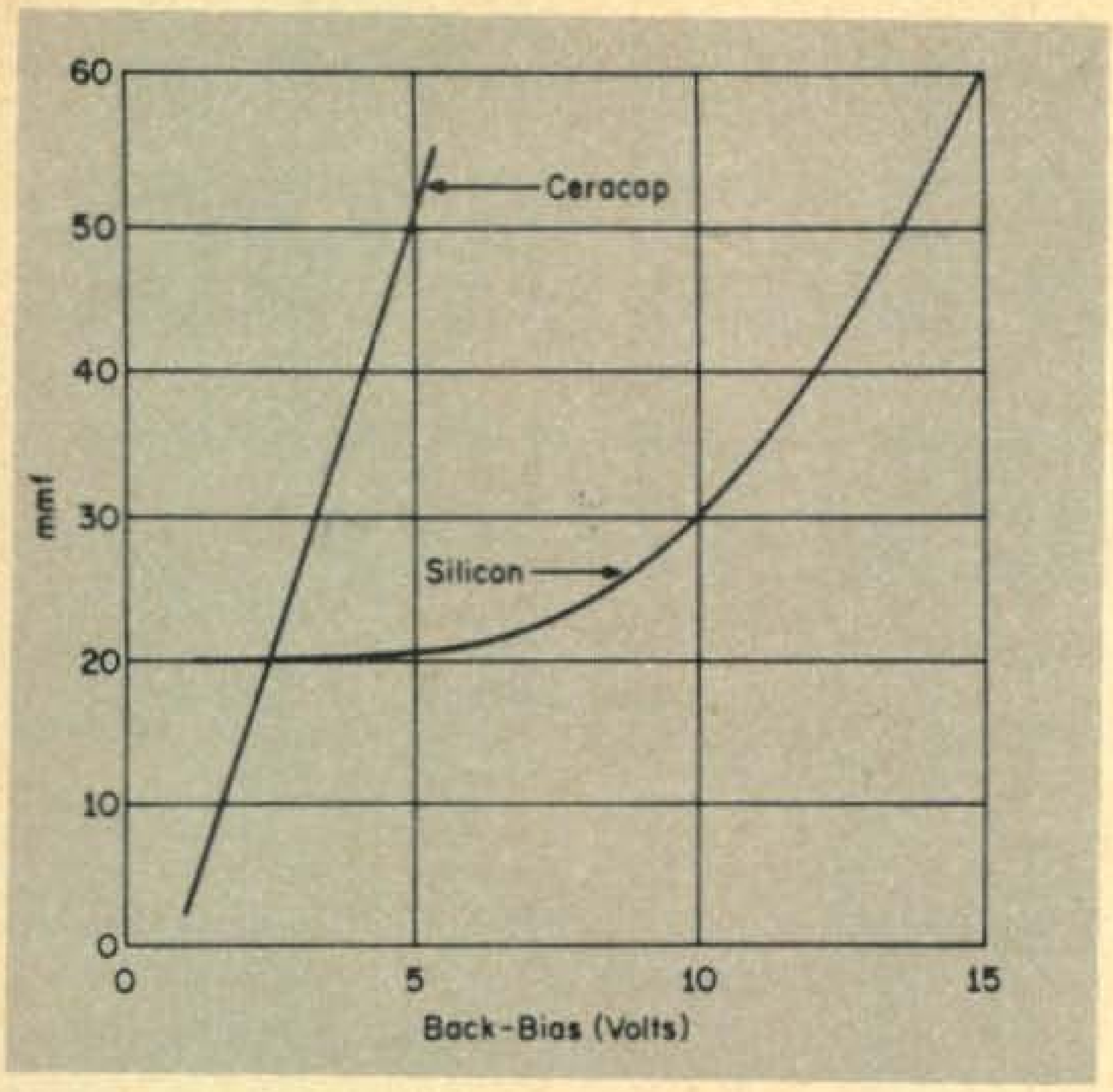


Fig. 2—Diodes with various construction present different capacitance variation with respect to applied bias voltage. Variation of a particular diode should be determined from manufacturers specification sheet.

imposes on the received signal. This is an especially interesting consideration for frequencies of 2 meters and above where transmission line loss, unless one uses very expensive cable, can become a major problem. With high power diodes, the p.a. stage of a transmitter can also be mast-mounted to avoid the same transmission line losses.

Another application would be for multi-band antennas for 80-10 meters. Instead of having a resonant feed line which radiates and can raise BC1 and TVI problems, the antenna tuner in the shack, etc. one can place the antenna tuner directly at the center of the flat-top portion of the antenna and the transmission line would always be operated "flat". Even trap dipoles can be improved since the capacitor element of the traps could be tuned from the shack so that exact resonance could be obtained in any portion of a band.

Remote tuning applications in mobile installations would particularly benefit. The complete tuning controls for a mobile installation could be built into a small mini-box which can be connected to the actual equipment, located anywhere in the automobile, by a small, multi-conductor cable.

Operation

The physics of varactor diodes is certainly a bit complicated but their operation can be visualized very simply. For instance, fig. 1 shows a regular signal diode connected in series with an inductor. Resistance *R* is to isolate the control from the circuit to prevent it from affecting the tuned frequency. When a negative potential is applied, the diode "switch" conducts and the inductor is effectively connected to ground. When a positive voltage is applied, the diode is back-biased and the "switch" is off so that the inductor end is lifted from ground. One interesting effect, however, is that certain diodes seemed to show a capacitance effect when switched "off" that varied with the level of back-bias voltage. Diodes were especially developed to take advantage of this effect and to give a smooth variation in capacitance as the back-bias voltage was varied. The simple diode switch configuration is a good one to remember since these diodes are always connected as simple switching diodes biased so that they do not conduct.

The amount of back-bias voltage range necessary to vary the capacitance of a diode is relatively small although it does depend upon the construction of the particular diode. Figure 2, for instance, shows the capacity range variation for two different types of diodes. One has a linear change in capacitance with voltage while the other has approximately a logarithmic variation. In general, the type with a linear variation tend to be more expensive although the capacitance variation of even a non-linear type can be made almost linear by choosing a potentiometer with a proper taper as discussed later.

Q Factor

Besides linearity, *Q* is another important factor in a diode. The *Q* of air variable

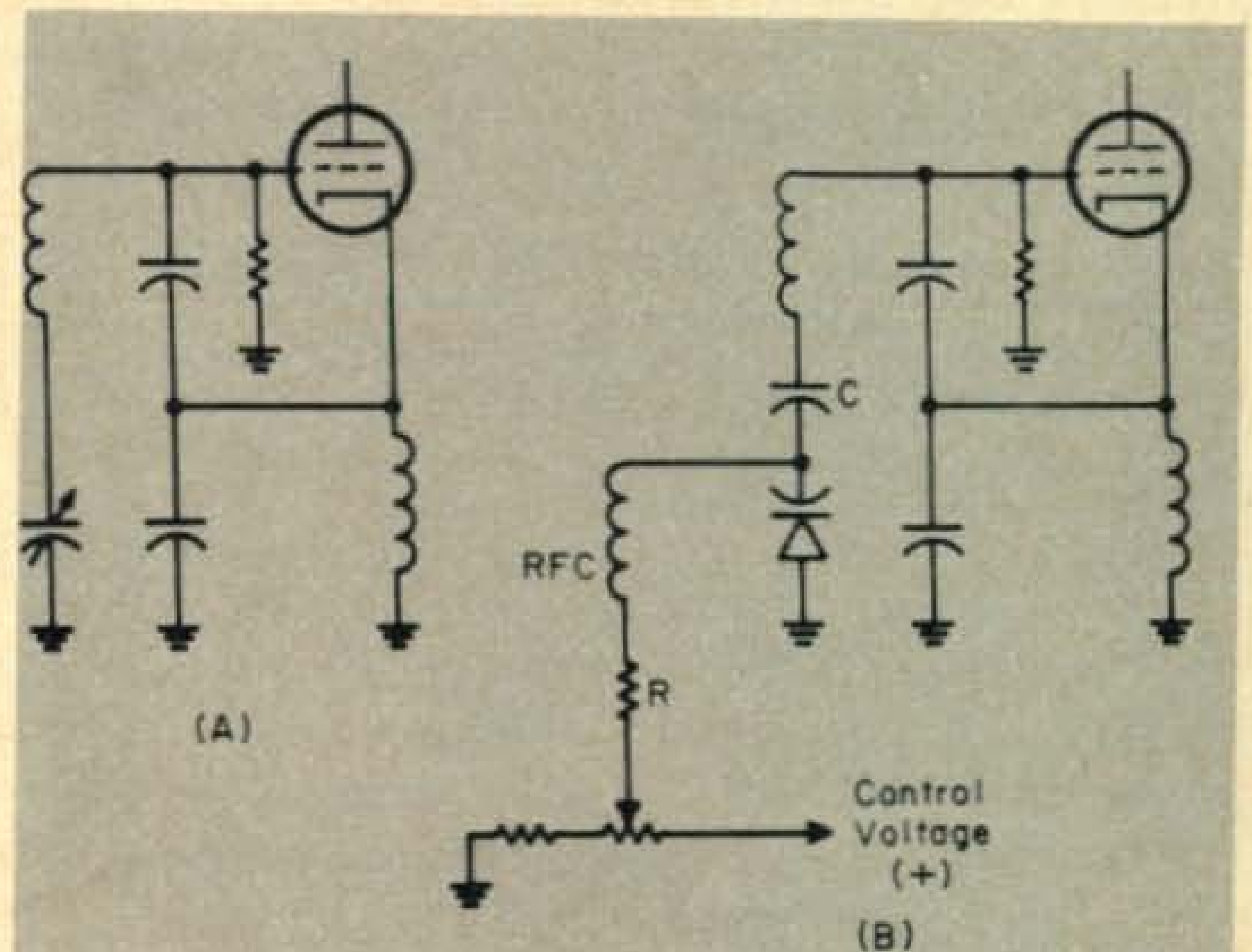


Fig. 3—Air variable capacitor in conventional Clapp oscillator circuit of (A) may simply be replaced by a diode providing a similar capacitance range as shown at (B).

capacitors varies over a wide range with perhaps 250 being an average for most types commonly used in amateur equipment. The *Q* of an air variable capacitor varies with the setting of the capacitor (being maximum with the plates fully extended) and with frequency. The same is true of the diodes although the variation may not be as great. Diodes are available with *Q*'s ranging from 10 to 500; those with higher *Q* generally being more expensive. The amount of *Q* necessary depends upon the circuit in which the diode is being used. For most oscillator circuits and tuning circuits which are not required to have sharp signal selectivity, diodes of moderate *Q*, 50 or less, are generally satisfactory. If one wanted to use a diode in a signal selective circuit, such as a variable i.f. filter, the *Q* would have to be higher. One may wonder also about the capacitance change versus temperature, especially if such a diode is used out-of-doors. Certain types are better than others but, the variation is less than 10% for most over the range of 0 to 140° *F*. The

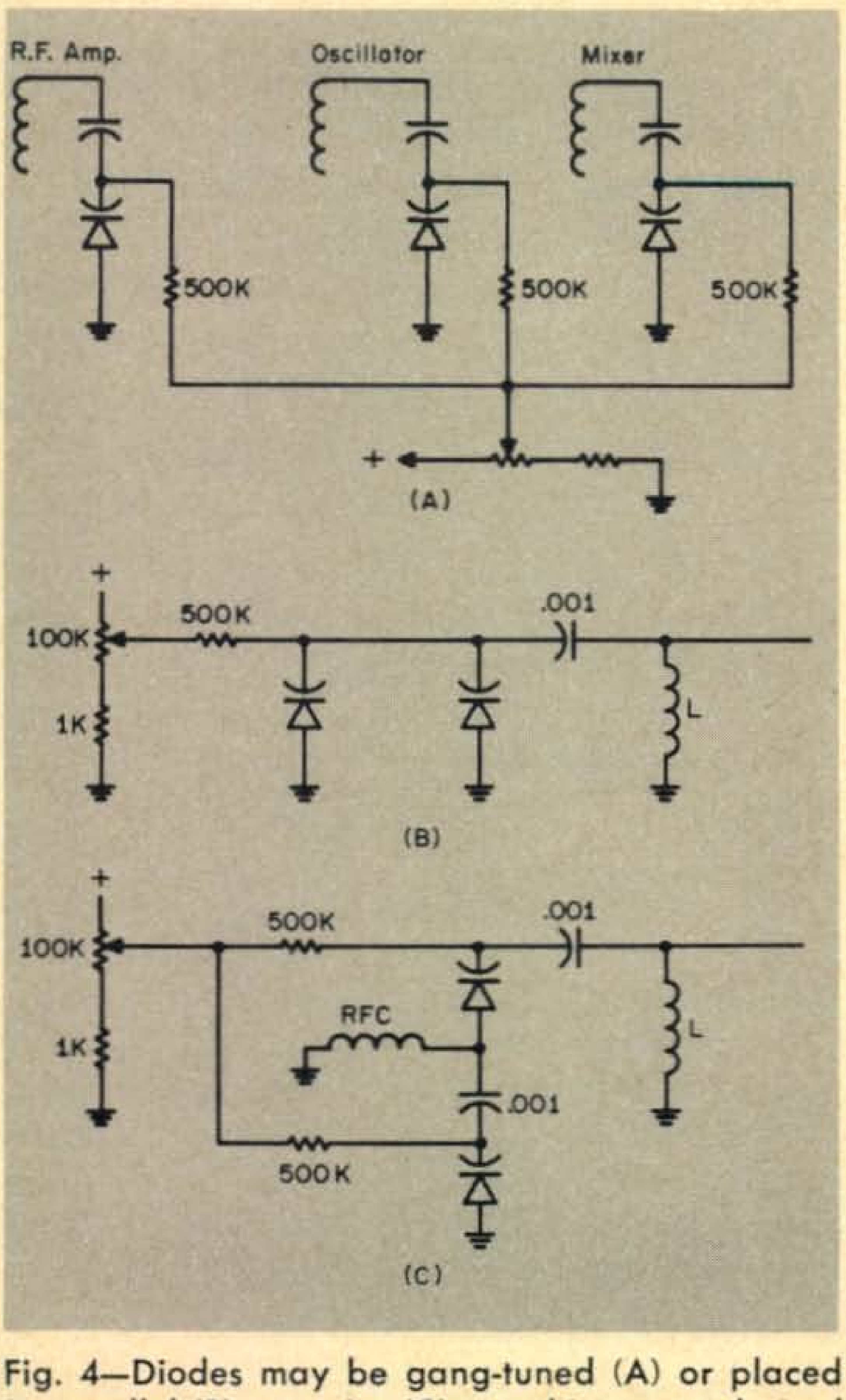


Fig. 4—Diodes may be gang-tuned (A) or placed in parallel (B) or series (C) to achieve any desired circuit function.

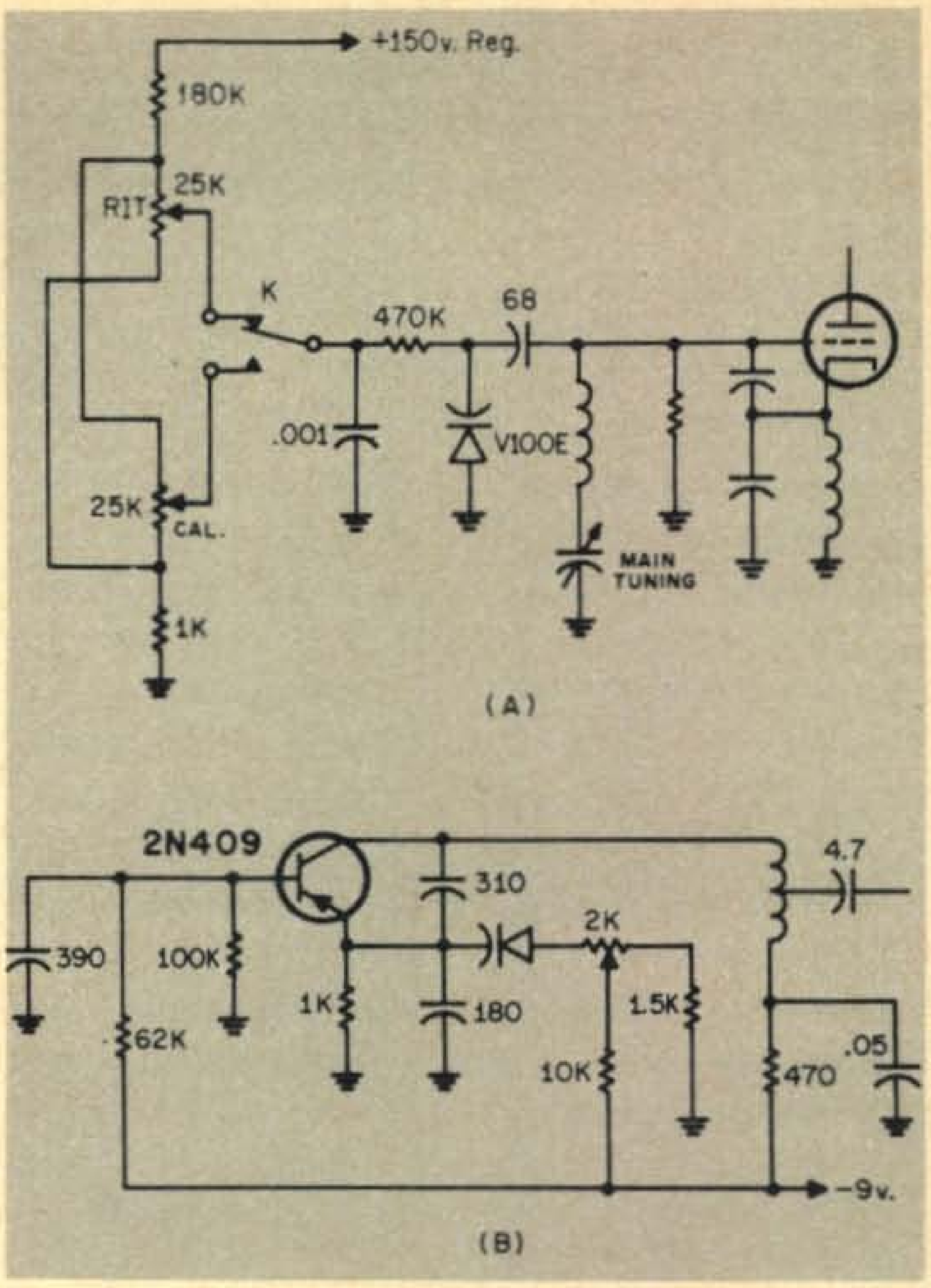


Fig. 5—Two practical examples of the usage of diodes to provide transceiver incremental tuning (A) and to control b.f.o. frequency (B).

variation can be worse than that of an air variable over the same temperature range but, then again, in a practical situation it is often difficult to properly weather-proof an air-variable in an outdoor situation while the diode is inherently "sealed".

Circuits

Figure 3 shows how easily a varactor diode may be used to replace an air-variable capacitor. The isolating resistor *R* may be of the order of a few hundred thousand ohms or it may be an r.f.c. in series with a high value resistor. In practical circuits, resistances ranging from 100K to several megohms have been used. The exact value of the resistor is generally not critical as long as the tuned circuit is isolated from any loading effects due to the low impedance of the power supply, since the reverse current of the diode is only several microamperes.

A regulated or battery type supply is usually used to provide reverse voltage for the diode since relatively small variations in voltage will change the capacitance effect of the diode considerably. Zener diodes are frequently used to provide a regulated voltage source; the zener being connected near the diode when the voltage source is remote,

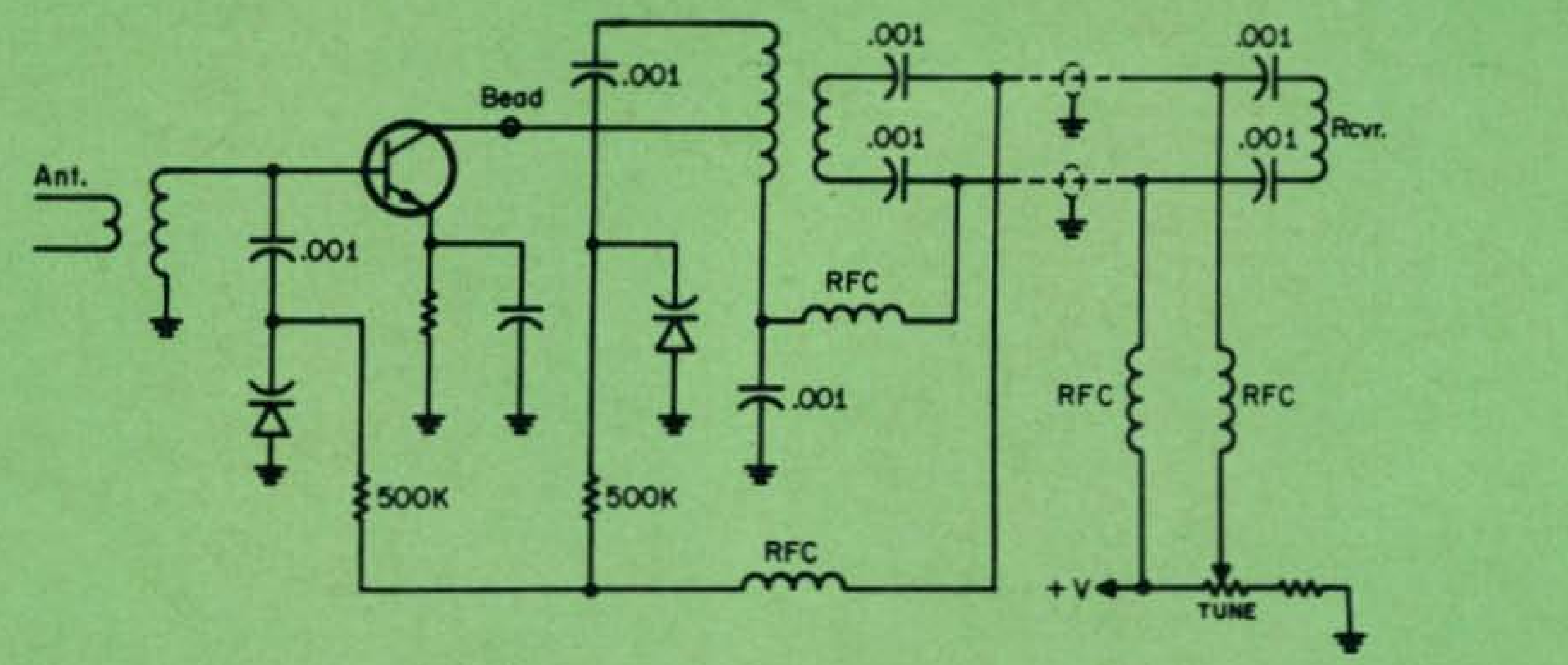


Fig. 6—Example of how mast mounted preamplifier may be tuned remotely using diodes.

such as in a mast-mounted preselector. The maximum value of the reverse or bias voltage is determined by the capacitance range desired and by the rated breakdown voltage of the diode. In a power type amplifier, a determination has to be made as to whether the d.c. control voltage or the peak r.f. a.c. voltage generated across the diode will limit the employment of the diode.

Ten turn (or more) potentiometers are frequently used to vary the d.c. control voltage to the diode. Actually, the bandspread effect due to the capacitance variation of the diode can be made any desired amount by using a suitable multiple-turn potentiometer. New multiple-turn potentiometers are still relatively expensive, on the order of $7 or $8, although surplus potentiometers can often be found from $1 to $2 by diligent hunting. A gear reduction tuning mechanism can be added to a conventional single-turn potentiometer to achieve the same purpose but generally the use of a multiple-turn potentiometer will be less expensive and complicated when all factors are considered.

Note that in fig. 3 a small resistance is placed in series with the potentiometer so that the voltage across the diode cannot be reduced to zero. This is because the capacitance variation of the diode becomes very non-linear in this low voltage region. In a circuit which produces some appreciable signal voltage across a tuned circuit there is also the possibility that the developed signal voltage will exceed the bias voltage applied to the diode and the former will be clipped, and hence distorted. A resistor may also be connected from the variable arm of the potentiometer to one side of the potentiometer in order to make the capacitance variation more linear with respect to the bias voltage. If the capacitance variation of the diode follows a logarithmic response, a potentiometer with a like taper will be used to control it while a diode with a linear variation normally uses a potentiometer with a linear taper. Exceptions will depend upon the particular circuit application of the diode. For instance, if used to control an i.f. filter, a slower variation in capacitance may be desired as the selectivity is reduced to a small value.

Voltage variable capacitor diodes can be placed in series or parallel or several can be controlled by one potentiometer as shown in fig. 4. In this case, the potentiometer acts as the main tuning control for a receiver and, when the cost and complexity of a conventional air variable capacitor and gear reduction mechanical mechanism is considered, can perform this function better than conventional mechanisms. One can, for instance, have different tuning rates available without resorting to any complicated mechanical arrangements. A separate isolating resistor (or r.f.c.) must be used for each diode but otherwise their combination is relatively simple. Almost any circuit combination can be made involving independently variable capacitance diodes as long as a separate d.c. control circuit is provided for each diode by isolating it from the r.f. signal path by coupling capacitors.

Figure 5 shows two very practical uses of these diodes. The circuit at fig. 5 (a) shows a system for obtaining receiver incremental tuning in a transceiver employing a common

Table I—Diode Characteristics and Prices					
Diode	C Range	Volt. Range	Q	Type	Price
1N5146	3-100	4-60	200	Rcvr.	$6
TIV301	9-17	0.3-12	120	Rcvr.	$1
1N954	14-88	0.1-25	175	Rcvr.	$3
PC135	5-50	0.5-50	100	Xmtr.	$12

Table I—The above listing shows how various diodes compare in characteristics and price. The capacitance range is in mmf and the voltage range in volts, d.c.

transmit/receiver v.f.o. Actually, it is a very simplified version of that used in the Hallicrafters SR-150 transceiver. The diode in series with the 67 mmf capacitor is placed in parallel with the v.f.o. grid circuit. When relay *K* is in the RECEIVE position, bias voltage to the diode is controlled by the RECEIVER INCREMENTAL TUNING (R.I.T.) potentiometer and the voltage variation produces enough capacitance change so that the v.f.o. frequency can be varied over several kc. When relay contact, *K*, is in the TRANSMIT position, the bias voltage to the diode is set by the CALIBRATE potentiometer which is set to produce a voltage equal to that produced by the RIT potentiometer when the latter is in its mid-position. Therefore, the RIT potentiometer can be calibrated in + KC deviation one side of its mid-position and − KC deviation on the other side. The v.f.o. itself is also adjusted by trimmer capacitors so its dial reads correctly for the mid-position setting of the RIT.

Figure 5 (B) shows the b.f.o. in the Heath Mohican receiver and how it is controlled in frequency by a diode. Such control can be used to save space or avoid mechanical linkages to the front panel for a conventional b.f.o. frequency control. If another calibrate potentiometer were provided such as in fig. 5 (A), varying the b.f.o. frequency could also be used as a means to obtain receiver incremental tuning in a transceiver. The control circuitry of the varactor in fig. 5 (B) is basically the same as that in fig. 3 (B). It may only appear different at first because the a.c. ground circuit of the varactor goes through the 2K potentiometer and 1.5K resistor.

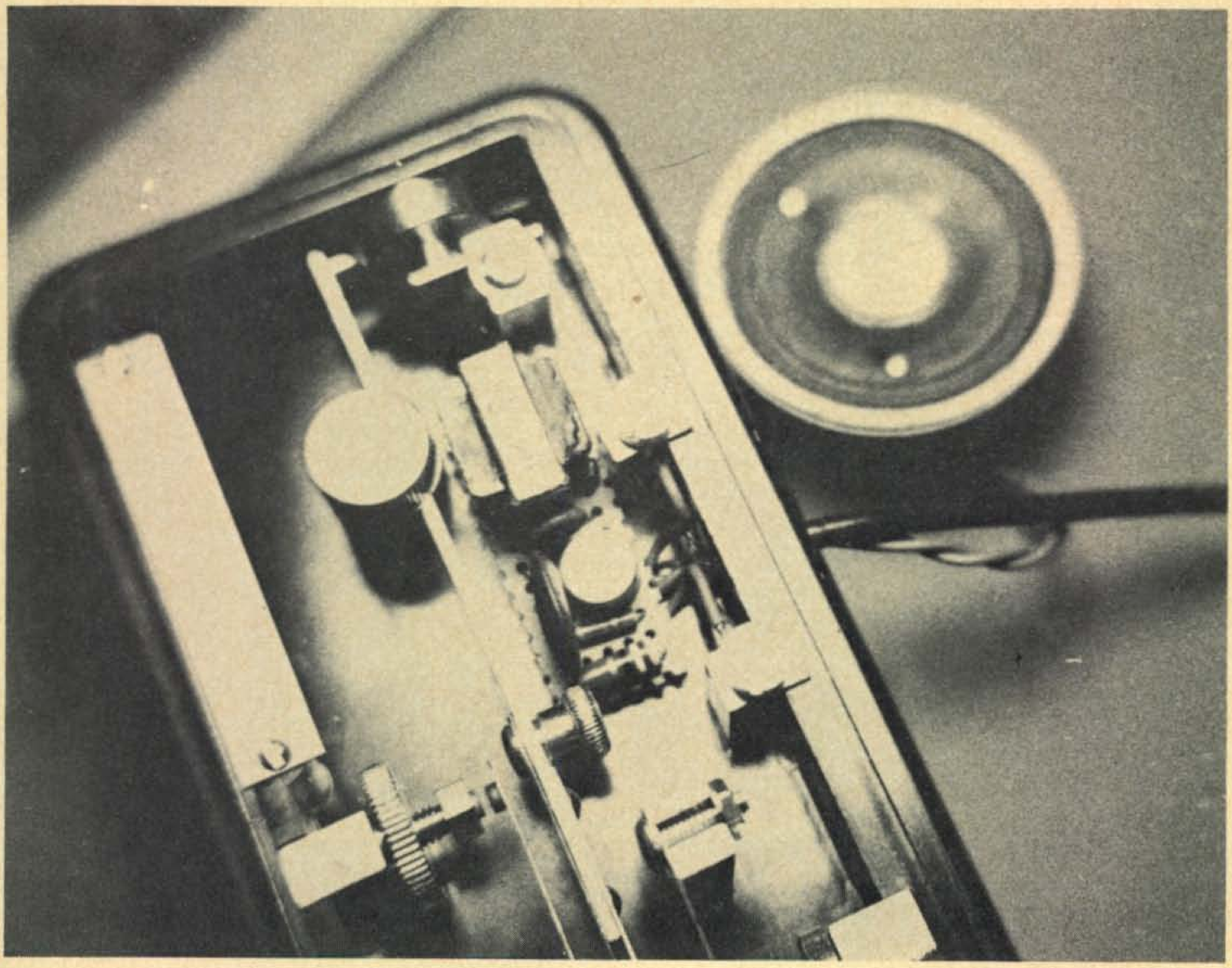
Another interesting use to which voltage variable capacitor diodes can be put is illustrated in fig. 6. In this case a mast mounted preamplifier is fed both its operating power and control voltage for tuning of its input and output circuits over each side of the 300 ohm shielded transmission line. Such a preamplifier might be very typical of that employed in a difficult receiving situation where both a fairly long transmission line is necessary from the antenna to the receiver and the transmission line must also pass through areas where considerable noise signal can be induced. The preamplifier serves both to raise the signal level to prevent degradation by transmission line noise pickup and to compensate for the signal attenuation in the transmission line run.

Many other uses of varactors will undoubtedly present themselves to the reader when he realizes how relatively simple they are to use. There would be no point in listing all the diodes available as this can be found in supply house catalogs. However, the four diodes in Table I with approximate prices do illustrate the wide variety of units commonly available: ■

BY THE WAY . . .

John, W2FX, and his XYL were guests of honor at a dinner given by The Spaghetti Network Radio Club in Italy this past June. About 40 prominent hams were on hand to welcome them to Italy on their vacation.

 For further information, check number 5, on page 126



Interior view of the key shows the monitor squeezed into the upper right corner.

A KEYING MONITOR IN THE KEY

BY JOHN J. SCHULTZ,* W2EEY/1

This keying monitor is extremely simple in installation and operation. It should appeal especially to the newcomer operating on c.w. who does not want to modify his commercial equipment to install a keying monitor and who does not want to spend more than $1.50 or $2.00 on parts.

MOST transmitters and transceivers do not come with a built-in c.w. monitor. If one does not have an electronic key with a built-in monitor, a separate monitor or the station receiver may be used. The latter is generally unsatisfactory and, of course, not possible with a transceiver. If one does not care to modify the transmitter or transceiver internally, the only solution is a separate monitor. The monitor described in this article is such a device but so small that it can actually be mounted inside the case of some semi-automatic keys or on the base of conventional hand keys. Also, in most cases, the monitor can be wired to be self-powered and no connections other than those to the key terminals are required. No r.f. pickup

*40 Rossie Street, Mystic, Connecticut 06355.

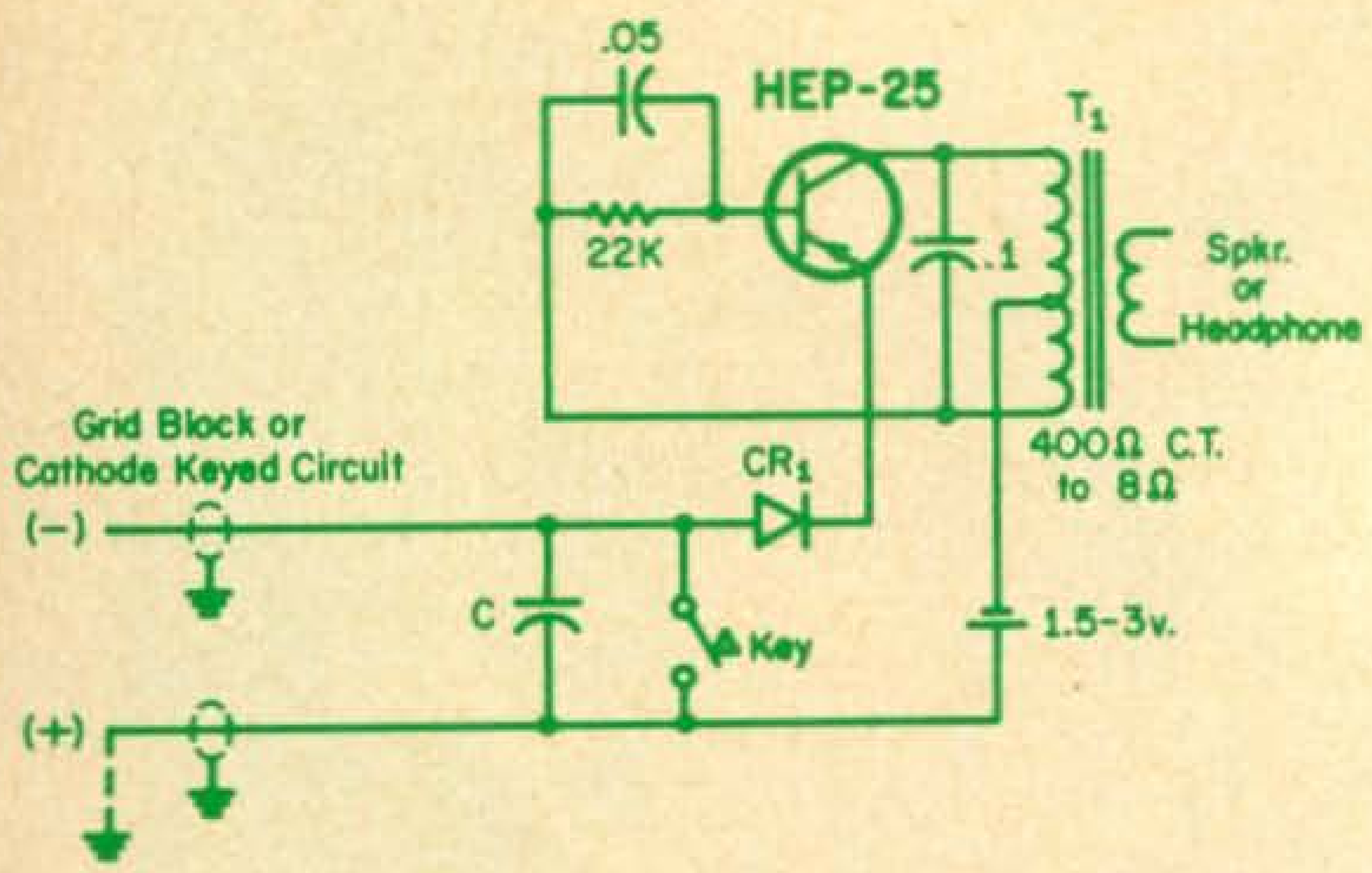


Fig. 1—Battery operated c.w. monitor is simply connected across key. The value of C is discussed in the text. Transformer T_1 is 400 ohms center tapped to 8 ohms.

is required, for instance, as for many self-powered keying monitors.

Monitor Circuits

With these features it might seem that the circuit of the monitor would be complex but actually it is just the opposite. Figure 1 shows the monitor connected as a battery-powered unit across the keying terminals. The audio oscillator itself is a simple, conventional, circuit where a feedback path is provided from the base of the transistor through the parallel RC circuit to half of the transformer primary winding. None of the component values used are critical. With the components shown, the circuit will produce a very pleasing tone of about 800 cycles. The frequency can be varied by changing the value of either capacitor or, over a smaller range, by varying the resistance in the base circuit. In fact, for those who can't be satisfied with the same tone for an extended period, the fixed resistor can be replaced with a fixed resistor of 1K in series with a variable resistor of 50 to 100K (miniature type) and will provide a tonal range adjustment of from about 300 to 1700 cycles.

The Motorola HEP-25 transistor used is a general replacement type costing less than a dollar. Almost any other low-power audio p.n.p. or n.p.n. type (the latter with battery polarity reversed) can be used. The higher the gain of the transistor, the lower the supply voltage required. The medium gain HEP-25 will provide a low-level signal into a small loudspeaker with as little as 1½ volts.

The battery-powered circuit of Fig. 1 can be used with either a grid-block or cathode keyed transmitter but the voltage polarities shown as they appear across the key must be observed. The diode D_1 acts to prevent the keying circuit from closing through the monitor circuit. The diode itself is a simple silicon rectifier type of 100 ma or more rating and a p.i.v. of 2 to 3 times the open circuit voltage as measured across the key terminals.

Figure 2 shows how the monitor is made self-powered for use with a cathode keyed transmitter. Basically a resistor of from 10 to 33 ohms (2 watt) is inserted in series with the keying circuit and the voltage drop across the resistor used to power the monitor. Note that the monitor is connected across the resistor and not across the key terminals, an easy mistake to make in constructing the monitor as the author learned. The monitor will not only not work but not survive long when subjected to the open circuit voltage of the keying circuit. The resistor should be chosen with as low a resistance value as possible to produce a satisfactory volume level from the oscillator. The voltage drop across the resistor reduces the plate to cathode voltage of the p.a. tube by an equal amount but certainly no effect will be noticed with the average 25 to 150 watt c.w. transmitter. The biasing effect created should also have no effect for c.w. operation with the usual Class C p.a. stage using cathode keying.

Figure 3 shows the monitor used with a grid-block keyed stage. The voltage to operate the monitor is developed again from a resistor placed in series with the keying circuit. The resistor used must be of a higher value to produce the necessary voltage drop

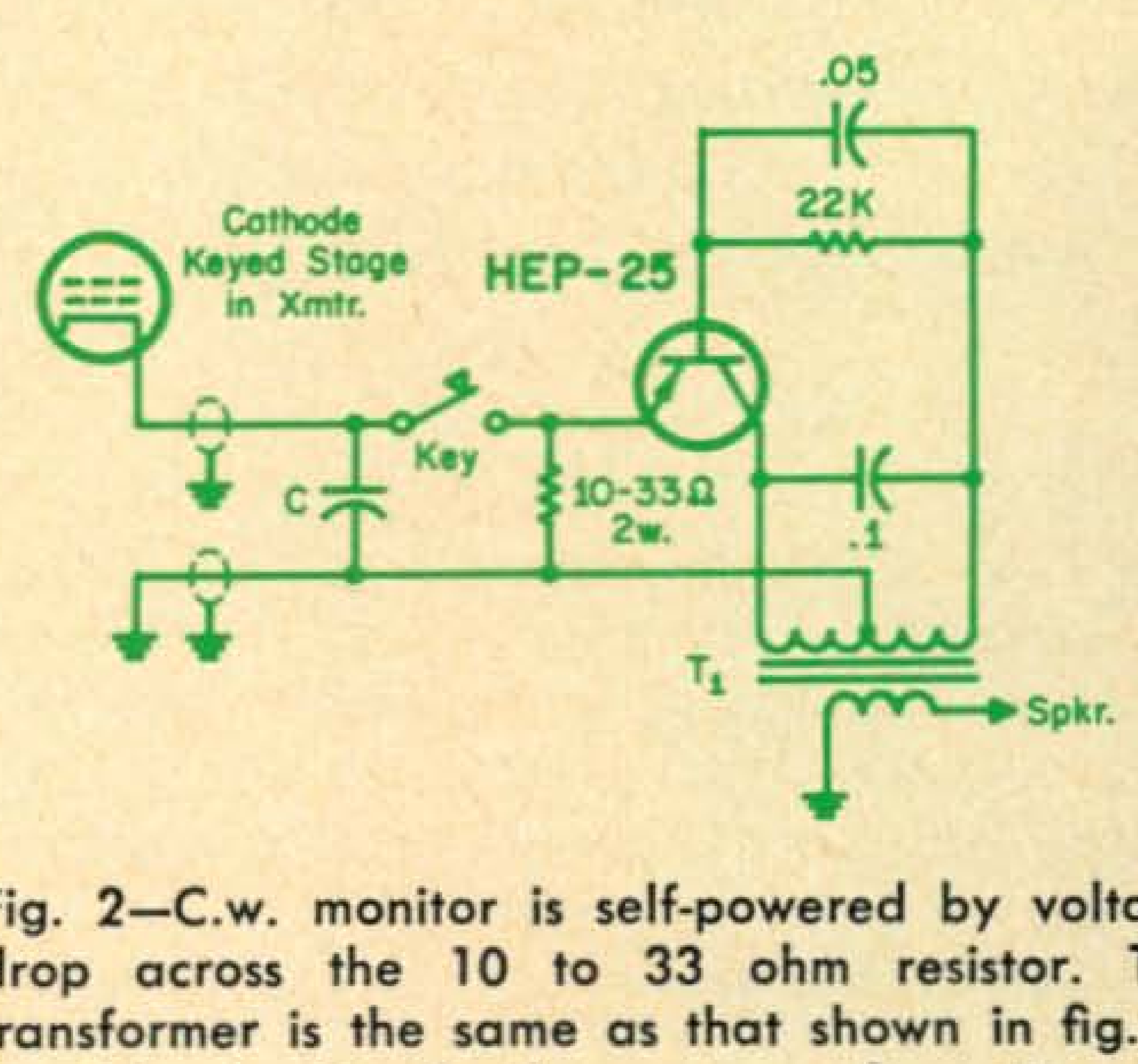


Fig. 2—C.w. monitor is self-powered by voltage drop across the 10 to 33 ohm resistor. The transformer is the same as that shown in fig. 1. For this circuit only the p.n.p configuration can be used.

because of the high value (10 to 100K) used as a limiting resistor in the bias supply line. The resistor in series with the key and the limiting resistor form a voltage dividing network when the key is closed. Perhaps the easiest procedure is to use a 50K variable potentiometer initially in place of the fixed resistor in series with the key and, starting from minimum resistance, find the value which produces satisfactory monitor volume. Placing the resistor in series with the key will change the bias on the keyed stage under key-down conditions. The change may have no significance but this depends upon the specific operating condition of the stage. For c.w., it can be checked easily enough by noting on a relative output meter if use of the resistor affects the power output. The effect on s.s.b. operation of the transmitter in case the resistor is left in the circuit (key contacts shorted) should also be checked by an on-the-air check or other means since bias conditions for s.s.b. service may effect signal distortion. In case any increased distortion is noted, the key can simply be removed when operating s.s.b.

Construction

The photograph shows how the author constructed the monitor to fit inside the enclosure of an imported semi-automatic key. The components are simply tied together using a small piece of vectorboard. A thin sheet of foam plastic is glued to the bottom of the vectorboard and the whole assembly glued to the key base. A separate miniature loudspeaker is shown in the photograph for use with the monitor. The normal station loudspeaker can be used as well, of course. Figure 3 suggests one way in which the monitor can be neatly wired to the loudspeaker by using three conductor cable from the key.

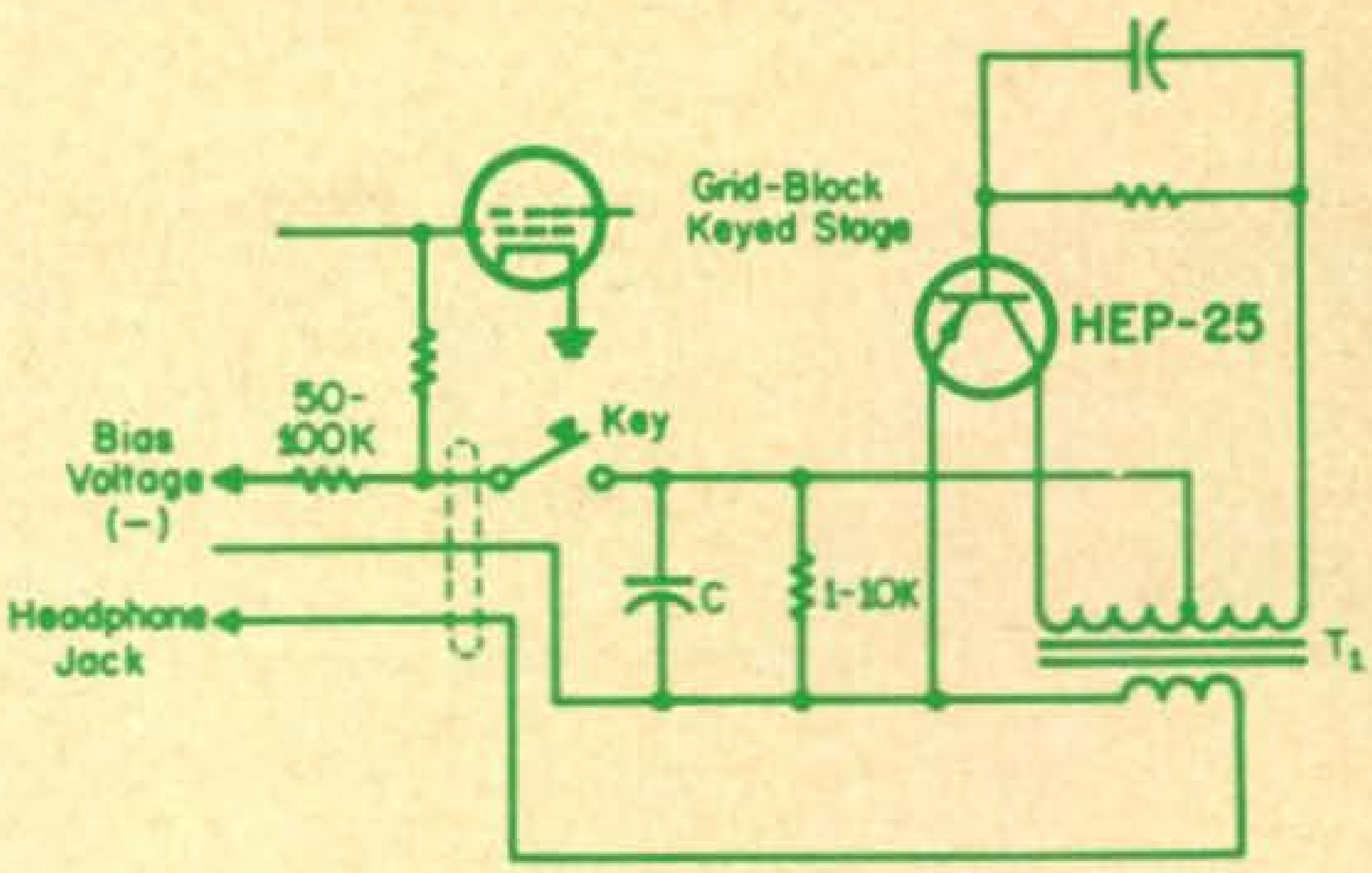


Fig. 3—This monitor is a variation of the circuit of fig. 2 for use with grid-block keyed transmitters.

The capacitor, *C*, shown across the key is used to reduce clicks and may vary from 0.01 to 0.5 mf. The capacitor may have to be connected across the resistor, as shown, or across the key or even two capacitors may be necessary to achieve the best results. ■

BY THE WAY...

Sam Berlin, WA2CVF, is shown receiving a plaque at a recent dinner meeting of the East Coast VHF SSB Association at the Flying "W" Ranch, Fostertown, N.J. The plaque was in appreciation for Sam's work as Net Control for the groups Sunday morning v.h.f. s.s.b. net. From left to right: Abe Cutler, WA2, ONB, Sam, and George Weilenmann, W2REB.

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE

DX

BY JOHN A. ATTAWAY,* K4IIF

Awards

It gives us great pleasure to announce that the following WAZ certificates will shortly be issued:

WAZ Two-way SSB: DL1EG—432, DL7FT—433, W5KUC—434, UB5ND—435, K8YBU—436, UR2KAA—437, DJ3GI—438, JA6AD—439, WA9AVV—440, DL6PI—441, DL6EZA—442, W8YCP—443, OK1EJ—444, W1MMV—445, HB9AAA—446, W4UWC—447, W9HP—448, WØGAA—449, SM5LM—450.

WAZ Two-way Fone: W8ACT—347, VK5MS—348, UR2KAA—349, VE6IN—350, PAØLV—351, OH2XA—352, XW8AX—353.

WAZ CW—Fone: K7PJF—2263, DL8KJ—2264, K4SHB—2265, W4HOS—2266, ON5DI—2267, LA9CE—2268, WB4BMV—2269, DJ9NI—2270, SM7IA—2271, W9BGX—2272, UA4KPA—2273, W6AJP—2274, DL9EZ—2275, UA2AC—2276, 9M2UF—2277, UR2KAA—2278, DL8FR—2279, WB6EFA—2280, VE3ACD—2281, W8KXO—2282, W4FRO—2283, OH2BH—2284, W1FTX—2285, DL2AB—2286, DJ1OJ—2287, KR6ML—2288, DL3OH—2289, W5ODJ—2290, KR6DB—2291, W8FRM—2292.

In addition there were the following new WPX certificates and endorsements:

WPX SSB: CX9CO, CR4AJ, HA5AM.

WPX CW: HK3AVK.

WPX Endorsements: SSB: WA5LOB—400, CR4AJ—300, HA5AM—300.

CW-Fone: K1SHN—650.

The WPX Certificate numbers will be updated in a later column.

The Award's Program

Past DX columns have mentioned our efforts to streamline the operation of the award's program by providing convenient checkpoints for verification of QSL cards. Established U.S. and Canadian DX clubs and national amateur radio societies may take part in this endeavor which we hope will eliminate the risk of loss or damage to cards in the mails. I am pleased to announce that this plan has been enthusiastically received. Four of the top U.S. DX clubs and 2 national societies abroad have already stated positively that they wish to participate. Here at home, the Long Island DX Association, the Virginia Century Club, the Ohio Valley Amateur Radio Association, and the Willamette Valley DX Club are working with us. Abroad, the German Amateur Radio Club (DARC), and VERON, the Netherlands IARU Society, are participating.

LIDXA has formed a committee of very outstanding DXers to verify cards from the W2 area for both WAZ and the SSB DX Award. This committee consists of Wally, W2BQM; Dave, W2GKZ; and Mike, W2IOT. Wally is chairman of the committee and inquiries should be directed to him at 92 Lagoon Blvd., Massapequa, L.I., N.Y. Joe Hiller, W4OPM, of the Virginia Century Club will handle cards from the upper south and mid-Atlantic area, while Jim, W8EVZ, or Jim, W8JIN, can assist you in W8 land. On the west coast, Bill, K7ADL, has written that the Willamette Valley DX Club members will be glad to help with the WAZ program as they can fit it into their already large job of operating the W7 Bureau.

Cards from DL-DJ-DK land may be sent to Walter, DL3RK, the WAE & Eu-DX-D Manager of the DARC DX Bureau, or to whoever else DARC designates to help. In return, DARC is interested in finding a U.S. club interested in checking cards from stateside applicants for the WAE (Worked All Europe) Award, and Eu-DX-D, the Europe

Jerry Plemmons, 5Z4KN, current manager of the 5Z4 QSL Bureau. Jerry's home call is WA6PKN in Oakland, California. He is in Kenya as Broadcast Engineering Advisor to Voice of Kenya radio and television. The gear is an NCX-5 transceiver, a Hallicrafter's TO-Keyer, and a Heath monitor scope and swr bridge. The antenna is a 2-element, triband quad.

* P.O. Box 205, Winter Haven, Fla. 33881.

DX Diploma. Anyone interested may contact K4IIF or write directly to Jurgen, DJ3KR. Here is a wonderful opportunity for some real international 'bridge-building' fellows.

PA, PI, PR applicants may send their WAZ cards directly to PAØKOR, the Traffic Manager of VERON.

Everyone PLEASE remember! The above are all volunteers. Therefore you MUST send a self-addressed, stamped envelope which you are certain contains adequate postage for the return of your cards. If you wish your cards returned via Certified or Registered Mail you must send sufficient funds to provide for this.

If there are DX clubs in other parts of the U.S. or amateur radio societies in other nations of the world who would like to participate in this program, they are cordially invited to contact DX Editor K4IIF for information.

Novices—We have a DX Award for you too, the WPNX Award for working 100 prefixes as a novice. All contacts must be made after May 15, 1967. Applications are available from the DX Editor.

De Extra

This is another time when someone else can say it a little better than I can, so I am turning the rostrum over to Fred Laun, HI8XAL, for some interesting comments on what its like to DX from a medium rare location right under the noses of the W/K big guns.

". . . on the subject of general operating practices, which you related to the Miller

For everybody who has speculated about the sharp wit and down-to-earth philosophy from G3NVA, here's the OM himself settling down for a good ragchew with some of his friends in W,K—land. (*Photo courtesy W4NJF*)

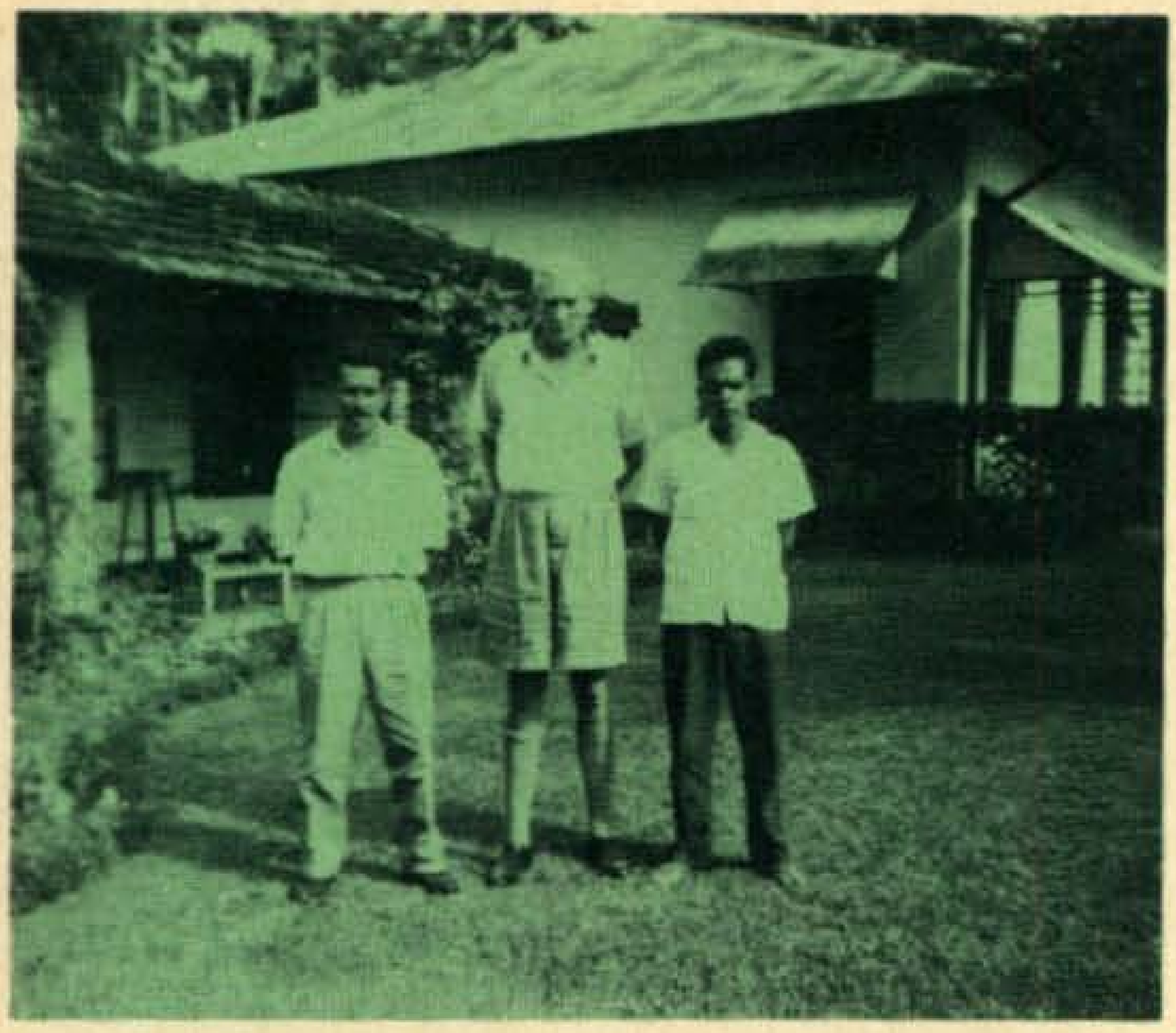
Wolfgang, DM2BRN, tuning up for the contest. Look for him this November. (*Photo courtesy DJ9NI*)

case in your column, I wish to make some general comments based on my own 3 year's experience operating just a stone's throw from the U.S.

"I did at times ignore stations, especially W/VEs and Europeans, which I heard calling me simply because it was very difficult to advance my own country total if I answered everyone. I always made a big effort to be on during ARRL contests when I couldn't work anything but Ws and VEs, and I usually managed to work the bands dry every year. Consequently, I feel that I gave ample opportunity for anyone who was at all active to confirm the Dominican Republic. Thus, I feel that I or anyone else for that matter, has the right to decide who he will work when. The fact that one is operating from a 'DX location' does not obligate one to sublimate his own desires to advance his country total to the desires of others to work him, any more than the 'big gun' W2 calling 'CQ DX' would respond to a call from a W5 who needed his county for USA-CA. I know this is irritating to some, and I have been called names and subjected to deliberate QRM. In general, however, I feel this concerns only a small minority of inexperienced operators.

"What it all boils down to is this: If the W/VE operator who feels 'slighted' by a DX Station would attempt to put himself in that station's place and ask, 'What would I do if I were him?', the answers to a lot of questions would quickly be found.

"I seldom called a CQ near the end of my stay in HI8 land. Instead I spent my time



Some of the outstanding DXers of 4S7 land. Left to right: Denver, 4S7DA; Ted, 4S7GE; and Nelson, 4S7NE. Nelson has been passing out 4S7 contacts to lucky W,K—land DXers for several months now on 14 m.c. s.s.b. (*Photo courtesy 4S7NE via Leo, W1MV*)

hunting and calling the stations I wanted to work. Thus it was particularly irritating to me when, after having called say a VU, I was pounced on by a herd of W/VEs or Europeans who didn't even wait to see if the station I called had responded or not. However, I do not believe in blacklists, and I did not maintain one. Even though a station who had called me in the wrong manner was not worked on that occasion, if he called me later under better circumstances I gladly worked him.

"One thing that presents a terrible burden to DX stations, especially those very close to the U.S., is the drive by some hams to see how many 'band countries' they can work. I have always felt that an individual who has already worked and confirmed a country should stand aside and allow those who haven't to get a chance, especially if the pile-up is a big one. [Amen! What was more disgusting than to hear some lid tell Gus at one of his rare stops that he sure was glad to get him on 20 after getting him on 40 and 80 the night before, and that he would be listening for him on 15 that afternoon—*DX Editor*.]

"Another thing that burned me up was the guy who answered my 'CQ Contest' call saying 'I'm not in the contest but please QSL as I need your country.' The least he could do was give me a number.

"Well, anyway, it's a great hobby, but the grass is beginning to look greener on the W side of the fence. No 'break, break', 'PSE QSL', or anything else. Just some good, solid, old-fashioned rag-chews."

Getting the QSL Card

Back in the June column I promised the new DXers some hints to help get those needed QSL cards, so its time I lived up to that promise. If you're going to be working toward WAZ or WPX your QSO is only half the battle, the second half is getting the QSL card to prove it.

The first thing you've got to get out of your mind in this QSL business is the idea that a rare DX station is going to be "thrilled" to get that beautiful or witty card of yours. Face it, he needs another stack of stateside cards like he needs the plague, and yours is just one in that stack. After answering several hundred or thousand stateside cards the prospect of answering that many more looks pretty dim and he might just say "ferget it." Its not only a lot of work for him, its very expensive as well. In many cases PROHIBITIVELY EXPENSIVE. Therefore, to have a good chance of getting an answer you must do whatever you can to make replying to your card as easy for him as possible.

However, before discussing this lets first go back to the QSO itself. If you're lucky enough to have some conversation with the rare one *tactfully* find out if he has a QSL Manager. If he does you're home free, particularly if it's W2CTN or one of the other top men in this endeavor. If not, inquire if his address is correct in the *Callbook*, and if it isn't get the correct address. Don't take too long though because some guy listening to the proceedings is going to jump out of his shoes with impatience to call when he realizes who you've got on the line. Of course if there was a pileup to begin with you probably won't be able to ask all these questions, you'll just have to scratch around for an address.

The first place to look is the foreign edition of the *Radio Amateur's Callbook* magazine. No well equipped DXer's shack is complete without a recent issue of this useful reference. If the address is in the *Callbook* you can heave a sigh of relief because you've got a place to start. However, QSLing direct to an exotic spot is the most expensive way because of the postage involved. Therefore, you still want to find out if the rare station has a QSL Manager. The first place to check is the QSL information section of the last few DX columns in *CQ*. There is a good chance he will be listed because we try to stay up to date on the currently active stations. If we don't have him, look in the DX column of *QST*. Jeeves may have picked up one that we missed. A third source is W6GSV's *QSL Manager's Directory*. The latter is a very thorough compilation of QSL Managers which is kept current by frequent supplements listing both additions and deletions.

If your rare one has a Manager things are simple. All you have to do is send your card showing the time of the QSO in GMT along with a *self-addressed, stamped envelope.* Chances are good that a card will come through in a reasonable length of time. However, if he doesn't have a Manager the procedure becomes just a little more complicated. Basically it remains the same. You send a self-addressed envelope (s.a.e.) as before, but unless the DX station is located in a U.S. possession it is a problem to stamp it. A problem yes, but impossible no. There are two principal methods for circumventing this dilemma. Either you can send the DX station sufficient International Reply Coupons (IRC's) to take care of the return postage, or you can put the stamps of his own country on the envelope. Some people send money but this is a poor practice as envelopes containing money sometimes don't reach their destination. Not all post offices operate under the same high standards as the U.S. post office. IRCs may be purchased at any sizeable post office for 15¢ each. One IRC will bring your card to you from anywhere in the world via *surface mail.* However, most DXers are unwilling to wait for a surface delivery from the far corners of the globe so they send sufficient IRCs to return their envelope by air. This varies from 2-6 coupons depending on the postage rates of the country in question. The exact number may be determined by consulting the *Callbook* or W9IOP's 2nd. Op.

If you don't like to handle IRCs you can stamp the envelope with stamps of the country desired. That's right, Sax, W2SAW, operates a DX Stamp Service which furnishes the correct postage to return an envelope by air from almost any country in the world. Sax has found that results are frequently better using this approach than using IRCs, particularly when you enclose a personal note and/or a photo of you and your station. Drop Sax a line and I'm sure he'll be happy to send you information.

Now assuming you've tried all those things and still no card, don't give up! Some DX stations have been known to keep your IRCs and stamps and send your card via the bureau. Unethical sure, but there isn't a thing you can do to prevent it so never be without several large size, s.a.s.e.'s on file at the ARRL QSL bureau which serves your call area. The addresses of the bureaus are listed frequently in *QST*.

Since I've mentioned the word bureau, it is well to point out that many unlisted foreign stations may be reached through the bureau in their own country. In most of the communist countries this is the only way. For example, cards to the Soviet Union are always sent to Box 88 in Moscow regardless of which Soviet Republic the station is located in. The bureaus are another vast subject and will be covered in detail in a later column.

Here and There

WAE—Don't forget the fone weekend of the Worked All Europe contest, Sept. 9, 0000 GMT to Sept. 10, 2400 GMT. This is a good time to pick up some rare Eu prefixes on s.s.b. and fone, and qualify for the Europe endorsement on your WPX certificate. DARC is emphasizing this year that UF6, UG6, and UD6 are in *Asia,* NOT Europe. (*Tnx DX-MB*)

SM-DX-Bulletin—SM5ACQ is editor of the DX bulletin transmitted every Saturday afternoon by SM5SSA at 1400 GMT on 7025 kc c.w. Information for this bulletin should be sent to Box 213, Vasteras, Sweden.

This fine set-up is the property of Gene Goffriller, OE2EGL, of Salzburg, Austria. Gene is very active in the CQ DX Contests and is a holder of the WAZ S.S.B. Award.

With regard to SM5 and SMØ prefixes, stations located in Stockholm may choose which prefix they want, after which they are bound by the choice. All *newly* licensed stations in Stockholm will have the prefix SMØ. (*Tnx DX-PRESS*)

DX Poll—The results of W9WNV's DX poll published in the Long Island DX Association Bulletin showed that the following were the 10 most needed countries as of May 30, 1967: 1. ZA—Albania; 2. VU—Laccadives; 3. YI—Iraq; 4. VQ8R—Rodriguez; 5. VQ8—St. Brandon; 6. KC4—Navassa; 7. EA9—Rio de Oro; 8. AP—West Pakistan; 9. HKØ—Malpelo; 10. FO8C—Clipperton.

W4BPD—Gus has started a fund to save money for a new DXpedition which he says will have no black list and stir no controversy. (*Tnx DX-Mag*)

AC3PT—There have been many reports that the Maharaja himself is on the air now. Signals have not been too strong as yet as he apparently doesn't have a beam up. (*Tnx DX-Mag*)

Chatham Island—ZL4PH and ZL4MO plan a trip to this rare one around Christmas time. They plan to operate both c.w. and s.s.b. (*Tnx DX-Mag*)

I1RB—Paul says that he had no connection with any ZA activity last winter, and that I1RB/ZA and ZA1RB were pirates. (*Tnx WGDXC*)

FM7WQ—Joe, W4OPM, writes that Pierre has returned to Martinique after two months in Paris where his father and eldest son were undergoing medical treatment. Joe is currently skedding Pierre on 15 meter s.s.b. and will be happy to help out anyone who needs FM7. Joe's address is 2208 Dinwiddie Road, Bayside, Virginia Beach, Va. 23455.

Tom Bradley, K4GXO, of Decatur, Ga., one of our recent WPX winners. Tom is an engineer by profession, Georgia Coordinator of Navy MARS, and in command of the Atlanta Naval Reserve Telecommunications unit. That's a real professional looking arrangement of gear in the background.

Here is the mastermind behind that strong signal from JA6AD, Hiroshi Yamamoto. Hiroshi uses an FL-100B transmitter, FR-100B receiver, and a two-element cubical quad antenna.

R-6K Award—Gerry, W6TMP, has received the following information from the Central Radio Club in Moscow: To obtain the "R-6-K" Award it is necessary to carry out 12 two-way contacts on s.s.b., c.w., and fone with radio amateurs of the following areas:

a.) Europe—1 contact
b.) Africa—1 contact
c.) North America—1 contact
d.) South America—1 contact
e.) Asia—1 contact
f.) Oceania—1 contact
g.) European USSR—3 contacts
h.) Asiatic USSR—3 contacts

This award consists of 3 classes. Class 1 on 3.5 mc, Class 2 on 7 mc, and Class 3 on the higher frequency bands. To apply you must send your QSL cards and 14 rubles to box 88. (I hope there is a mistake here somewhere, because my currency book says that 14 rubles is $15.40—*DX Editor*)

"Belarus" Award of UC2—This award is given in 2 classes for contacts with the amateurs of Bielorussia (UC2). The first class is for 50 different contacts with UC2 stations located in 6 oblasts of Bielorussia, and the second class is for 25 contacts with different UC2 stations located in 6 oblasts, except when the applicant is located in *CQ* zones 1, 2, 3, 6, 7, 10, 12, 13, 19, 24-32, 38, 39, or 40. For those zones the first class award is given for 25 QSOs in 4 oblasts and second class for 10 contacts in 2 oblasts. Contacts

Here is the gang at KG6IF. These boys have given many a DXer a new one. From left to right: Jim, Kelly, and Paul.

may be c.w., fone, or s.s.b., but must be made after July 3, 1964. To apply send your list to Central Radio Club, Box 88, Moscow. There is no charge.

The 6 UC2 oblasts and their capital cities are: 009—Minsk, 005—Brest, 006—Vitebsk, 007—Gomel, 008—Grodno, and 010—Mogilev.

EXPO - 67—VE2XPO is the call of the amateur station at Expo '67.

New Prefixes—4Z4 has been issued to Israeli amateurs. 5LA2, 3, etc. is being issued to Liberian amateurs.

Kenya—Jerry (WA6PKN), 5Z4KN, writes that amateur licenses are being issued in Kenya for the first time since independence in 1963. Seven new stations are on the air. Jerry is 5Z4 QSL Manager from July through October, and is also QSL Manager for the Voice of Kenya shortwave stations.

ZD7WR—This is a beacon station on 28.983 kc sending "Test de ZD7WR." It is part of an RSGB propogation research projects, and reception reports would be greatly appreciated by Steve, G2BVN, at 28 Little Russell St., London, WC 1, England.

I9RB—I1RBJ writes that his group Worked All Zones and over 450 prefixes during the *CQ* WW SSB contest in April.

QSL Information

CO2BO/CO4 — Via OK3MM, Box C-22, Piestany, Czechoslovakia.
CN8FF — To W2GHK.
CR3GF — Via W4VPD.
CR5CA — To P.O. Box 47, Sal Tome.
CR5SP — Via W2GHK.
CR7GF — To W4VPD.
CR7GF/FR7 — Via W4VPD.
CT2GF — To W4VPD.
CT3AS — Via G2MI.
EA6AR — To DL7FT.
F9RY/FC — Via HB9TL.
FH8GF — To W4VPD.
FK8BK — Via P.O. Box 96, Noumea, New Caledonia.
FL8DY — To R.E.F., Boite Postale 70, 75 Paris 12, France.
FL8RA — Via W2LJX.
FP8DD — To WB2RSW.
FR7ZL/T — Via FR7ZD.
FY7YN — R. Robinson, Route Mango, Cayenne, French Guiana.
G3ESP/LX — To G3ESP.
GB2DSF — Via G3WAO.
GB3WGC — Via G3PKV.
GC8HT — To W6UNP.
GD3VBL — Via W2GHK.
HB0LL — To WA4QVQ.
HC8FN — Via WA2WUV.
HI8XJG — Jack Gillette, Santo Domingo (AID/ED), Dept. of State, Washington, D.C. 20521.
HK0AI — To W9WHM.
HK0QA — Via W9ECE.
HM5BF — Kim Dong-Ho, North Box 4, Pusan, Korea.
HP1XYZ — R.E. Perry, Box 241, Panama, Panama.
HZ1KE — To G3FWR.
I3CTL — Via I1CTL.
I6ESV — To P.O. Box 26, Varese, Italy.
I6KDB — Via I1KDB.
IS1ALX/p — To P.O. Box 33, Fiesole, Florence, Italy.
JT1AG — Via P.O. Box 639, Ulan Bator.

A recent winner of the coveted WAZ Award, Randulf, LA9CE, of Stavanger, Norway. Randulf uses a T4X transmitter and R4A receiver on a 'share' basis with LA1ZI who happens to be his XYL, Klarentze.

There's A Definite Difference In Ham Magazines!

All three amateur radio magazines run good technical articles and construction projects . . .

BUT . . . CQ runs more and better ones because CQ has the top writers in the field.

All three magazines have classified advertising sections . . .

BUT . . . Only CQ subscribers can run classified ads throughout the year ABSOLUTELY FREE OF CHARGE!

All three publications have attractive layouts . . .

BUT . . . CQ's new easy-to-read presentation puts the others to shame.

All three magazines have specific-interest departments . . .

BUT . . . CQ has far more such departments than the other two publications combined!

All three magazines offer cash savings to subscribers over the single copy prices . . .

BUT . . . CQ offers the greatest savings to subscribers, and includes bonus premiums as well.

All three ham magazines are good . . .

BUT . . . CQ is by far the best,

The best reading!
The most authoritative!
The most interesting!
The best buy for the dollar!

Shouldn't you have a subscription to CQ?

JT1AJ — To P.O. Box 639, Ulan Bator.
K8NHW/XV5 — Via W6FAY.
KØOXV/CEØA — To K8EHU
KB6CZ — Via K4MQG
KC6CL — Ron Seigal, Peace Corps, Truk, E. Carolines, APO San Francisco, Calif. 96942.
KG6IF — To W6ANB.
KG6SL — Via W4FRO.
KH6CH/KW6 — P.O. Box 365, Wake Island.
KS4CE — To K6QPG.
MP4MAW — R.N. Francis, c/o Cable & Wireless Ltd., Muscat.
MP4MAY — c/o Box 18, Mondeor, Johannesburg, South Africa.
OA4UO — P.O. Box 280, Iquitos, Peru.
OHØNM — John Roos, Sodragatan 1, Mariehamn, Aland Island, Finland.
PJ2MI — To VE3EUU.
PJ3CG — c/o VERONA, P.O. Box 383, Willemstad, Curacao.
PY7AOA/Ø — To PY7AKW.
PY7APS/Ø — Via PY7APS.
ST2SA — P.O. Box 244, Port Sudan.
SU1AR — c/o WB2UKP.
SVØWL — Via W3CJK.
TA2AC — To K4AMC.
TF2WJU — Via W4VBB.
TJ1QQ — c/o W4DQS.
TL8DL — P.O. Box 924, Bangui, Central African Republic.
TR8AG — To CR6GO.
TU2BA — P.O. Box 172, Abidjan, Ivory Coast.
UA1CK/JT1 — P.O. Box 639, Ulan Bator, Mongolia, or to UA1CK, Box 88, Moscow.
UM8FZ — U.S. stations via WA5EFL.
VK2AVA/Lord Howe — Via WA2RAU.
VK9DR — To W2GHK, P.O. Box 7388, Newark, N.J. 07107.
VK9RH — Ray Hoare, P.O. Box 97 Norfolk Island.
VR3G — To G3KDE
VR3L — Via K8PKY.
VR3O — To K6UJW.
VP1LP — c/o VE3ACD.
VP1VR — Via W4VPD.
VP2AA — To VE3ACD.
VP2AP — c/o W2OIB.
VP2GZW — Via WA4UOE.
VP2LA — VE3EUU.
VP2LS — K1IMP is NOT, NOT, NOT QSL Manager for this station.

George Cherney, WN8TND, of Lorain, Ohio, an outstanding candidate for top Novice DXer. George made over 1000 contacts as a Novice. He worked all states, worked all continents, worked all countries of Europe, and worked 31 zones. In addition he worked 113 countries and confirmed 105 as a Novice and has applied for DXCC. This was all in the 15 meter Novice band using a Ranger I transmitter and 16 crystals. Too bad that George was a little early for WPNX.

Bob, W5KUC, another member of the CQ DX Awards Advisory Committee. Bob holds the Extra Class License, WAZ #303, and WTW 2XSSB #1.

VP2MW — P.O. Box 274, Montseratt.
VP2VZ — To W1WQC.
VP8IE — c/o W2GHK.
VP8IU — Via G3MBQ.
VP8JD — To CX2AM.
VQ8CC — P.O. Box 14, Curepipe, Mauritius.
VQ8CG — c/o G3APA.
VS5MH — Via W1DGJ.
VS9MB — To W2CTN.
VS9OSC — c/o K2KTK.
WØICJ/KM6 — Via KM6CE.
XW8AX — Via W6KTE.
YA1FV — To KP4CL.
YVØAA — c/o W2GHK.
ZD3I — Via YASME, Box 2025, Castro Valley, Calif. 94546.
ZD7IP — To K2HVN.
ZD7KH — To K2HVN.
ZD8JES — c/o WA4UHK.
ZD9BH — Via W2GHK.
ZD9BI — To GB2SM.
ZL1AI — c/o G8JM.
ZP5OG — P.O. Box 512, Asuncion, Paraguay.
ZS9L — Gordon Davis, P.O. Box 525, Gaberones, Botswana.
3V8BZ — Via DL7FT.
4W1L — To HB9ABV.
5H3KJ — U.S. stations via W7VRO.
5LA8FD — c/o EL8B.
5R8AM — Via K2KTK.
5R8AS — To W6ZPX.
5R8AX — c/o TG9EP.
5R8AZ — Via G3TTG.
5Z4KK — To K1SLZ.
5Z4KN — Via 5Z4 Bureau, P.O. Box 30077, Nairobi, Kenya, East Africa.
6W8DX — c/o P.O. Box 347, Dakar, Senegal.
7Q7EC — P.O. Box 207, Zamba, Malawi.
8R1S — P.O. Box 739, Georgetown, Guyana.
9G1BF — Via W3HQO.
9G1GA — To P.O. Box 625, Tema, Ghana.
9G1HM — c/o OK3MM.
9M6JP — R.A.F. Labuan, BFPO 660, London, England.
9M6MG — P.O. Box 229, Labuan, Sabah.
9Q5SR — Via W1BPM.
9U5DP — To W2SNM.
9U5ID — c/o W2GHK, Box 7388, Newark, N.J. 07107.
9X5GG — Via W2GHK.
9Y4VT — To W3DJZ.

73, John, K4IIF

PLEASE include your **ZIP** code number on all correspondence.

Contest Calendar

BY FRANK ANZALONE,* W1WY

Calendar of Events

September	1-30	British Columbia QSO Party
September	5-7	Cuban DX Contest
September	9-10	WAE Phone DX Contest
September	9-11	ZERO District QSO Party
September	16-18	Pennsylvania QSO Party
September	16-18	Wash. State QSO Party
September	16-17	SAC C.W. Contest
September	23-24	SAC Phone Contest
September	23-24	MARC VE/W Contest
September	26-28	YLRL "Howdy Days"
October	7-9	Massachusetts QSO Party
October	7-8	WADM C.W. Contest
October	7-8	VK/ZL/Oceania Phone
October	14-15	VK/ZL/Oceania C.W.
October	14-15	RSGB 21/28 mc Phone
October	14-16	RTTY Sweepstakes
October	18-19	YLRL Anniv. C.W. Party
October	**21-22**	**CQ WW DX Phone**
October	28-29	RSGB 7 mc Phone
November	1-2	YLRL Anniv. Phone Party
November	11-12	OK C.W. DX Contest
November	11-12	RSGB 7 mc C.W.
November	11-12	ARRL SS Phone
November	18-19	ARRL SS C.W.
November	**25-26**	**CQ WW DX C.W.**

WAE DX Phone

Starts: 0000 GMT Saturday, September 9
Ends: 2400 GMT Sunday, September 10

The c.w. section took place last month, complete rules were given in July CALENDAR.

Logs go to: Dr. H. G. Todt, DL&EN, Chlodwigstr. 5, 1 Berlin 42, Germany. Mailing deadline, Sept. 15 for c.w., Oct. 15 for phone.

British Columbia QSO Party

Starts: 0000 GMT Friday, September 1
Ends: 2400 GMT Saturday, September 30

The British Columbia A.R.A. has organized this month long QSO Party to celebrate the National Centennial.

Each station may be worked 3 times on each band, i.e.: c.w., RTTY or phone.

Each contact counts 1 point. B.C. stations score QSO points × ARRL sections × countries. All others score by total QSO points from all contacts. (No multiplier)

The VE7's will be found in these sections of the bands: 3755, to 3850, 7250, 14150 to 14400, 21140, to 21350, 28500 to 28800.

Certificates will be awarded to the top scoring station in each ARRL section and DX country. In addition the Dogwood Trophy will be awarded to the top out of area station.

Log go to: Les West, VE7AKB, 960 Keith Road, West Vancouver, B.C., Canada.

Cuban DX Contest

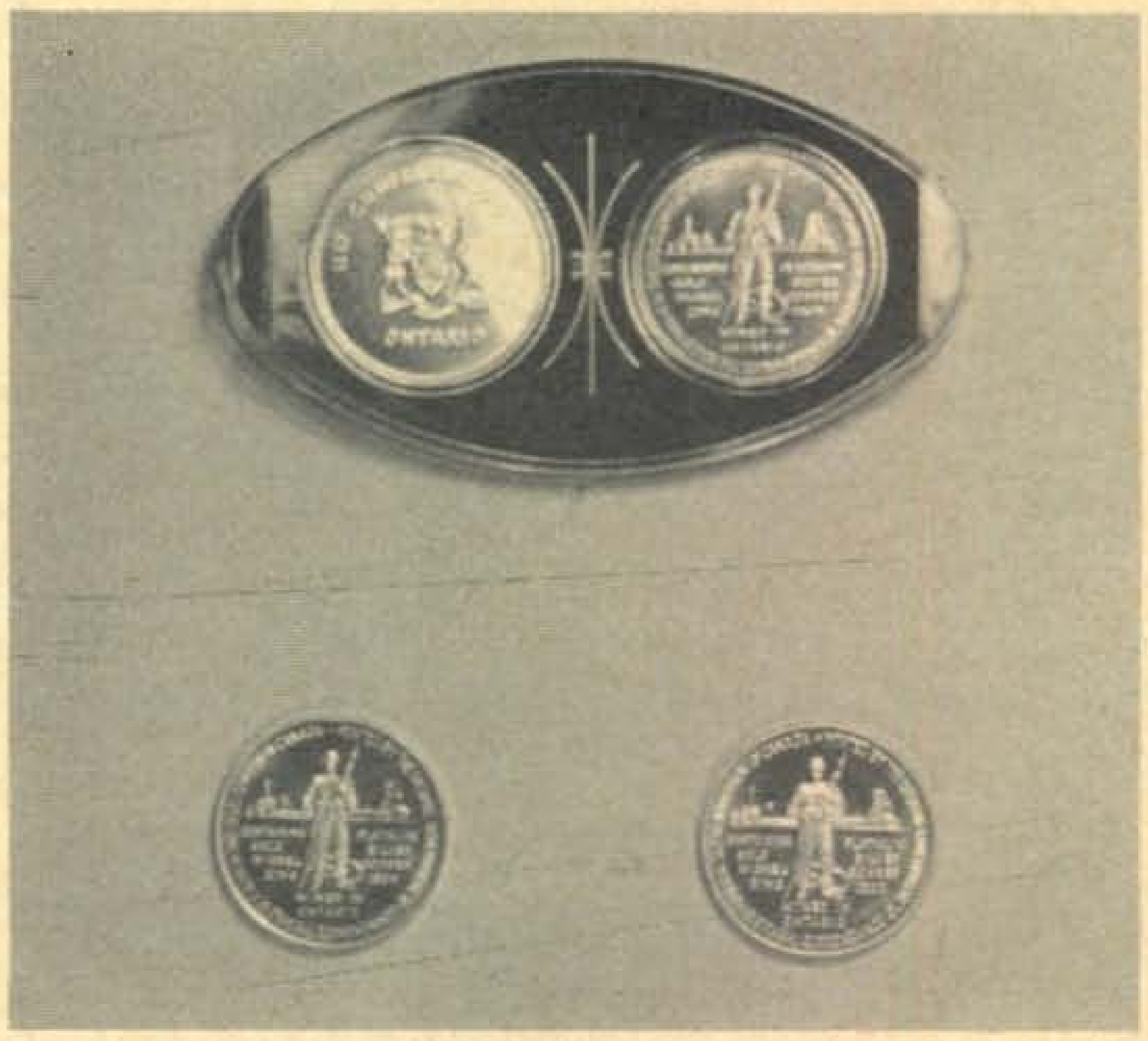
Starts: 0000 GMT Tuesday, September 5
Ends: 2400 GMT Thursday, September 7

This is a new one organized by the Radio Amateur Federation of Cuba. The event will coincide with a world spearfishing contest to be held at Avalos Key, Treasure Island. (Isle of Pines.)

A DX-pedition to this region will be made by several CO4 stations. These as well as other Cuban stations are expected to be active on all bands.

Exchange: Usual signal report and progressive QSO number.

Scoring: Contacts with CO4 stations, 20



Medallions that will be awarded to the winners of the 7th World Wide RTTY Sweepstakes that will take place October 14-16.

*14 Sherwood Road, Stamford, Conn. 06905.

points on c.w., 30 points on a.m./s.s.b. All other CO stations, 10 if on c.w. and 15 if on a.m./s.s.b. (There is a s.w.l. division. Score 10 points for each CO station heard on c.w. and 5 if on a.m./s.s.b. You get double credit if both stations are reported.)

Awards: 1st place, Plaque. 2nd and 3rd places, Medals. 4th thru 10th places, Diploma. (s.w.l., 1st, 2nd, 3rd place Diplomas.)

All those sending a log will receive a color QSL dedicated to the event.

Mailing deadline is October 1st. Logs go to: Radio Club, P.O. Box 6996, Habana, Cuba.

ZERO District QSO Party

Three Periods:
0100-0400 GMT Saturday, September 9
2000-0600 GMT Sat./Sun., September 9/10
1200-0200 GMT Sun./Mon., Sept. 10/11

The Roosevelt High School ARC of Des Moines is again sponsoring this QSO Party.

A station may be worked once per band both on c.w. and phone.

Exchange: QSO nr., RS/RST and QTH; county and state for Zero stations; state, province or country for others.

Scoring: One point per QSO. Zero stations will use sum total of states, VE provinces and countries worked for their multiplier. All others, sum total of states (max. 8) and counties (max. 682) Contacts with club station WAØQJX are worth 5 points.

Frequencies: 1815, 3575, 3950, 7075, 7230, 14075, 14300, 21075, 21290, 28600 and u.h.f. & v.h.f. bands. Novices, 3720, 7165, 21110.

Awards: 1st and 2nd place certificates in each state, province and country. And 1st place awards in each Zero county.

Rare counties expeditions are being organized. WAØKXJ, WAØNYK and WAØQJX are planning simultaneous operation from 3 counties. QSL cards may be sent with your logs.

Mail logs before November 1st to: Roosevelt H.S. ARC, WAØQJX, 1000 - 56th Street, Des Moines, Iowa 50312

Pennsylvania QSO Party

Starts: 2300 GMT Saturday, September 16
Ends: 0300 GMT Monday, September 18

This is the 10th annual party sponsored by the Nittany A.R.C. The same station may be worked once per band and mode.

Exchange: QSO nr., RS/RST and QTH. County for Penn. stations, ARRL section or country for others.

Scoring: Penn. stations, 3 points per out of state QSO, 1 point for Penn. contact. Multiply by ARRL sections and countries worked. Out of state stations, 1 point per QSO, multiply by Penn. counties worked. (Max. of 67)

Frequencies: 3575, 3880, 7075, 7280, 14075, 14280, 21075, 21325. Check phone bands on even GMT hours.

Log Data: Date/time in GMT, QSO nr., station worked, report, QTH, band and mode. Also a summary sheet with scoring, name and address in BLOCK LETTERS and other pertinent information.

Awards: Certificates to the top station in each ARRL section and country, 2nd and 3rd place awards where justified. The latest Call Book to the overall winner for Penn. and out of state station. (Club members are not eligible for awards.)

Mailing deadline is Oct. 16th and logs go to: Nittany Amateur Radio Club, P.O. Box 60, State College, Penna. 16801

Washington State QSO Party

Starts: 2300 GMT Saturday, September 16
Ends: 0500 GMT Monday, September 18

This is the 2nd annual party sponsored by the Boeing Employees' ARS, K7NWS.

The same station may be worked once on each band and mode.

Exchange: QSO nr., RS/RST and QTH. County for Wash. stations; state, province or country for all others.

Scoring: One point per QSO for Wash. stations, including other W/K7s. Out of state stations get 2 points per QSO. Wash. will use states, VE provinces and countries for their multiplier. Out of state, total of Wash. counties worked, (Max. of 39).

Frequencies: C.W.: 3560, 7060, 14060, 21060, 28100. a.m.—3990, 7260, 14230, 21310, 28600. s.s.b.—3960, 7220, 14290, 21290, 28700. Novices—3735, 7175, 21110.

Awards: Certificates to the top scoring stations in each state, province, country and Washington county.

The Worked Five Bears certificate is also available for working 5 club members, before, during, or after the Party. Work the club station K7NWS and you get a gold seal endorsement.

Mailing deadline is October 7th and logs go to: Boeing Employees' A.R.S., Att: Contest Chairman, 18415 38th Ave., South Seattle, Wash. 98188

Scandinavian Activity Contest

C.W.: Sept. 15-17. Phone: Sept. 23-24.
Starts: 1500 GMT Saturday, Ends: 1800 GMT Sunday in each instance.

It's the world working the Scandinavians in this one. Use all bands, 3.5 thru 28 mc. The same station may be worked once on each band and c.w. and phone are separate contests.

Classes: Single and multi-operator. Multi-operator stations may use one or more bands simultaneously, but the exchange number must be in chronological order.

Exchange: The conventional five or six digit number, RS/RST plus a progressive three figure contact number.

Scoring: One point per QSO multiplied by the sum total of Scandinavian countries working on each band. (Max. of 9 per band.) The following prefixes will be considered country multipliers: LA (Norway), JW (Svalbard), JX (Jan Mayen), OH (Finland), OHØ (Aland Is.), OX (Greenland), OY (Faeroes), OZ (Denmark), SM/SL (Sweden). (Scoring is for all band operation only.)

Awards: To the two highest scoring stations in both classes for each country and U.S.A. call areas.

Logs: Should show in this order: Date/time in GMT, station worked, number sent & received, band and each new multiplier as it is worked. Separate log sheets for each band not necessary but a summary sheet showing scoring is required. Include name and address in BLOCK LETTERS and a signed declaration that all rules have been observed, and you will abide by the decision of the Committee.

This year's logs go to: The S.R.A.L. Contest Committee, P.O. Box 10306, Helsinki, 10, Finland. Mailing deadline is Oct. 15.

YLRL "Howdy Days"

Starts: 1700 GMT Tuesday, September 26
Ends: 1700 GMT Thursday, September 28

This a middle of the week party for YLs only. Contacts may be made on any band or mode but cross-band or net contacts do not count. And only one QSO with each station is permitted.

Score 2 points for each YLRL member worked and 1 point for non-member contacts. There is no multiplier.

There are appropriate awards for both members and non-members.

Logs go to: Marte Wessel, KØEPE, P.O. Box 756, Liberal, Kansas and must be received by October 13th.

R.S.G.B. 21/28 mc Phone

Starts: 0700 GMT Saturday, October 14
Ends: 1900 GMT Sunday, October 15

With the ever improving conditions on 10 and 15, this should be a popular activity. It will be the world working the British Isles. Rules are same as previous years (see Sept. '66 issue) and will be given in details in next month's CALENDAR.

RTTY Sweepstakes

Starts: 0200 GMT Saturday, October 14
Ends: 0200 GMT Monday, October 16

The Canadian Amateur Radio Teletype group is sponsoring the 7th world wide RTTY DX contest. Rules are the same as last year (see Oct. '66 *QST*) with an additional 100 bonus points for working different bands. Full coverage in next month's CALENDAR.

Massachusetts QSO Party

Starts: 2300 GMT Saturday, October 7
Ends: 0200 GMT Monday, October 9

This is the third annual party sponsored by the M.I.T. Radio Society, W1MX.

The same station may be contacted on each band and mode but crossband contacts are not allowed.

Exchange: QSO nr., RS/RST and QTH. County for Mass. stations; state, province or country for others.

Scoring: 2 points per contact. Mass. will use states and VE provinces for their multiplier; others, Mass. counties (max. of 14) DX stations may be worked for QSO points but do not count as multipliers.

Frequencies: C.W.: 3560, 7060, 14060, 21060, 28060. Phone: 3960, 7220, 14290, 21410. Novices: 3735, 7175, 21110. Try s.s.b. at 0130, 1300, 1600, 2130 and 2400 GMT.

Awards: Certificates to the top single operator station in each state, province and Mass. county. Awards for DX and multi-operator stations will be issued if the activity warrants. (Minimum score of 200 required for an award)

Logs: Should show, date/time in GMT, QSO nr. sent/rec'd, station, report sent/rec'd, QTH, band and mode. The usual signed declaration that all rules and regulations have been observed is also requested.

Mailing deadline is Oct. 25th and logs go to: M.I.T. Radio Society, W1MX, Box

558, 3 Ames St., Cambridge, Mass. 02139. Include a s.a.s.e. if results are desired.

VK/ZL/Oceania DX Contest

Phone: Oct. 7-8 C.W.: Oct. 14-15

Starts: 1000 GMT Saturday, Ends: 1000 GMT Sunday in each instance.

Rules apply to stations other than VK/ZL.

Exchange: Usual 5 and 6 figures, RS/RST plus a progressive 3 digit contact number starting with 001.

Scoring: Oceania stations: 2 points for VK/ZL contacts, 1 point for rest of world. Stations outside Oceania; 2 points for VK/ZL contacts, 1 point for Oceania. Final score: multiply total points by sum total of VK/ZL call areas worked on all bands.

Logs: Must show in this order: Date/time in GMT, station worked, band, number sent and received, QSO points. *Underline* each new VK/ZL call area worked on each band and use a separate log sheet for each band.

A summary sheet showing the scoring and other information pertinent to the contest is also requested. Your name and address should be in BLOCK LETTERS, and include a signed declaration that all rules and regulations have been observed.

Awards: Attractive coloured pictorial certificates to the top all band scorer in each country and call areas for W/K, JA and UA. Single band awards may be made, depending on conditions and activity.

There is also a s.w.l. section, but only VK/ZL stations are to be listed. Include call of station being worked and the serial number sent. Log procedure same as above.

Logs go to: W.I.A., Federal Contest Committee, Box N1002, G.P.O., Perth, Western Australia, and must be received before January 20, 1968.

CQ WW DX Contest

Complete rules including a list of 13 Special Awards will be found on page 59 of this issue. There are no changes from those of previous years, however they have been rewritten and should be easier to follow.

Attention is called to Sect. XIII, Disqualification. There are many items under which a score may be disqualified but duplication of contacts and multipliers should especially be closely checked. You are expected to score your log and thoroughly check same before it is submitted. Recopied logs must remain in their original form, with duplicate contacts out and no credit taken.

A summary sheet is a *must*. Log sheets are not essential as long as you follow the sample shown with 40 contacts to the page.

There is still time to get official forms from *CQ*. A large s.a.s.e. of course.

John Beck, ZD8J and Sonia Rotenberg, PY2SO who placed #1 and #2 in our last C.W. Contest. The photo was obviously taken before the contest when John visited Brazil. He probably will not be allowed in Sao Paulo now.

Top Ten Scores
1967 QCWA QSO Party

W8NBK 303, W6ZPX 266, W4BGO 251, W3EIS 222, W9VZP 173, K6GIL 140, W9GIL 125, W6PLS 121, W4KJL 116, W1DIT 115.

Earl Reichman, W8NBK won the QCWA Plaque for the third time and therefore now has permanent possession. VE3DU received a certificate for the most contacts made by a foreign station.

Editor's Notes

Do you recall the inquiry in the C.W. Results story, if the Bazley's who won most of the top scores for England, was a family affair? It is, G2BOZ is the father and his two sons are G3HCT and G3HDA. How about that!

The response to the suggestion of changing the contest dates has been that we leave things as they are, as the present dates are well established the world over. However, we do anticipate moving the Phone section one week so that it will fall on the last full weekend in October. That would make the Contest for 1968, the last two full weekends in October and November.

Official rules for the MARC VE/W contest have not been received as we go to press. Unofficially we understand rules are same as last year with the following modifications. VO1 and VO2 are now separate multipliers and the "ratio" multiplier is now 10. Logs go to VE2CK. 73 for now, Frank W1WY

Propagation

BY GEORGE JACOBS,* W3ASK

MARKED seasonal changes are expected in propagation conditions on the high frequency bands during September. A greater number of DX openings are forecast during the daylight hours on 10, 15 and 20 meters, although these bands will close somewhat earlier than during the summer months. During the hours of darkness, improved conditions and a considerably greater number of DX openings are expected on 40, 80 and 160 meters, with these bands remaining open somewhat longer than during the summer months.

With the continued rise in solar activity and the seasonal change in propagation conditions, the 10 meter band is expected to be full of activity during September. Excellent DX openings are forecast to almost all areas of the world sometime during the daylight hours, especially during the latter half of the month.

Excellent propagation conditions are also forecast for the 15 meter band from shortly after sunrise, through the daylight hours, and into the early evening. During most of this period, 15 meters is very likely to be the optimum DX band to most areas of the world.

Excellent propagation conditions are also forecast for 20 meters, almost around-the-clock. Conditions on this band are expected to peak during the sunrise period, and again during the late afternoon and early evening hours, when it should be possible to work into almost every corner of the world.

During the hours of darkness, good propagation conditions are forecast to many areas of the world for the 40 meter band. During most of this period it will probably be a toss-up between 20 and 40 meters for optimum DX propagation conditions. Some fairly good openings to many areas of the world are also expected during the hours of darkness on 80 meters. Some 160 meter DX openings may also be possible during the hours of darkness and the sunrise period, especially towards the end of the month.

Static levels are expected to decrease during September, and signals on all the high frequency bands should sound stronger during many DX openings.

*11307 Clara Street, Silver Spring, Md., 20902

LAST MINUTE FORECAST

Day-to-Day Conditions and Quality for Sept.

Days	Forecast Rating & Quality (4)	(3)	(2)	(1)
Above Normal: **1, 8, 12, 28**	A	A-B	B	B-C
Normal: **2-3, 5-7, 9, 11, 13-14, 17-19, 21-22, 25-27, 29-30**	A-B	B	C	D
Below Normal: **4, 10, 15-16, 20, 23, 31**	B-C	C-D	D	E
Disturbed: **24**	C-D	D-E	E	E

HOW TO USE THESE CHARTS

The following is an explanation of the symbols shown above, and instructions for the use of the *CQ* propagation predictions:

1—Enter Propagation Charts on following pages under appropriate band and distance or geographical area columns. Read predicted times of band openings at intersection of both columns.

2—Following each predicted time of band opening is a forecast rating which indicates the relative number of days the band is expected to open during each month of the forecast period. The higher the rating, the more frequent the opening, as follows: (4) band open more than 22 days each month; (3) between 14 and 22 days; (2) between 8 and 13 days; (1) less than 7 days.

On the "Short-Skip" Chart, where two numerals are shown within a single set of parenthesis, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. Note the forecast rating for later use.

3—With the forecast rating noted above, start with the numbers in parentheses at the top of the "Last Minute Forecast" appearing above. Read down the table for a day-to-day forecast of propagation conditions in terms of Above Normal (WWV rating higher than 6); Normal (WWV rating 5-6); Below Normal (WWV rating 4); Disturbed (WWV rating less than 4). The letter symbols (A-E) describe reception conditions (signal quality, noise and fading levels) expected for each day of the month and have the following meanings: (A—excellent opening with strong, steady signals; B—good opening, moderately strong signals, little fading and noise; C—fair opening, signals fluctuating between moderately strong and weak; D—poor opening, signals generally weak with considerable fading and noise; E—poor opening, or none at all.

4—This month's Propagation Charts are based upon a transmitter power of 75 watts c.w.; 150 watts s.s.b., or 300 watts d.s.b., into a dipole antenna one quarter-wave above ground on 160, 80 and 40 meters and a half-wave above ground on 20, 15 and 10 meters. For each 10 db increase above these reference levels, reception quality shown in the "Last Minute Forecast" will improve by one level; for each 10 db loss, reception will become poorer by one level.

5—Local Standard Time for these predictions is based on the 24-hour system.

6—These Propagation Charts are valid through Oct. 31, 1967. These Charts are prepared from basic propagation, data published monthly by the Institute For Telecommunication Sciences And Aeronomy of the U.S. Dept. of Commerce, Boulder, Colorado.

During September and continuing through the fall season, there is generally a noticeable improvement in propagation conditions on long circuits between the northern and southern hemispheres, for example, between the USA and Australasia, or between the USA and South Africa or South America, etc. This improvement is expected to take place on all amateur bands between 10 and 160 meters.

This month's *CQ* Propagation Charts contain a detailed forecast of short-skip openings between distances of approximately 50 and 2300 miles, as well as forecasts centered on Alaska and Hawaii. These forecasts are valid for September and October, 1967. See last month's column for a band-by-band forecast of DX openings for September.

V.H.F. Ionospheric Openings

Six meter openings may make news during September. Solar activity has risen to the point where there is a *slight* possibility that some F-layer openings may take place between the USA and South America, South Africa and Australasia. Best time for these openings should be the hours between noon and sundown. There is also a fair possibility that trans-equatorial scatter openings may take place during the early evening hours. Although sporadic-E propagation is expected to decrease considerably during September, some 6 meter short-skip openings are likely to occur over distances ranging between approximately 1000 and 1300 miles. Some 6 meter openings should also result from the increased level of auroral activity expected during September. Check the "Last Minute Forecast" appearing at the beginning of this column for periods that are forecast to be disturbed or below normal during the month, as chances are good that v.h.f. auroral opening may be possible on these days.

Meteor activity is generally at a low level during September, and few meteor-scatter openings are likely to occur on the v.h.f. bands during the month.

Sunspot Cycle

The Swiss Solar Observatory reports a mean sunspot number of 63 for June, 1967. This results in a smoothed sunspot number of 72, centered on December, 1966. The sunspot cycle is based upon smoothed sunspot numbers, and the new cycle continues to rise.

The following are the provisional 12-month smoothed sunspot numbers reported for 1966:

Jan.	28	July	49
Feb.	31	Aug.	55
Mar.	35	Sept.	63
Apr.	37	Oct.	67
May	41	Nov.	69
June	45	Dec.	72

A smoothed sunspot number of 94 is forecast for September, 1967.

CQ DX Contest Special

This year's *CQ* Worldwide DX Contest will be held on the following dates:

October 21-22	Phone Period
November 25-26	C.w. period

As has been the practice for the past 16 years, next month's Propagation column will be devoted to a special forecast for the Contest periods. ■

CQ Short-Skip Propagation Chart

SEPTEMBER & OCTOBER, 1967

LOCAL STANDARD TIME AT PATH MID-POINT (24-HOUR TIME SYSTEM)

Distance From Transmitter (Miles)

Band (Meters)	50-250 Miles	250-750 Miles	750-1300 Miles	1300-2300 Miles
10	*Nil*	09-13 (0-1)	07-09 (1) 09-12 (1-2) 12-13 (1-3) 13-15 (0-3) 15-17 (0-2) 17-21 (0-1)	07-08 (1-2) 08-09 (1-3) 09-15 (3-4) 15-17 (2-3) 17-19 (1-2) 19-21 (1)
15	*Nil*	07-09 (0-1) 09-15 (0-2) 15-21 (0-1)	07-09 (1) 09-15 (2-4) 15-17 (1-4) 17-19 (1-3) 19-21 (1-2) 21-07 (0-1)	07-08 (1-2) 08-09 (1-3) 09-17 (4) 17-19 (3) 19-21 (2) 21-00 (1) 00-07 (1-0)
20	11-13 (0-1) 13-16 (0-2) 16-21 (0-1)	07-09 (0-3) 09-11 (0-4) 11-16 (2-4) 16-21 (1-3) 21-02 (0-2) 02-07 (0-1)	07-09 (3-4) 09-16 (4) 16-21 (3-4) 21-00 (2-3) 00-02 (2) 02-07 (1)	07-09 (4) 09-15 (4-3) 15-21 (4) 21-23 (3-4) 23-00 (3) 00-02 (2) 02-07 (1-2)
40	07-09 (2-3) 09-18 (4) 18-20 (3-4) 20-22 (2) 22-05 (1) 05-07 (1-2)	07-09 (3-4) 09-11 (4-3) 11-15 (4-2) 15-17 (4-3) 17-20 (4) 20-22 (2-4) 22-00 (1-4) 00-05 (1-3) 05-07 (2-3)	07-09 (4-2) 09-11 (3-1) 11-15 (2-1) 15-17 (3-2) 17-20 (4-3) 20-00 (4) 00-06 (3-4) 06-07 (3)	07-09 (2-1) 09-15 (1-0) 15-17 (2-1) 17-19 (3-2) 19-20 (3) 20-06 (4) 06-07 (3)
80	06-11 (4) 11-18 (4-3) 18-23 (4) 23-06 (3-4)	06-08 (4-2) 08-11 (4-1) 11-16 (3-1) 16-18 (3-2) 18-06 (4)	06-08 (2-1) 08-16 (1-0) 16-18 (2-1) 18-21 (4-2) 21-03 (4) 03-05 (4-3) 05-06 (4-2)	06-08 (1) 08-16 (0) 16-18 (1) 18-21 (2) 21-03 (4-3) 03-05 (3-2) 05-06 (2-1)

[*Continued on page 120*]

THE awards PROGRAM

FEATURING USA-CA

BY ED HOPPER,* W2GT

THE September "Story of The Month" is:

Carl R. Ditsch, WØVFE

Carl, as his many friends in hamdon, know him; was born 41 years ago in the town of Flint, Michigan. Shortly after that, he was moved to Missouri, where he started his education near Excelsior Springs in a small town called Mosby. Then in the late 30s off to Kansas where he finished his schooling. In 1943, his father (a retired Navy Chief) was called to Indiana to fill a wartime job. Carl then spent a year in Crane, Indiana, from where he enlisted in the Navy in April 1944. After boot training at Great Lakes, he was sent to Radio School at the University of Wisconsin at Madison. After graduation came sea duty and a lengthy career in the Navy. In March 1965, Carl retired from the Navy after almost 21 years of service as a Chief Radioman.

At present Carl and his family live in Lansing, Kansas. His family includes his wife Carol, three daughters Caryla, Hazel and Dixie; also two sons, Dennis who is serving in the Navy aboard the Guided Missile Destroyer Escort, U. S. S. Ramsey, and Dale who is at home.

Carl became interested in ham radio while in the service. He was in constant contact with hams, as *many* find their way into Navy communications. After being so close to it, he decided on a ham ticket in 1954, thus the beginning of a wonderful hobby which he has greatly enjoyed ever since.

Just a year or so before retirement from the Navy, Carl got an SR-160 for mobile work. After installing it in his 1960 Ford, he soon realized that mobiling was real fun. One day on the way home from duty, he tuned to the county hunters net frequency on 40 meters. When Ole "Otts" (K8CIR) heard WØVFE/Mobile, he asked Carl to join the net and give out his county. *Well,* that did it, and ever since that day, Carl has been an ardent county hunter.

His first trip with the gang was that fall on his annual deer hunting trip to Wyoming. Traveling through the states of Kansas, Nebraska, S. Dakota and Wyoming provided many contacts and much enjoyment.

The highlight of the county hunting, so far, was his trip in March 1965 (2 days after retirement) made with Sherm, K9BLX through Kansas, Nebraska, Colorado, Iowa and Missouri. Carl and Sherm gave out 67 counties on this three day trip for the county hunters.

Carl says the real goal behind county hunting is making friends, and he has had the pleasure of meeting many of the gang in person.

Neat radio room of Carl, WØVFE.

*103 Whittman St., Rochelle Park, N.J. 07662

B&O/C&O R ARC Award

On September 20, 1963, USA-CA-500 award #279 was issued to Carl. On February 9, 1965, #66 USA-CA-1000 award and #26 USA-CA-1500 award were issued to him, closely followed by #19 USA-CA-2000 on April 3, 1965 and #14 USA-CA-2500 on April 28, 1966. Although he has been inactive since the hunting trip last November, his total of confirmed counties is up to 2787.

Other hobbies enjoyed by Carl are hunting, fishing, trapping and stamp collecting.

He still has the SCR-160 and is presently installing it in his new Ford so it will be all ready for the hunting (deer and county) trips this fall. So keep your ears open and you will surely hear "WØVFE/Mobile", somewhere on the bands and be sure to remember the third week in November as he will be heading for Wyoming for the deer hunting affair. GOOD HUNTING!

Letters

Cliff, WAØKXJ/Ø, writes: "Jim, WAØHYS and I set up stations at the Sky Motel, Schuyler, Nebraska in *rare* Colfax county for the Nebraska Centennial QSO Party. As there were no trees around, we had to use homemade dipoles at nearly ground level, but the old saying, "if they need you they can hear you", evidently held true, since we completed 140 QSOs in spite of miserable band condx and competition from the N.Y. QSO Party. Special QSLs will be mailed to all stations worked.

Many more rare county trips are being planned for the future. Want lists are invited for the mid-west states. Watch for activity in Illinois QSO Party, Zero District QSO Party (3 counties simultaneously), and Minnesota QSO Party." (Send needed county lists as mentioned, to Cliff Davidson, WAØKXJ, 5200 Shriver Ave., Des Moines, Iowa 50312.)

Larry, K6SLP, writes: "Starting on 14 Sept. and for about 2 weeks I'll be operating mobile and portable from the following counties in California: Inyo, Mono, Alpine, Mariposa, Tuolumne, Calaveras, Amador, El Dorado & Placer. In Nevada from the counties of Esmeralda, Mineral, Lyon, Storey, Washoe, Ormsby and Douglas.

I think the County Award Program is interesting and certainly a most worth while project. Keep up the good work."

Norm, W3DYA, writes: "Would like to see more efforts to establish a c.w. county net on perhaps 14060 kc. Fellows could call CQ and mention their county and call."

Awards

WFC VT—This Worked Franklin County Vermont Award is sponsored by the Franklin County Amateur Radio Club, Inc. of St. Albans, Vermont. It is issued for contacts with any three Franklin County Vermont Amateur Stations at any time or any mode. For additional three contacts an endorsement is issued. Send your list and $1.00 to help defray costs to: F.C.A.R.C., Box 332, St. Albans, Vermont 05478. The award is available to s.w.l.s and is free to blind and paralyzed amateurs and s.w.l.s.

The Worked All Parishes of Louisiana Award—This attractive certificate is issued after application is made showing that you have contacted a minimum of 16 Louisiana parishes or counties. A list of these contacts must be submitted showing complete log information about each contact—date, time, call letters of Louisiana stations, mode of operation, band, and time ending of each contact. This application must be signed by an officer of your radio club or another radio operator verifying these contacts. The list must be accompanied by a handling fee of 50 cents. A sticker to be attached to your original certificate will be issued after you have submitted a verified list and log information showing contacts with an additional 16 parishes (total of 32) and another sticker is available upon submittal of complete information showing contacts with an addi-

WAP Louisiana

tional 32 parishes (total of 64). Applications for stickers must be accompanied by a stamped self-addressed envelope, but no other charge will be made for the stickers. Send all applications to Awards Chairman, Tom Harson, K5VJZ, 110 Claymore Drive, Lafayette, Louisiana 70501. (Award free to paid LARC Club members).

The B&O/C&O Railroads ARC Award—The B&O Amateur Radio Club has now become the B&O/C&O Amateur Radio Club. Their new award is issued in five classes to any amateur working and exchanging QSL cards with their members:

Class Award	*U.S. Stations*	*Other Stations*
AAA	100 Members	35 Members
AA	75 Members	25 Members
A	50 Members	15 Members
B	25 Members	7 Members
C	10 Members	3 Members

Send list of QSL cards you have in your possession showing date of QSO, time and frequency. List must be certified correct by two other amateurs or local club official. Do not send QSL cards. No charge for award but postage would be greatly appreciated. The membership is about 135 and much too long to list, but there are about 4 members in 2nd district; 73 in the 3rd district; 10 in the 4th district; 2 in the 7th district; 30 in the 8th district; 14 in the 9th district and one in WØ land. For membership list send s.a.s.e. and for award send application (and some postage for a mighty fine looking award) to William T. Heller, W3BVL, Awards Manager, B&O/C&O ARC, 7388 B&O Building, Baltimore, Maryland 21201. Here is some net data to help:

B&O/C&O NETS.

s.s.b./a.m.—Wednesdays
at 1045 GMT—3930 kc
s.s.b./a.m.—Fridays
at 2345 GMT—3970 kc
6 Mtrs—Sundays
at 7 P.M. EST—50.3 mc

W A G Award

Worked Franklin County, Vermont

2 Mtrs—Sundays
at 8:30 P.M.—145.35 mc
s.s.b./a.m.—Sundays
at 1500 GMT—21,345 kc

The W A G Award—As this is the *BIG* year for our Canadian neighbors, here is the data on the Worked All Goose Award issued by the Goose Bay Amateur Radio Club, and it is available to all amateurs in the world. Amateurs in the USA and Canada must QSO four members of the G.B.A.R.C., all others must QSO three, after January 1st, 1958. Send list showing stations worked, date, time and frequency along with three IRCs, no QSL cards required to *NEW* address-Awards Manager, G.B.A.R.C., P. O. Box 232, Goose Bay, Labrador, Canada. Remember they used to sign VO6 and now VO2 but during 1967 they may also use 3B2.

Notes

Kentucky Amateurs have been honored by Governor Edward T. Breathitt proclaiming the week of September 4 thru 10, 1967 as "Amateur Radio Week In Kentucky". In celebrating this year as the 175th Anniversary of statehood in Kentucky, the amateur fraternity will be participating in many civic state and national events. During "Amateur Radio Week In Kentucky", stations who submit logs showing contacts with five (5) or more Kentucky stations will be presented with a specially designed *certificate* of participation signed by Governor Breathitt. These logs should be submitted to this address: Governor, P. O. Box 20094, Louisville, Kentucky 40220. No charge for the award, but please include 25¢ in stamps or coin to cover mailing tube and postage. No charge for DX stations.

Many requests are coming in from our overseas friends for POD 26, so if you have one you do not need, please let me know. By the time you read this, most will have had their vacations, hope you are all refreshed and ready for much county hunting, QSLing and letting me know—How was your month?, 73, Ed., W2GT.

SURPLUS sidelights

BY GORDON ELIOT WHITE*

HARRY GARTSMAN, of Alvaradio, out in California, inventoried his warehouse last spring and turned up two surplus items of interest, with which I will deal this month. I have seen both—a transmitter input filter and a v.h.f. portable transceiver—in New York and in the Washington area, so apparently there is a reasonable supply of these goodies around.

The first and most interesting item is the Bendix MRT-9, a commercial design that was also used to some degree by the military, and by police, the Federal Aviation Agency, some of the railroads, etc. This is a hand-carried F.M. transmitter and receiver combination that originally put out approximately 1 watt in the 152-174 mc band. It converts easily to 2 meters, for rather standard amateur use, but has an even more interesting application as a receiver for the 136 mc weather satellite channel. This was my first thought on seeing the specs—here was a 19 tube, double-conversion, f.m. receiver with a sensitivity of better than ½ microvolt, with squelch and the usual receiving controls. What better way is there to copy those elusive satellite signals, which being f.m. are not readily copied on normal a.m. receivers.

*5716 N. King's Highway, Alexandria, Virginia 22303.

This is the complete Bendix MRT-9 "packset," designed as a portable f.m. transceiver in the 152-174 mc band. Surplus units are available without the handset and external controls at a fraction of the original price.

I found through correspondence which followed my articles on facsimile equipment that a number of amateurs and non-amateur technicians were recording or attempting to record the *NIMBUS* and *TIROS* weather facsimile photos which are transmitted from the satellites in phase-modulation or frequency-modulation form.

Though it is possible to build a good converter for 136 mc and add an outboard discriminator after the station receiver, there are few discriminator transformers made for 455 kc, the standard receiver i.f. My own Collins and Hammarlund receivers have i.f. outputs as standard equipment, but at the 455 kc frequency. If you are not up to designing your own low-frequency discriminator, the logical thing is to fall back on standard components, which are typically designed for 10.7 mc, the normal i.f. for commercial receivers covering 88—108 mc. Here you need an up-converter from 455 kc or else you have to abandon the station receiver altogether and build your satellite terminal from scratch.

The MRT-9 however will do the job nicely. Alvaradio has the MRT-9A, which by the way may be licensed for commercial 2-way operation. The MRT-9 or 9A can be mounted permanently on a blank 19-inch rack panel, with the controls mounted thereon, and the associated vibrator power unit either retained, with 6 volts d.c. supplied from batteries or externally, or a complete a.c.-powered supply could be easily built up. I have the set partially mounted as described for rack use, though I must admit my project is still in the haywire stage as I write this.

A modified version of the MRT-9 was made for some government telemetry requirement, in which a tone was required

rather than voice communications. These sets were altered to receive 138.06 mc signals, and the voice input circuits replaced with a tone oscillator. In the receiver, a tone filter was added in place of the squelch, with an additional audio stage wired in. Either the original or modified sets will do for satellite work, though the tone filter in the receiver will have to be removed.

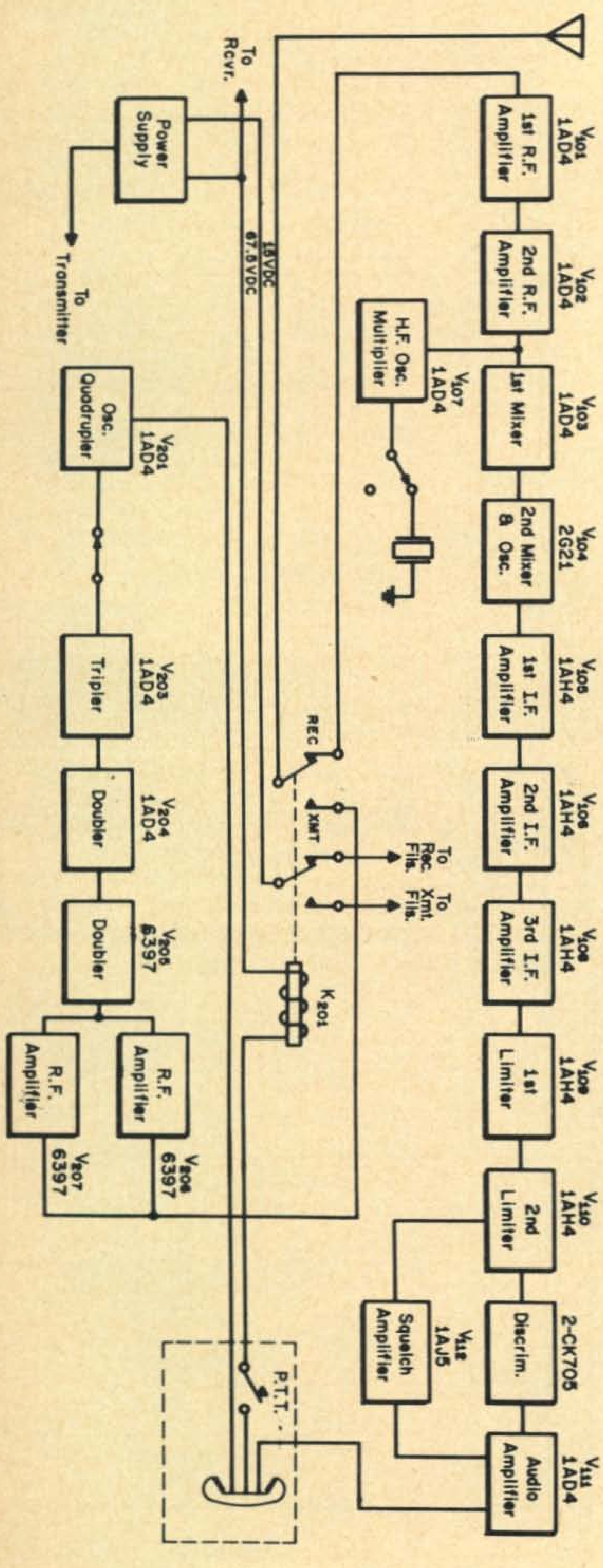


Fig. 1—Block Diagram of the MRT-9 set.

The set overall weighs about 10 pounds, measuring 10½ × 8½ × 4⅝ inches, making it a neat portable unit for that type operation.

The MRT-9 transmitter is rated at 15 kc maximum deviation at 100 percent modulation. It normally uses a 6 volt battery, and the rated receiver sensitivity of ½ microvolt produces an output of 80 milliwatts, according to the specs.

A block diagram is shown in fig. 1.

The MRT-9 is crystal-controlled on both receive and transmit. Crystals are in F-605 holders and I am told that International Crystals, 18 North Lee, Oklahoma City, Oklahoma, can supply transmitting crystals at $5.75 and receive rocks at $6.50. These are a little more expensive than the ordinary amateur crystals because they operate at relatively high overtones. The receive crystal is figured by subtracting 13.31875 mc from the incoming r.f. signal and dividing the remainder by four: 28.17031 mc for a 136.0 mc satellite (though you should check the U. S. Weather Bureau for the precise frequency before buying the crystal, if that is your intention) Transmit-side crystals should be the desired output divided by 48.

Be cautioned that there are a few differences in the MRT-9, 9A and 9B units, and of course in the modified sets. There are one and two channel versions, which are available. My advice is to obtain the schematic and puzzle out possible differences in your unit with the diagram before doing any converting.

Of course, as with any conversion, it is best to get the unit talking before you start cutting. Hook up the batteries and at least get antenna noise, or better yet get a signal generator to whistle at you before going any further.

The "loose" resistors waving at you in the chassis are test points, not wires the manufacturer neglected to attach somewhere.

I will not attempt a wire-by-wire conversion. Those who want to go into Satellite work will go one way, those wanting 2-Meter f.m. transceivers will want to tune up the set for that band. It is of course possible to put the MRT-9 into condition to receive a.m. signals for normal 2-meter work. Roy Pafenberg, W4WKM, has worked out that application, which I have not done myself. Basically Roy used the first limiter as an a.g.c. detector to control the r.f. and 1st i.f. stages, and made the second limiter into an a.m. detector. A transistor audio stage was added.

If this is your cup of surplus, Alvaradio has MRT-9 units, less the handset and controls, for $39.95 with a schematic and conversion dope. They may be available elsewhere, particularly in the New York area.

The second Alva suggestion was the Westinghouse variable input filter, see fig. 2. This little unit is designed to clean up spurious

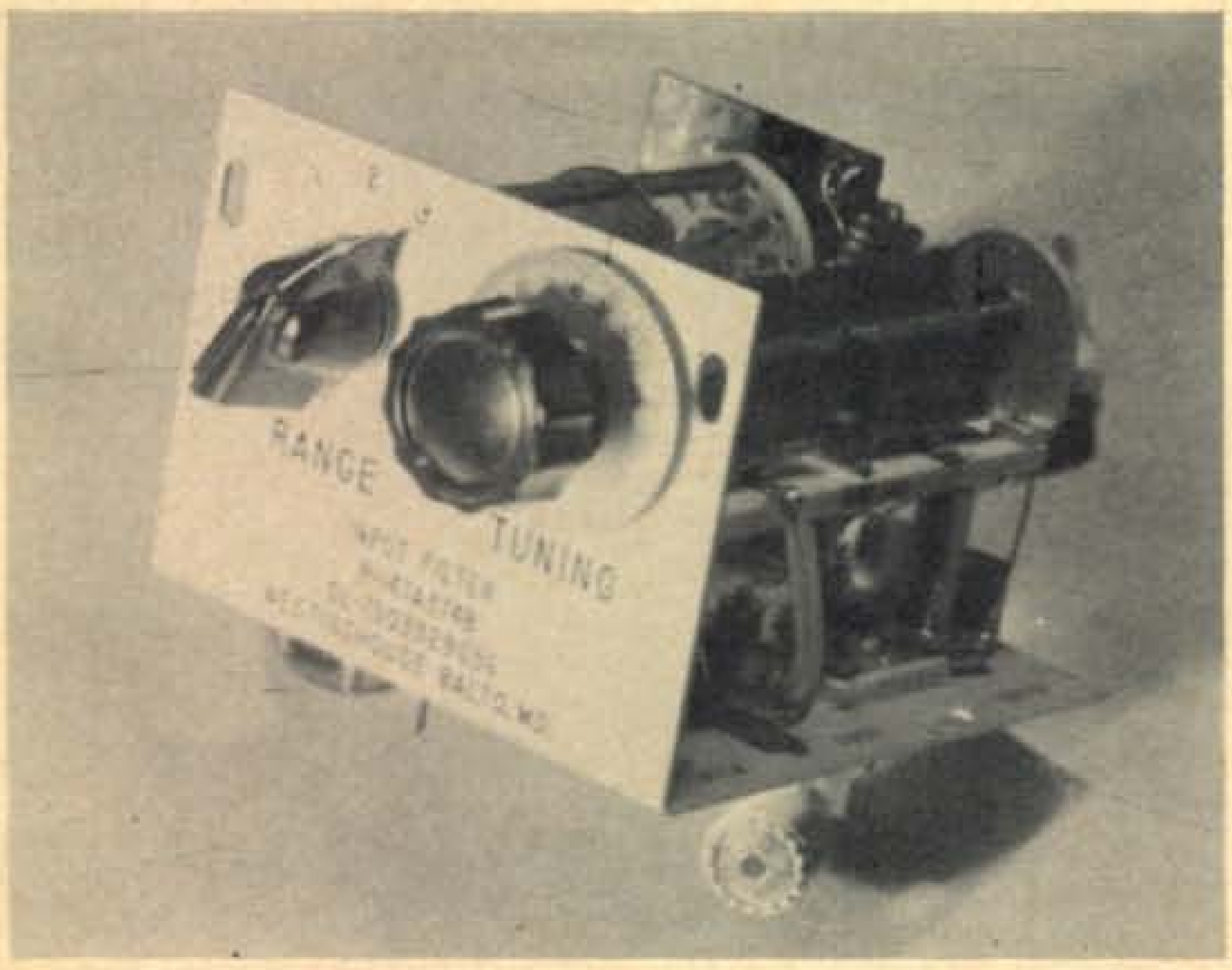


Fig. 2—This is the Westinghouse R-147A transmitter input filter, a very compact tuneable filter that weighs less than a pound and may be attached to virtually any transmitter input in the 2-4.5 mc band.

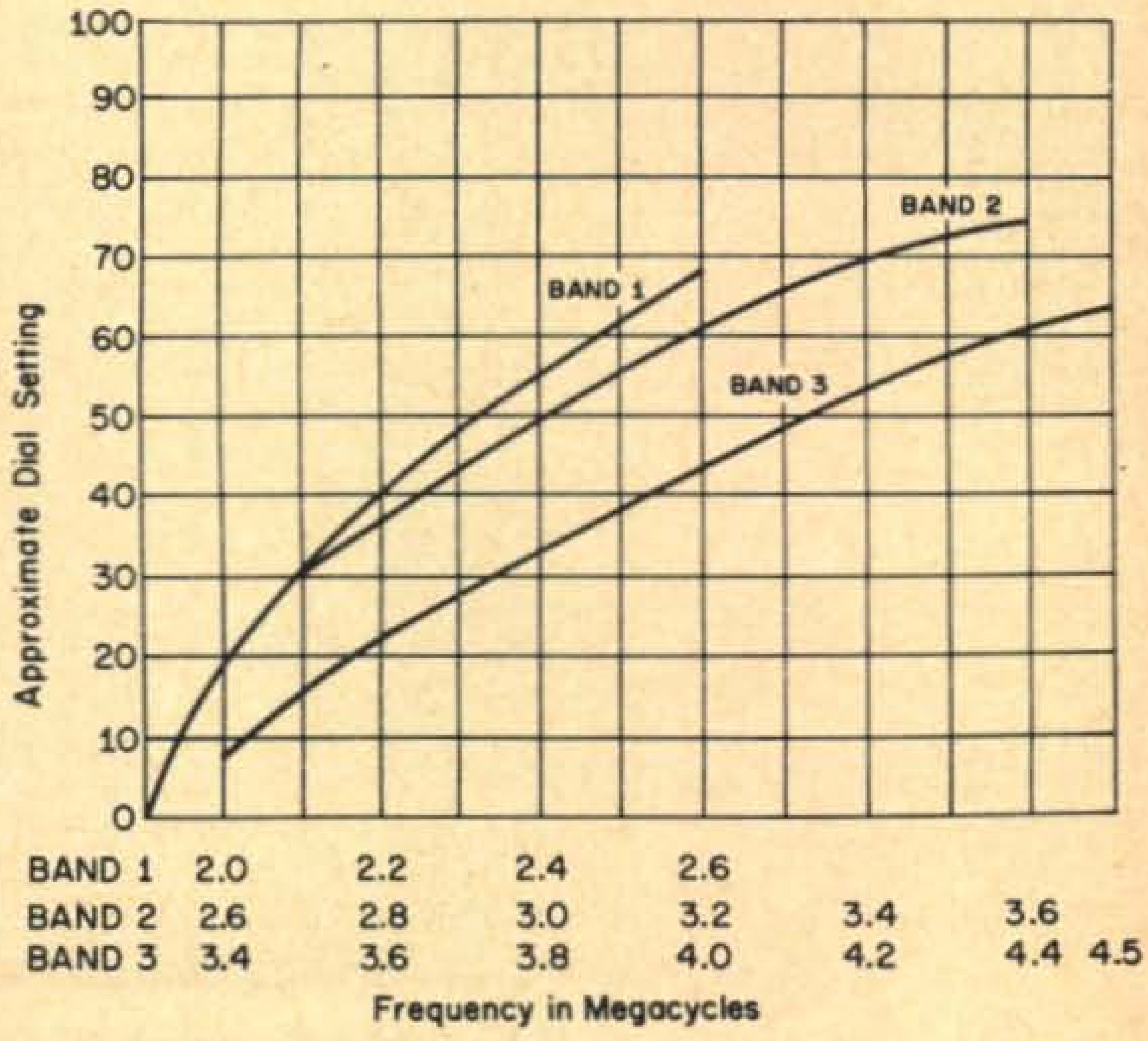


Fig. 3—Calibration chart for the R-147A filter.

Fig. 4—This unit is the combiner out of the AN/FGC-29 Teletype terminal

signals from an exciter to feed a clean input to a power r.f. amplifier. They were an accessory to the Air Force MW-1 and MW-2 transmitters. Nomenclature on the filter is R-147A374B. The technical order is 31R2-4-13-2.

The filter pretty much speaks for itself. It is tuneable over the range 2-4.5 mc and has an input of 72 ohms using an SO-239 jack and other u.h.f. fittings which are supplied with it. The unit will handle a 2-watt input and has a high output impedance. Attenuation of frequencies outside of a 200 kc passband is at least 20 db, with a 3 db insertion loss. Tuning instructions accompany the filters, which are new, if the one I received is an accurate indication.

Fig. 3 is a calibration chart for the filter unit.

One more item I want to mention is the AN/FGC-29, an RTTY terminal unit, built for the Navy a few years back. It is a tube type, and is being replaced by much smaller transistor equipment.

The whole FGC-29 is three tons of stuff, but individual portions seem to have some possibilities. Fig. 4 is a photo of the combiner section of the receiving converter. From the schematic, there may be possibilities that this section alone can be made into

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE a diversity or single-channel RTTY converter. I wonder if any *CQ* readers are familiar with this set, and could offer any assistance on the combiner or other parts of the AN/FGC-29?

Also on the subject of RTTY, I note that of late there has been an increasing amount of model 35 equipment showing up in commercial/military surplus channels. This is designed for 8-level code, 100 words per minute, and thus not of too much direct use to amateur RTTY people, who use the standard 5-level, 60 w.p.m. code and speed. However, the #35 cabinets are quite handsome, in fact are a lot more attractive to the average XYL. than the 14-15-19-26 or even 28 cabinets, which are just too functional. I have had some little success in mounting model 28 machines in #35 cabinets, which is basically quite easy because the #35 is just an improved #28. I expect to go into this conversion in an upcoming Surplus Column, but for those interested in putting a 28 into new "clothes" Martin Geisler, 8926 Kester Ave., Van Nuys, California 91402 has a few #35 cabinet parts and can furnish most of the parts for this shack-beautification program. Martin also repairs Teletype equipment for West Coast amateurs and has a large stock of parts for the #14, #15, #19, #26 and #28 units. For eastern amateurs interested in the #35 cabinet conversion, I have a few pieces which I would be willing to swap off, or would sell at a nominal cost.

Finally, since surplus gear is often quite dirty, I am always looking for a good cleaner. You wouldn't believe the messes I've tried, including one solvent that dissolved some Teletype keytops before it got them clean! My wife advised me that *Fantastic spray cleaner* was excellent for the purpose, and my own tests of this stuff on several types of paint and plastic indicate that it is the best cleaner I have yet seen. It does not seem to harm finished surfaces, but it removes grime that I had thought was beyond cleaning.

The stuff comes in a squeeze plastic spray bottle that costs about 89¢ for 22 ounces. It apparently contains fairly active ingredients and should be wiped off immediately; should be kept out of the reach of small children. *Fantastik* is made by the Texize Chemical Co., Greenville, South Carolina. We found it in the local Co-op supermarket in Virginia. ■

For further information, check number 22, on page 126

Electronics Careers *[from page 26]*

going career? They are many and exciting: an opportunity to visit practically any or all of the seaports of the world at no cost; an excellent salary; a various assortment of fringe benefits; a comfortable stateroom and bountiful meals; an opportunity to progress with either the steamship line or the radio operating company leading to administrative and executive positions ashore.

Just the other day we talked with a marine Radio Officer who had retired from more conventional employment ashore some eight years previously. When asked what had drawn him to return to the sea, he replied, "Well, with the shortage of operators and the generous salaries being paid, I just couldn't resist the urge. I'm 73 years old (!) but they welcomed me with open arms! The work isn't arduous, I'm making about $800 a month, have a nice stateroom and wonderful meals. Preparing for a license was easier than I thought; I merely took a refresher course in a good school; got my ticket on the first try. I'm piling up a nice little nest egg and after a couple of years of riding the briny, I'll be ready to settle down and enjoy my leisure." There you have it; display advertising by the radio operating companies eager for operators of any age, is doing much to attract former sea-going brass pounders back to the fold. Newcomers to the profession are also given every encouragement to present their applications and, if they can cut the mustard, are generally offered immediate employment.

And, if a floating assignment doesn't appeal to you but you still like telegraph, shore assignments at coastal marine radio stations are open to you in junior operating positions with plenty of room for advancement. This is a formerly unheard of and relatively recent development. In earlier days, long years at sea were almost a must as an apprenticeship before being considered for a coveted assignment as a coastal station operator. For the ham who aspires to a position as a marine Radio Officer or coastal station operator, his amateur background should be amplified and rounded out by attendance at a good resident electronics school whose curriculum includes preparation for FCC commercial radio operator licenses. If he is unable to attend residential classes, most of the reliable schools offer home study courses which will accomplish the same thing.

There you have it then, covering the strictly radio operating phases of electronics. It should be mentioned also that not only are operating positions confined to the few which we have outlined but many similar operating position opportunities exist with a great many diversified interests such as oil exploration companies, historical foundation expeditions and the like. Federal, State, county and municipal governments use many licensed operators in various departments of their structures . . . police and fire departments, state police and county sheriffs, aviation and a long list of others. Most of these are of a civil service nature and full information is available at the offices of the various civil service commissions.

As we have repeatedly pointed out, *proper* training is the surest and quickest road to employment in the electronics field. The best assurance of such training is enrollment in a guided course of study at an educational institution specializing in the particular skills required in electronics work. And again we stress that the prospective electronic career man (or woman) who can proudly point to a background embracing amateur radio operation has more than just his 'foot in the door' . . . he is already half-way into the room!

In our next installment we will take up a number of other 'highways' leading to an electronics career in whatever specialized branch you choose to elect, all of which can lead to rich rewards for the *trained* electronics man. How and where you can acquire this training will form an important part of our later discussion as well. ■

Loud Shorty *[from page 58]*

few inches with solder. Take frequent leads from the bonding wire to the ground stake (fig. 1).

4—Locate the base insulators (bottles) as required. A spacing of a foot between the radiators causes no interaction. Four brass woodscrews driven into the support board around the base of each bottle will prevent them from sliding.

5—Run the coax feeder to the base of radiator. This can be buried or simply laid on the ground screen and clipped to it every few feet. The coax shield is connected to the ground stake with a solid, low resistance soldered connection.

6—The radiator is set on the bottle and the guys tied off. The coax inner conductor

CONQUER NEW HORIZONS

WITH

CONTROLLED QUALITY CRYSTALS

- *Tried and True*
- **Complete Range**
- *Guaranteed*
- **Ready for you at your dealer**

Division of Whitehall Electronics

TEXAS CRYSTALS

1000 Crystal Drive • Fort Myers, Fla. 33901
Plants in Fort Myers and Los Angeles

For further information, check number 29, on page 126

BUY THE BEST

KIRK

FIBERGLASS

SUPER-QUAD

TRI-BAND KITS

2-3-4 Elements or more Available

2 ELEMENT, 3 BAND KIT

CONTENTS

- **8 FIBERGLASS** Arms Specially reinforced at butt and element intercept points
- 2 Quad Arm "X" Mounts
- 1 Boom to Mast "T" Mount
- 1 Instruction Manual

$69.95
Less boom & wire
F.O.B. Dayton, O.

Special Instruction Manual, complete plans $1.00

WRITE FOR BROCHURE OF INDIVIDUALLY PRICED COMPONENTS

KIRK *Electronics*

5151 DAYTON-LIBERTY ROAD DAYTON, OHIO 45418
PHONE: AREA CODE 513 — 835-5028

"The Quad People"

For further information, check number 20, on page 126

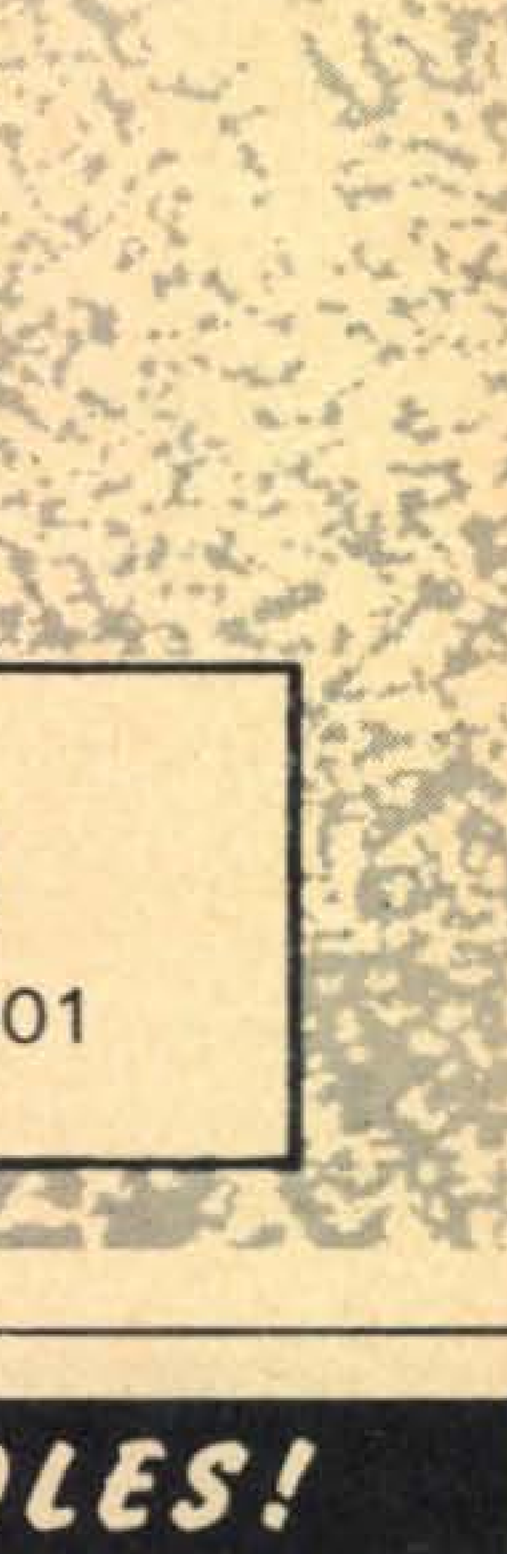
LOOK...NO HOLES!

FITS ANY C.B. OR HAM ANTENNA

THIS RIGID RUSTPROOF ANODIZED ALUMINUM ANTENNA MOUNT FASTENS TO YOUR CAR TRUNK LID IN MINUTES . . . AND NO BODY HOLES ARE NECESSARY!

SEE THESE SUPERIOR MOUNTS AT YOUR DISTRIBUTOR/DEALER OR REMIT $8.95 (check or M.O.) TO E-Z MOBILE ANTENNA MOUNT INC., P.O. BOX 277, ALGONAC, MICHIGAN (Michigan residents add 4% sales tax) PHONE 313 794-7343

SPECIFY ANTENNA MOUNT HOLE DESIRED (3/8"–3/4"–SMALL OR MEDIUM BALL)



DEALER INQUIRIES INVITED

E·Z MOBILE ANTENNA MOUNT

PATENT PENDING

Gateway Tower Co.

7530 BIG BEND
ST. LOUIS, MO. 63119
(314) 644-1500

ALUMINUM TOWERS — ALL KINDS

SEND POSTCARD ATTN: RALPH CRISS

is connected to the connecting strap at the base of the radiator.

Tuning

Start on the radiator for one band only. The radiator should be a little longer than the design frequency. A grid dip oscillator reading or a series of s.w.r. readings across the band will give a clear indication of the resonance point and hence how much shortening is needed. Careful work with a sharp hacksaw will rapidly prune the radiator to resonance and a s.w.r. close to 1:1:1.

If more than one radiator is wanted the above procedure is repeated for each band in turn. As more radiators are added there may be a slight degrading of s.w.r. but not enough to be significant especially considering the advantage of a single coax feeder to the system.

Antenna Site

It should be made abundantly clear that this antenna can *only* be recommended to those having a site suitable to its characteristics. It would be, to say the least, unrewarding to set it up in a backyard in the middle of a heavily built up area.

A word of warning to proprietors of "California Kilowatts." With a couple of kws p.e.p. going up the spout the voltage on top of "Shorty's" head will be formidable. Even with the voltage gradient dropping off at the base, an inquisitive dog would get a nasty surprise—one way or another. Where there is really high power it would be wise to enclose "Shorty" in a light non-metallic fence to protect him from the public—and vice versa.

The author wishes to give thanks and much credit to EI9Q for his enthusiastic collaboration on this project and his apparent imperviousness to the weather that often swept in from the Atlantic when building was going on. ■

160M S.S.B. Transmitter [*from page 42*]

two meters seen in the photograph of the front panel are the cathode current meter and the grid current meter. The grid current meter should just barely flicker when the amplifier is being operated correctly. The RCA Receiving Tube Manual data for typical operation of the 7868's as a Push-Pull Class AB_1 Audio Amplifier with 400 volts on the plates was used for operation of the final amplifier. A number of sets of operating data for these tubes can be found in the manual for which the pi-network tank circuit values shown will be satisfactory.

Conclusion

The 160 meter s.s.b. transmitter described has been in operation for a number of months now and has been giving a good account of itself while "on-the-air." It has provided the author with much practical information in regard to s.s.b. operation which would normally not have been gotten had a commercial unit been purchased for operation on "160." Building the unit described is highly recommended to the ham who is anxious to get started in sideband or to the one who would like to operate the 160 meter band.

The author has been very pleased with the favorable reports received from the stations he has worked and hopes that this article will satisfy a longtime need for information concerning the design and construction of a 160 meter s.s.b. transmitter. ■

Clegg 66'er [*from page 72*]

upper end of the range, the calibration was accurate to within the width of the dial pointer.

Operationally the sensitivity and selectivity were entirely adequate for the intended service and the absence of spurious responses or unwanted signals, particularly at our location which is infested with TV and f.m. stations, was indeed gratifying. The tuning operates very smoothly and the four revolutions of the control for covering the range provide a good ratio for easily tuning in signals.

The noise limiter works extremely well and of special benefit is the squelch, not only for diminishing background noise in the absence of signals, but also for locating weak signals or unmodulated carriers which simply pop up "out of the blue." You don't have to search through background noise, watch the S-meter or even hear a voice to locate the signal. The 66'er does not provide for c.w. operation, but in some cases the squelch enables you to at least copy c.w. signals by listening to the carrier noise as it appears out of the silence during keying!

The stability exceeds the requirements for a.m. use in relation to the i.f. bandwidth and thus avoids the need for frequent retuning to hold a signal, even during part of the warmup period.

Transmitter

The carrier output of the transmitter, rated at 10 watts, was 13 watts (with 120 v.a.c. line potential) and it could be modulated a full 100 percent. Raising the speech-input level clips the envelope peaks, resulting in an increase in average power, yet not introducing deteriorating splatter. The a.f. quality sounds excellent and the signal carries a good punch, particularly in comparison to many of the inadequately modulated rigs we've heard on the air. The transmitter tunes up quickly and easily, even when crystals for operation at the extremes of the range are interchanged. With the 66'er operating in the same room with a TV set, t.v.i. was not experienced on Channels 2-13.

The transceiver also may be used for MARS, CAP and CD service near 50 mc, for which adapter kits are available to provide on-channel crystal-controlled operation on both receive and transmit. Further information in this regard may be obtained from the manufacturer.

The Clegg 66'er is priced at $249.50, less microphone and crystals. An adjustable mobile cradle for floor mounting is available at $15.00. The size of the set is 12" W. × 12" D. × 6½" H. and it weighs 19 lbs. The manufacturer is Squires-Sanders, Inc., Martinsville / Liberty Corners, Millington, N.J. 07946.—*W2AEF*

DDRR Antenna [*from page 16*]

an s.w.r. near 1.15 to 1 at resonance and a ratio not larger than 2.2 in the whole 144-146 mc band.

After the DDRR has been tuned to a given frequency, a change of frequency requires a resetting of *C*. This operation may be facilitated by leaving a standing-wave indicator in the feedline at all times for tuning to minimum s.w.r. as needed.

Another tune-up procedure consists in adjusting capacitor *C* for maximum field-strength at some distance from the antenna (as picked up by a field strength meter) and adjusting tap *X* for minimum s.w.r. on the feedline. The adjustment of capacitor *C* may be made by means of a remote control using, for instance, a flexible shaft, in order to avoid mistuning due to the operator's proximity.

Results

The performance of the $\lambda/2$ DDRR antenna was found to be excellent. By recording the fieldstrength far from the radiator, the proposed antenna showed a +1 db gain over the standard full height λ/4 radiator. Radiation directivity was in very good accordance with the theoretical omnidirectional pattern reported by Mr. J. M. Boyer.[1] The proposed modification of the DDRR-antenna is also highly valuable in lower frequency operation. In fact, doubling ring's diameter does not enlarge the overall DDRR dimensions beyond practical limits, while it avoids the loss of 2 to 3 db which characterizes the λ/4 DDRR as compared with the full-height λ/4 vertical radiator. ■

M.A.R.C. Award [*from page 62*]

Network was founded by Dr. Braley, an amateur radio operator, WØGET, in December, 1962 to provide rapid, inexpensive and effective communication once a day to make known to participating eye banks throughout the country any emergency requirements for eye tissue and where such eye tissue is available. The fact that eye tissue deteriorates in 48 hours unless used makes such a rapid method of communication essential, and prior to the network's foundation many persons became blind because the eye tissue could not be obtained fast enough. The sight of scores of patients has been saved since the network was founded.

The Medical Amateur Radio Council —(MARCO) was established in 1966 and the major purpose of the Council is to establish broad personal communications among members of the medical, dental and related professions through amateur radio for the dissemination of factual medical, electronic and communication information, both theoretical and practical.

The corporation proposes to establish emergency public assistance networks among members.

Scratchi [*from page 11*]

rig so that Scratchi can talking to it from main headquarters control point which are on Hon. Brother Itchi's ranch in Feenix. Beginning to getting the picture, Hon. Ed?

Also, of course, are needing Hon. Compooter to keeping track of which saddlelites are where. Are even having threedimenshunal map so so can visually seeing where each saddlelite are at eachmoment.

Like taking you want to talk to Tibet. You looking at display, seeing which saddlelite are closest to Tibet, punching rite buttons on master control console, and calling "seekyou Tibet" on all bands from 160 down to

For further information, check number 28, on page 126

For further information, check number 19, on page 126

Hon. Microwaves. If nobuddy answers, it's on acct. nobuddy on air in Tibet.

But that's not all. Sometimes when feeling like getting away from home, or when having to do some small service job on a saddlelite, Scratchi also having own personal spaceport—Cape Scratchi. So, for a change, I can hopping up to saddlelite number seventeen, and working dee-x while going round the world.

And, when reely getting bored, I pack a few sandwiches, and take off for Venus. That will giving some lucky fellow on earth a chance to working me portable-mobile in orbit around Venus.

So, Hon. Ed., are you not thinking that are reely peechy kind of amchoor radio stayshun!! I'm not sure how I'll get it licensed, but I am sure I'll have an answer to that by time I figyouring out how to get the money to building it!

Respectively yours,
Hashafisti Scratchi

Propagation [*from page 104*]

160	16-18 (1-0) 18-20 (2-1) 20-05 (4) 05-07 (3-2) 07-09 (2-1) 09-11 (1-0)	17-19 (1-0) 19-20 (1) 20-02 (4-3) 02-05 (3-2) 05-07 (2-1) 07-09 (1-0)	19-20 (1-0) 20-22 (3-1) 22-02 (3) 02-05 (2-1) 05-07 (1)	20-22 (1-0) 22-02 (3-2) 02-05 (1) 05-07 (1-0)

Hawaii

Openings Given In Hawaiian Standard Time †

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	06-08 (1) 08-12 (2) 12-14 (3) 14-16 (2) 16-17 (1)	05-06 (1) 06-08 (2) 08-12 (1) 12-16 (2) 16-18 (3) 18-20 (2) 20-22 (1)	11-14 (1) 14-16 (2) 16-18 (3) 18-21 (4) 21-00 (3) 00-04 (2) 04-06 (3) 06-07 (2) 07-08 (1)	18-20 (1) 20-23 (2) 23-00 (3) 00-01 (2) 01-02 (1) 20-22 (1)* 22-00 (2)* 00-01 (1)*
Central USA	06-08 (1) 08-11 (2) 11-14 (4) 14-16 (2) 16-17 (1)	05-06 (1) 06-08 (2) 08-10 (1) 10-12 (2) 12-14 (3) 14-16 (4) 16-18 (3) 18-20 (2) 20-22 (1)	09-14 (1) 14-16 (2) 16-18 (3) 18-22 (4) 22-00 (3) 00-04 (2) 04-06 (3) 06-09 (2)	18-20 (1) 20-22 (2) 22-01 (3) 01-03 (2) 03-04 (1) 21-22 (1)* 22-00 (2)* 00-02 (1)*
Western USA	07-09 (1) 09-11 (2) 11-14 (4) 14-16 (3) 16-18 (2) 18-19 (1)	06-07 (1) 07-09 (2) 09-14 (3) 14-17 (4) 17-19 (3) 19-22 (2) 22-00 (1)	10-15 (2) 15-17 (3) 17-19 (4) 19-00 (3) 00-02 (2) 02-04 (1) 04-06 (2) 06-08 (4) 08-10 (3)	18-19 (1) 19-20 (2) 20-02 (4) 02-04 (3) 04-05 (2) 05-06 (1) 21-22 (1)* 22-23 (2)* 23-02 (3)* 02-03 (2)* 03-04 (1)*

Alaska

Openings Given In GMT ‡

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	18-20 (1) 20-23 (2) 23-00 (1)	16-18 (1) 18-22 (2) 22-01 (3) 01-02 (2) 02-03 (1)	14-16 (1) 21-23 (1) 23-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	08-12 (1)
Central USA	19-21 (1) 21-00 (2) 00-02 (1)	17-19 (1) 19-22 (2) 22-00 (3) 00-02 (4) 02-03 (2) 03-04 (1)	15-17 (1) 21-23 (1) 23-00 (2) 00-04 (3) 04-05 (2) 05-07 (1)	08-14 (1)
Western USA	20-22 (1) 22-00 (2) 00-02 (3) 02-03 (2) 03-04 (1)	18-21 (1) 21-23 (2) 23-02 (4) 02-03 (3) 03-05 (2) 05-06 (1)	16-18 (1) 18-20 (3) 20-00 (2) 00-02 (3) 02-04 (4) 04-05 (3) 05-06 (2) 06-10 (1)	08-11 (1) 11-14 (2) 14-16 (1) 11-14 (1)*

†To use in other areas of the United States, *add* 5 hours to the times appearing in the Chart in the Eastern Standard Time Zone; 4 hours in the CST Zone; 3 hours in the MST Zone and 2 hours in the PST Zone. For example, when it is Noon, or 12 hours, in Honolulu, it is 5 P.M., or 17 hours, EST in N.Y.C.

‡To convert to Local Standard Time in Alaska, *subtract* 8 hours from the times appearing in the Chart in the Pacific Standard Time Zone; 9 hours in the Yukon Zone and 10 hours in the Alaskan Standard Time Zone. To use in other areas of the United States, *subtract* 5 hours in the EST Zone; 6 hours in the CST Zone; 7 hours in the MST Zone and 8 hours in the PST Zone.

*Indicates predicted 80 Meter openings. Openings on 160 Meters are also likely to occur during those times when 80 Meter openings are shown with a forecast rating of (2) or higher.

FREE!
Ham Shop Ads

Beginning with the March issue, CQ will offer a new free service, on a trial basis, to its subscribers. What's the deal? Simply this: If you are a regular subscriber to CQ, you will be offered a FREE Ham Shop ad in the very next available issue of CQ, and *every* issue during the duration of your subscription! No strings attached! It's just one more little way we feel we can better serve our regular readers.

How does it work? Just **type** or print your ad, (limit: 3 lines or about 150 characters), on a **POST CARD**, attach your mailing label from your latest issue of CQ, and mail it to: **(POST CARDS ONLY)**

FREE Hamshop Ads
CQ, The Radio Amateur's Journal
14 Vanderventer Avenue
Port Washington, L.I., N.Y. 11050

That's all there is to it.

A few logical limits have to be imposed: Due to space limitations, only six columns per month can be allocated to the New Free Ham Shop, so ads must be run on a first-come, first-served basis. Postmark will be the determining factor. If, because of late arrival, your ad can't make a given issue, it gets first preference for the very next issue, but still you'll want to get your ad in early. Only one ad per subscriber per issue. Your mailing label is an absolute **must;** no label, no free ad.

Nov. CQ is the next issue you can make. Deadline is Sept. 5. Mail your ad today.

No ads from commercial enterprises, please. This service is designed to aid the cash-tight **amateur** only!

The publisher reserves the right to refuse any ad he feels is unfairly deceptive or unsuitable for an amateur magazine. He also reserves the right to withdraw this offer without notice.

Ham Shop

Advertising Rates: Non-commercial ads 10¢ per word including abbreviations and addresses. Commercial and organization ads, 35¢ per word. **Minimum Charge $1.00.** No ad will be printed unless accompanied by full remittance. **Closing Date:** The 10th day of the second month preceding date of publication.

Because the advertisers and equipment contained in Ham Shop have not been investigated, the publishers of CQ cannot vouch for the merchandise listed therein.

Direct All Correspondence & Copy to: **CQ Ham Shop, 14 Vanderventer Ave., Port Washington, L.I. N.Y. 11050.**

RADARS Wanted: Radar equipment of all kinds bought. Writ M. Cemprola, 550 Fifth Avenue, New York, New York 10036.

GOVERNMENT surplus picture catalog 25¢. Meshna, Nahan Mass. 01908.

QSL's by RUTGERS VARI-TYPING SERVICE, Thomas Street, Milfor N.J. 08848. Free Samples.

QUADS: Proven sensational! All metal (except spacing insulat dowels): full size; two element; absolutely complete with boo all hardware, wire and fittings; terrific gain and directivity; bamboo or fiberglass; uses single 52 ohm coaxial feedline. 1 15-20 quad, $35; 15-20 quad, $32; 10-15 quad, $30; 20 met quad, $25; 15 meter quad, $24; 10 meter quad, $23. Remit wi order, shipped charges collect same day. Gotham, 1807 Pur Ave., Miami Beach, Fla. 33139.

HOT-SHOT CARD. Designed for clubs and individuals engaged emergency communication, this 4" by 5" red card with bla printing may be placed in your mobile unit's window to identi you as an "Emergency Radio Unit." Card is on a heavy Brist board stock and is almost identical to those issued to regu emergency vehicles by many agencies. 50¢ each, ppd, or ava able in bulk amounts of 25 cards for $6.25. Order now fro HOT SHOT CARD, c/o CQ's Ham Shop, 14 Vanderventer Av Port Washington, L.I., N.Y. 11050.

RED or WHITE, die cut Scotchlite letters. Day-Night Visibili Postpaid/letter, 2"-15¢, 2½"-20¢, 3"-25¢. Portage Industri Inc., Dept. B, Box 188, Portage, Ind. 46368.

POLICE—fire—aircraft—amateur calls on your broadcast radi Tune the band with TUNAVERTER. Free catalog. Salch Compa Dept. CC, Woodsboro, Texas 78393.

RUBBER ADDRESS STAMP including call letters. Three or f line text $1.50. Signature stamp $2.88. Free catalog. Jacks Stamps, 1433 Winnemac, Chicago, Illinois 60640.

SHIELDING Systems, Kits, accessories. Eliminate mobile int ference. Estes Engineering, 1639 West 135th, Gardena, Ca 90249.

QSLs—BROWNIE—W3CJI—3111 Lehigh, Allentown, Pa. 181 Samples 10¢ with catalog 25¢.

HIGHLY Effective home study review for FCC commercial ph exams. Free Literature. Cook's School of Electronics, P.O. 36185, Houston, Texas 77036.

WANTED—QST's—Last four issues needed to complete priv collection. 1916—FEB., MAY, JUNE, JULY. Any reasonable pr paid. K2EEK, CQ Magazine, 14 Vanderventer Ave., Port Wa ington, L.I., New York 11050.

WANTED: Silver Dollars any date. Must see actual coin befor can make a firm offer. If interested in making a profit on y dollars send your silver dollars to me by insured mail. I return any and all postage even if we can not come to ter Coins not accepted will be returned immediately by insu mail. Send to HAM SHOP, c/o CQ MAGAZINE, Box CESR, Vanderventer Avenue, Port Washington, L.I., N.Y. 11050.

QSL CARDS. Samples 25¢ Malgo Press, Box 375, Toledo, O 43601.

CLUB EMBLEMS reproduced as embroidered patches. S sketch, colors, size, quantity for quotation. Alabama Sportsw Box 1505, Decatur, Alabama 35601.

YOUR Card in glittering raised 3-D on blazing backgrounds comes a beautiful collector's item. Samples 25¢ (refundab 3-D QSL Co., Monson, "4", Mass. 01057.

SOLID STATE SALES would like to send you one of their catalo They have for sale transistors, rectifiers, zeners, SCR's switches and many other semiconductor devices in large small quantities. All devices are checked and guaranteed. I grated circuits (JK, SR, SRT, Flip flops and gates) with chec imputs and diagrams are available. Include 20¢ for handl which will be deducted from your first order. Solid State Sal Box 746, Somerville, Mass. 02143.

HUNDRED QSL's. $1.00 Samples, dime. Holland Printing, R3, 649, Duluth, Minn. 55803.

CQ, April 1945 still needed to complete my collection. Also R/9, Nos. 40, 41 & 43-49, and RADIO, July 1935. F. A. Herridge, G31DG, 96 George Street, Basingstoke, Hampshire, England.

SBE-34. Never Mobile. Like new condition. Can't take overseas. $300. Capt. Len Clark, W5AYS/4, Cross City AFS, Florida 32628.

HEATH HR-10 Recv, 2 months old, Factory aligned. $65. Gus Lucas, WN5RYN, 414 Durango, El Paso, Texas 79901.

FOR SALE—Viking Invader 200 $300. Johnson Phone Patch—$18. Johnson SWR indc. to coupler—$28. Charles Kaufman, 231 So. Jasmine Denver, Colorado 80222.

SELL: QST—'36 thru '66, CQ—'46 thru '66, Radio—'36 thru '41. Some issues missing. Make offer—you pay shipping. F. Hassenplug, W3JYU, 21 S. 29th St., Camp Hill, Pa. 17011.

WANTED: KWM-2- or 2A, 75S-3B or 3C, "S" Line and KWM-2 accessories. State price, modifications and when made. Heinlein, W7BIF, 107 Wyoming, Boulder City, Nev. 89005.

FOR SALE—KWS 1 like new. Mod 15 with table, AFRCUG T.U. 0-73/4RT NFSK RTTY exciter. LAE 4, 'X' band sig generators. PRC-6 Walkie Talkies. A. B. Hitterdal, W6ILL, Box 841, Woodland Hills, Calif. 91364.

TUBE TESTERS—Used in drug stores—perfect condition—$12.50—Ted Banks, WN9UNQ, A1655 E. 91st St., Chicago, Illinois 60617.

SINGLE SIDE Band station complete $500.00 Clegg equipment—Venus-Booster-Apollo linear, and National power supply/speaker. Price firm, will not split, and will not ship. Mint condition. Snyder, K3YMN, 2185 Sampson Street, Pittsburgh, Pa. 15235.

NEW UNUSED (Never Unpacked) HQ-170C—$290.00 and Johnson 6 N2 Converter (factory wired)—$65.00. Excellent SB-400—$290.00. Much More—Stamp for list. J. R. Shank, W3CNS, 21 Terrace Lane, Elizabethtown, Pa. 17022.

RTTY WANTED—Model 28 ASR. Will consider KSR—Sell 14 typing report with keyboard, 14 TD new, Mendelson, W2OKO, 27 Somerset Pl., Murray Hill, N.J.

FOR SALE: Jennings Vac. Var. UCS-300, 300 mkd, $30. 4-400A (new $30. 4-400A (used) 2 hours) $18. PL-175A penta (slightly used-good), $25. SWØ54 Receiver, $20. Ferris, W4TYZ, 120 Williams Terr., Warner Robins, Ga. 31093.

MOBILE 55 Amp Alternator with transistorized regulator Good Condx $30. Collins 8R-1 Xtal calib. for 75A-2, 3 mint $10. H. C. Sherrod, Jr., 3635 Barcroft View Terr., Falls Church, Va. 22041.

WANTED: your old Antique receiving and transmitting vacuum tubes with brass bases for private ham collection. R. W. Schnedorf, W9LGH, 610 Monroe Ave., River Forest, Illinois 60305.

WANTED TO BUY: old radio receivers and transmitters, books, magazines, call books and early radio parts for amatier museum. Erv Rasmussen, W6YPM, 164 Lowell Street, Redwood City, Calif. 94062.

WANTED—Following tubes, Donle, Margo detector, Kellogg Top Heater, Brass base. Dage, W2EZM, 431 Oakland, Maple Shade, N.J. 08052.

FOR SALE: Gonset Super 12 and gonest noise silencer, both in mint condition and post paid anywhere $30. Orson Curtis, W8JSK, 855 Woodworth, Jackson, Mich. 49202.

KWM2 $750. A1 in and out. BTI-LK 2000 save. SB34 Demo $340. ADCOM 350-12 800 V. 350W Power SY & Cable New $100. 30 LI $400. SB 200 $190. Hygain Ants. save-terms. F. Baker, W8FLT, Box 546, McComb, Ohio 45858.

COMMUNICATOR II—B 6 MTR 12V $100. P&H 6-150 Six MTR Transverter $200. 829B's @ $4; 4D32's used, Gtd. $5 ea. Large Items REA collect, money order or certified check, PLS. E. F. Lankford, W4HHY, 511 Purnell Dr., Nashville, Tenn. 37211.

SELL HEAHTKIT QF-1 $6; VF-1 $10; Meissner FM tuner $12; Millen 90501 freq. standard DC-9-M crystal $27; Robert Ireland, Pleasant Valley, N.Y. 12569.

TOO MUCH Equipment. Mint one month old galaxy V MK II, deluxe console, AC 35 supply. Will ship in original factory cartons, $500 firm. plus shipping. Mike Schwartz, K9CZV, 4608 N. Central Park Ave., Chicago, Illinois 60625.

WHO has a National HFS receiver they will sell me? Lorenson, Hillsdale, N.Y. 12529.

FOR SALE: Apache—cheap. 2B, 2BQ, 2AC—$175. Knight star Roamer rx—$20. Mosley V3-$15 Telex Magna Twin headset—$12. Terry Windmiller, Wa4YSG, 752 NE, 128 St., N. Miami, Fla. 33161.

TG-34B Keyer, instructions, McElroy tape and book, Posi-check questions and answers for general and extra exams. $25.00 FOB. Barker, W2AFV, P.O. Box 725, Sag Harbor, N.Y. 11963.

WANTED: Any coils for HRO-7 or HRO-5 or HRO-M receiver Especially need BC Band and 15 M Band spread. Phill Reich, W2HUG, 226 Linden Place, New Milford, N.J. 07646.

DRAKE 2B, 2BQ, 2AC, $195. Drake 2BS $6. Elmac AF67 $25 Harold Beebe, W9OEQ, Box 25, Mokena, Illinois 60448.

WANTED—BW 850 A, 852, F10A, Variable Vacuums, other KW items. Must be reasonable. State price and condition. Reply Airmail, KZ5FN, William F. Montgomery, Jr., Box 27, Gatun, CZ

12V converter 50 MC less Xtal $20, ATR inverter 117 VDC to 117 VAC $5. Nuvistaplug replaces pentode $9, H. R. Bettke, 18 Kingsley Dr., Yonkers, N.Y. 10710.

FOR SALE: ARC-5 Receivers (a) 3-6 MC, (b) 0.52-1 mc, (c) 190-550KC; Heath Q Meter; SW-3 with 6 pair coils and 2 sets of tubes. Subraco 10 M-AM Tx. Leskinen, WZRUZ, 33-45 172 St., Flushing, N.Y. 11358.

FOR SALE: DX-40, $25.00; SX-99, $50.00. with manuals certified check or money order—you pay shipping. N. A. Ginga, WA2MTI, 21 Napoleon St., Newark, N.J. 07105.

ANTENNA Engineering handbook by Jasik, new $20. Harber Wells TBS-50C and p/s 2-80 mtr $45. Heath VF-1 vfo $10. Heath Ten'er $40. Amperex HV 6693 new $10 ea. RCA 3E29 (829) new $7 ea. 6080WA $5. D. R. Etheredge, K6UMV, 12040 Redbank St., Sun Valley, Cal. 91352.

SELL Heath Apache, SB-10, Mosley CM-1 Rcvr. First $200 certified check, Freight collect. Furno, WA4KJX, 13310 108 Ave., N. Largo, Fla. 33540.

HQ 170 A mint condx $195, DX40 FB XMTR $30. H6-10 VFO $20. Johnson T-R switch $20. 25 Watt home brew 6 MTR XMTR, $20. will sell above as complete station for $270. or separate. Talbot, WA8LTJ, 131 Pepperidge LN., Battle Creek, Mich. 49015.

TEKTRONIX 511AD with manual, central electronics 200V, model 26 with table. Henry C. Garretson, III, K2SSX, Box 175 A, RD 3, Troy, N.Y. 12180.

DRAKE 2B. $170. Warrion Amplifier 1000 W. PEP. $150. Heath QFL, Q moltiplier $7. WRL. VFO 755, $15. All Fob Spark. Nick, K7AØA, 5750 Yukon Dr., Sparks, Nev. 89431.

COUNTY HUNTERS: Send your most wanted county list and if you might be interested in a county hunters bulletin to county expeditions. Paulson, P.O. Box 4, Needham, Mass.

MOTOROLA Service manuals for VHF mobile units. Twin V and T-Power series. $5. each. Saltus, K6AVF, 10074 Cristobal Dr., Spring Valley, Calif. 92077.

FOR SALE: Ameco 2 Meter Visitor convertor 14-18 MC $15. John Wentz, Box 102, West Liberty, Ohio 43357.

EICO 753, $150; AC or DC supply, $50 ea., ART-13, $49; WAØLJM, Box 138, Mayville, N. Dak. 58257.

SELL-TRADE: RCA-TK20 Film camera with TM 6 B master monitor, 2-WP33 power supplies and consoles, make offer. Tate, W4AIS, 7 Artillery, Taylors, S.C. 29687.

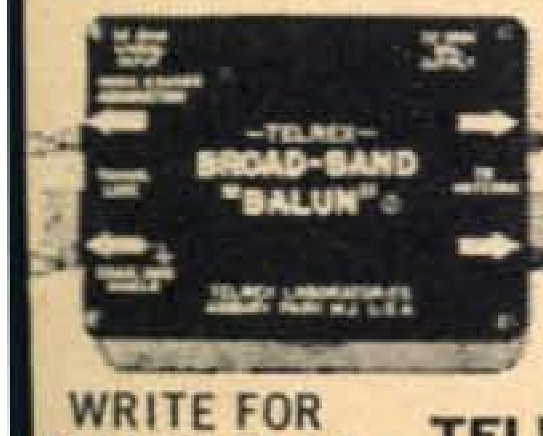
FOR SALE: Heath Apache, factory reconditioned in January, needs power xfmr, $100. Drake 2B, 2BQ Q Multiplier speaker, 2AC xtal calibrator, $175. Mosley V3 vertical $15. Knight Star roamer receiver $20 pp. Telex Magna Twin headset $12 pp. All reasonable offers considered. T. Windmiller, WA4YSG, 752 NE 128 St., Apt. #4, North Miami, Fla. 33161.

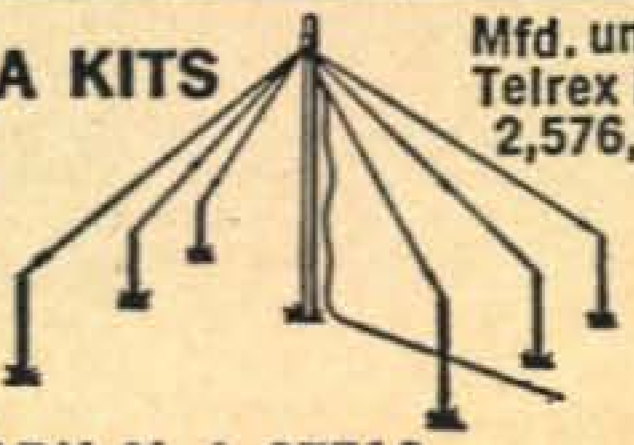
FOR SALE—B7K model 700 Tube testor $35., Model 600S Lysco transmitter—$25. Good cond. Breyfogle, WØMDM, 18 North 7 Street, Estherville, Iowa 51234.

FOR SALE: Elmac AF-68 transmitter—PMR-8 Receiver-M-1070 for 6 or 12 DC and 117 VAC power supply. Selling price $200. Mobile mount included, with interconnecting cables. Harry E. Miller, WA3BSK, 820 12th St., Altoona, Pa. 16602.

FOR SALE: AN/TT-63A Regenerative Repeater, $25 incl shipping. Less tubes and wetted-mercury relay, but like new condition. Bill L. Nielsen, P.O. Box 47, APO, N.Y., N.Y. 09757.

★ **PLEASE** include your **ZIP** code number on all correspondence. ★





For further information, check number 26, on page 126

For further information, check number 23, on page 126

READER SERVICE

NAME ________________ CALL ________
(Please Print)

ADDRESS ________________

CITY ________________

STATE ________________ ZIP CODE ______

Please send me more information on your ads in the Sept. 1967 *CQ* keyed as follows:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	Total Inquiries				

Void after Sept. 1967

CQ MAGAZINE, Dept. RS
14 Vanderventer Ave.
Port Washington, L. I., N. Y. 11050

advertisers index

For further information, check number 18, on page 126

U.S.A. FIRST !

DOUBLE BONUS

$25 ☐ FREE WORTH OF
- Transistors
- Rectifiers
- Condensers
- Diodes
- Knobs
- Coils, etc.

Radio, TV Parts. Add 25¢ for handling

—PLUS—

CHOOSE ANY **$1** ITEM FREE ☐ Check Here

BOTH "GIFTS" FREE WITH $10.00 ORDERS

SOLID STATE

24 volt 3 amp. DC

ARC-5 power supplies! in 117 VAC, /60 **9⁹⁵**

MOVIN' *Special!*

2 AMP SILICON RECTIFIERS • GLASS CAPS

PIV	Sale	PIV	Sale
50	☐ 7¢	600	☐ 19¢
100	☐ 9c	800	☐ 29¢
200	☐ 12c	1000	☐ 51¢
400	☐ 16c	1200	☐ 69¢

1. AMP 600 PRV TOP HAT 6 for $1

BEST SELLING 1 AMP TESTED

SILICON RECTIFIERS

PIV	Sale	PIV	Sale	PIV	Sale
50	☐ 5¢	800	☐ 23¢	1800	☐ 99¢
100	☐ 7¢	1000	☐ 40¢	2000	☐ 1.50
200	☐ 9¢	1200	☐ 59¢	3000	☐ 1.90
400	☐ 11¢	1400	☐ 69¢	4000	☐ 2.50
600	☐ 19¢	1600	☐ 89¢		

SILICON POWER STUD RECTIFIERS

Factory Tested — All Tests

AMPS	50 PIV	100 PIV	200 PIV
3	☐ 7¢	☐ 11¢	☐ 17¢
15	☐ 22¢	☐ 40¢	☐ 65¢
45	☐ 75¢	☐ 90¢	☐ 1.25
160	☐ 2.50	☐ 2.95	☐ 4.05
250	☐ 4.50	☐ 5.50	☐ 6.89

AMPS	400 PIV	600 PIV	800 PIV	1000 PIV
3	☐ 22¢	☐ 31¢	☐ 40¢	☐ 59¢
15	☐ 90¢	☐ 1.35	☐ 1.59	☐ 1.79
45	☐ 1.59	☐ 1.90	☐ 2.50	☐ 2.95
160	☐ 5.75	☐ 7.50	☐ 9.25	☐ 10.95
250	☐ 9.59	☐ 12.50	☐ 15.00	☐ 19.95

FACTORY TESTED $1 SEMI-KON-DUCTORS

- ☐ 2—85 WATT 2N424 PLANAR, silicon. TO-53 npn ... $1
- ☐ DUAL TRANSISTORS ☐ PNP (2N2807) ☐ NPN (2N2060) $1
- ☐ 100 GERMANIUM & SILICON DIODES, no test $1
- ☐ 3—40W NPN SILICON MESA 2N1648, transistor $1
- ☐ 4 2N170 TRANSISTORS, by GE, npn for gen'l rf $1
- ☐ 10 3 Amp RECT's, studs, silicon, to 800 V no test $1
- ☐ 4—2N255 POWER TRANSISTOR EQUALS. $1
- ☐ 10 PNP SWITCHING TRANS'TRS. 2N404. no test $1
- ☐ 2N3088 "N" Channel FET'S Very High Input Z ... $1
- ☐ 5 2N107 TRANS'TRS, by GE, pnp, pop, audio pak . $1
- ☐ 5—2N1613 3W NPN SIL. 120 mc, by "Rheem" $1
- ☐ 3—45 AMP POWER RECTIFIERS, stud, silicon....... $1

FACTORY TESTED $1 SEMI-KON-DUCTORS

- ☐ 10 2-6Amp RECT's, studs, silicon to 800 V no test $1
- ☐ 10 PNP SWITCHING TRANSISTORS. no test. TO5 . $1
- ☐ 4 2N43 OUTPUT TRANSISTORS, by GE. pnp. TO5 . $1
- ☐ 3 - "EPOXY" TRANSISTORS 2N3638, by Fairchild $1
- ☐ 10 ZENERS REFERENCES stud, asst types $1
- ☐ 25 TOP HAT RECTIFIERS, silicon, 750 ma, no test $1
- ☐ 2—1000 MC-TRANSISTOR 2N918 NPN SILICON .. $1
- ☐ 4 2N333 NPN SILICON transistors, Transitron .. $1
- ☐ 4 BIDIRECTIONAL TRANSISTORS, 2N1641 .... $1
- ☐ 10 NPN SWITCHING TRANS'TRS, 2N338 no test $1
- ☐ 15 PNP TRANS'TRS, CK722, 2N35, 107, no test $1
- ☐ 15 NPN TRANSISTORS, 2N35, 170, 440, no test $1
- ☐ 30 TRANSISTORS, rf, If, audio osc-ifs, TO5 no test $1
- ☐ 10 FAMOUS CK722 TRANSISTORS. pnp no test .. $1
- ☐ 30 TRANSISTORS, rf, If, audio, no test. TO5 no test $1
- ☐ 4 35-W. TRANS'TRS. 2N1434, CBS, TO10, stud... $1
- ☐ 5 2N706 500MW. 300MC NPN transtrs, TO18 $1

1 AMP Actual Size →

MICROMINIATURE SILICON RECTIFIERS

PIV	Sale	PIV	Sale
50	☐ 5¢	600	☐ 19¢
100	☐ 7¢	800	☐ 25¢
200	☐ 9¢	1000	☐ 45¢
400	☐ 12¢		

ZENER RECTIFIERS Tested

- ☐ 1—WATT...... .49
- ☐ 10 WATTS... 1.00

5.4	18	36 43	82	100
6.4	20	39 47	91	110
8.0	22	51		120
9.1	24	56		130
10	27	62		150
12	30	68		160
13	33	75		180
				200

2N1100 $1.99

VCB (volts) 120

GLASS AMP' ONE AMP

PRV may be exceeded without the rectifier breaking down.

PIV	Sale	PIV	Sale
50	☐ 5¢	600	☐ 19¢
100	☐ 7¢	800	☐ 29¢
200	☐ 9¢	1000	☐ 45¢
400	☐ 13¢	1200	☐ 59¢

☐ **TRANSISTORS 100 for $2⁹⁸**

Power, Audio, RF, untested

SILICON CONTROLLED RECTIFIERS Factory Tested

PRV	7 AMP	16 AMP	25 AMP
50	☐ 48	☐ 70	☐ 80
100	☐ 70	☐ 1.05	☐ 1.20
200	☐ 1.05	☐ 1.30	☐ 1.70
300	☐ 1.60	☐ 1.90	☐ 2.20
400	☐ 2.10	☐ 2.30	☐ 2.70
500	☐ 2.80	☐ 3.00	☐ 3.30
600	☐ 3.00	☐ 3.30	☐ 3.90

HAM SILICON TUBE SPECIALS

- ☐ 5U4GB 2.39
- ☐ 5R4 .... 4.39
- ☐ OZ4 .... 2.39
- ☐ 6AU4GTA...... 2.39
- ☐ 866A 11.19

6-MONTHS' GUARANTEE

Poly Paks, the only company of its kind in the world due to its tremendous purchasing power, quality and factory testing procedures, GUARANTEES all items AS ADVERTISED for 6 months or your money back. A 'FIRST' ANYWHERE

10¢ FOR OUR "XMAS" BARGAIN CATALOG ON: ☐ Semiconductors ☐ Poly Paks ☐ Parts

POLY PAKS

TERMS: send check, money order, include postage—avg. wt. per pak 1 lb. Rated, net 30 days. CODs 25%

P.O. BOX 942Q
SO. LYNNFIELD, MASS. 01940
"PAK-KING" of the World

☐ 2¼" 0—100 MICROAMMETERS DC **$2⁸⁸**

→ MONEY BACK GUARANTEE ←

For further information, check number 14, on page 126

For further information, check number 3, on page 126

You probably thought top quality electronic test instruments were too expensive ...*didn't you*

Well, they're not when you build them with money-saving RCA kits

You've known right along that you can save money on electronic test instruments by building from kits.

But you may have shied away from kits because you thought they involved complicated calibration or adjustment problems. Forget it!

RCA kits are inexpensive, of course, but they're also easy to build. Build them right and they'll give you the best performance you can buy in their price range.

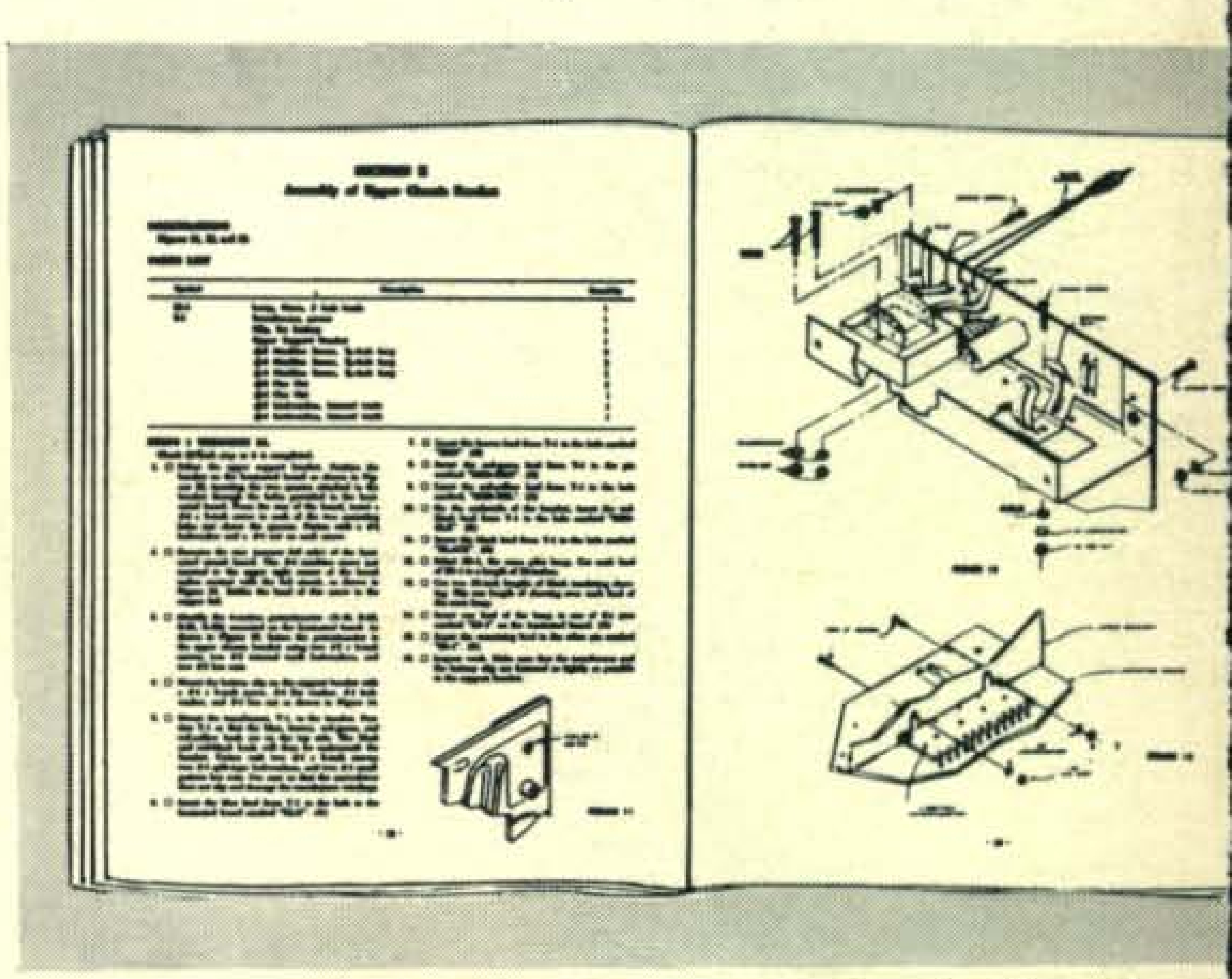
What's better about RCA test instrument kits?

Ease of assembly is one thing. Parts are clearly identified. Each assembly diagram appears on the same page as the step-by-step instructions for that section of assembly. There's no need to refer back constantly to other pages, which consumes time and increases the chance of error.

Ease of alignment is another thing. Each kit contains complete instructions for accurate calibration or alignment of the instrument. Where necessary, precision calibrating resistors are provided for this purpose.

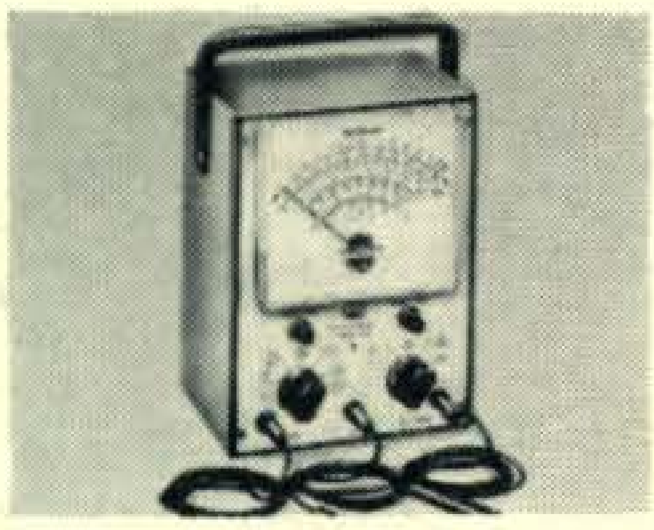
What does it mean? It means that with RCA kits you can get a professional V-O-M or VTVM for as little as $38.00*. Or you can get a good oscilloscope (one of the most useful—but normally one of the most expensive—test instruments) for only $99.00*

Specialized instruments such as an AC VTVM or an RF Generator, are also available as kits for far less than they cost otherwise. In every case, RCA kits, when complete identical with RCA factory assembled instruments.

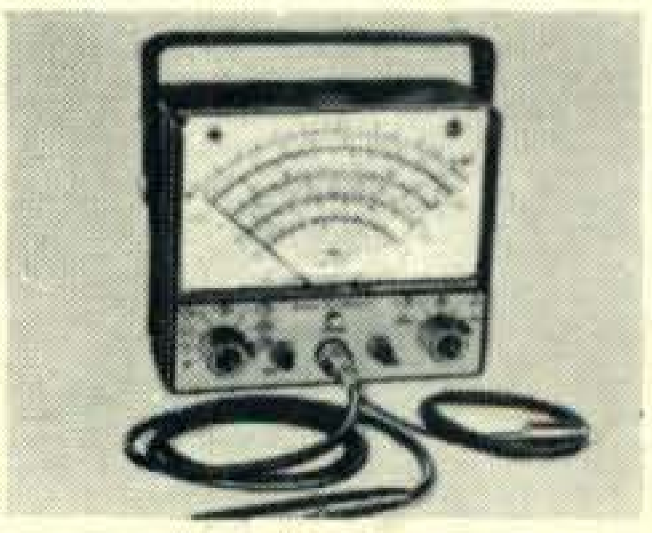


Each sub-assembly is described in a separate section with illustrations a to that sub-assembly available at a glance. No cross referencing ne

LOOK WHAT'S AVAILABLE TO YOU IN KIT FORM:



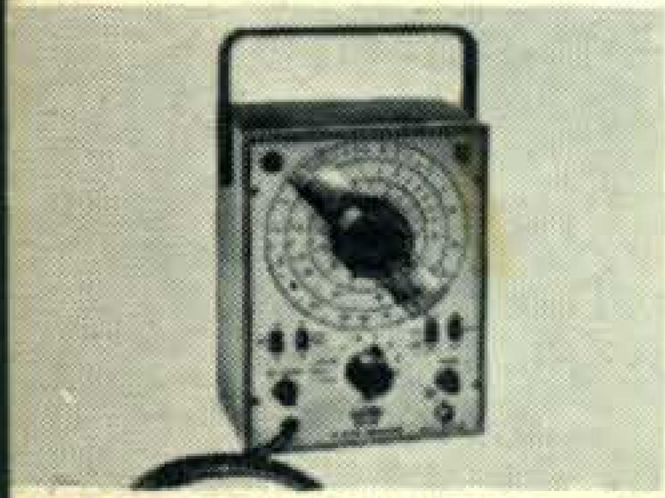
RCA VOLTOHMYST®. The most popular VTVM on the market. WV-77E(K). Kit price: $38.00*



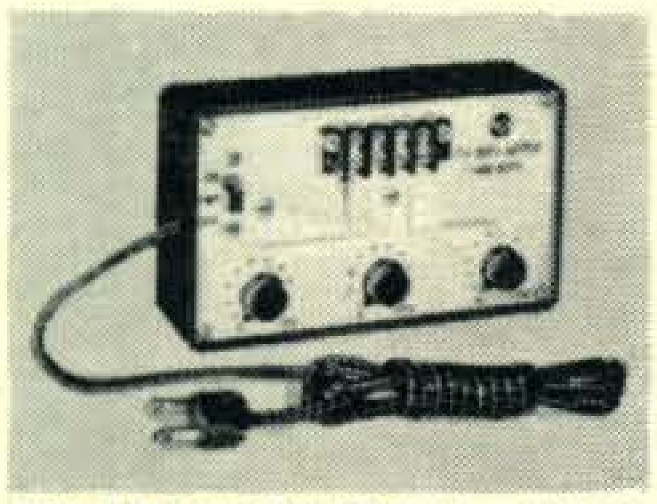
RCA SENIOR VOLTOHMYST. professional VTVM. WV-98C(K). Kit price: $57.95*

RCA VOLT-OHM-MILLIAMMETER. One of most useful instruments. WV-38A(K). Kit price: $38.00*

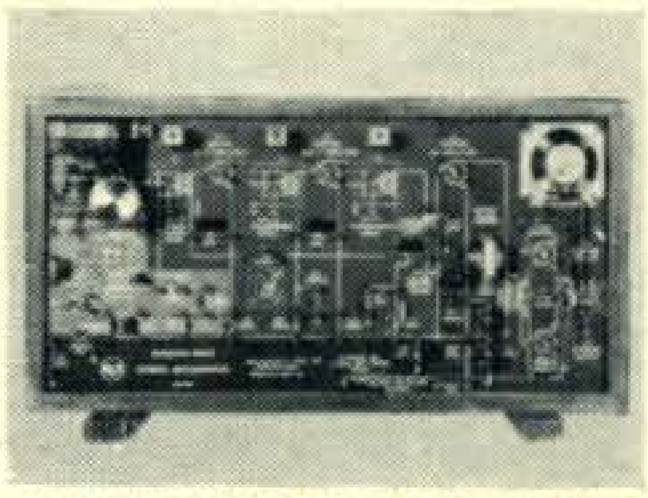
RCA 3-INCH OSCILLOSCOPE. C pact, lightweight, portable. WO-33A(K). Kit price: $99.00



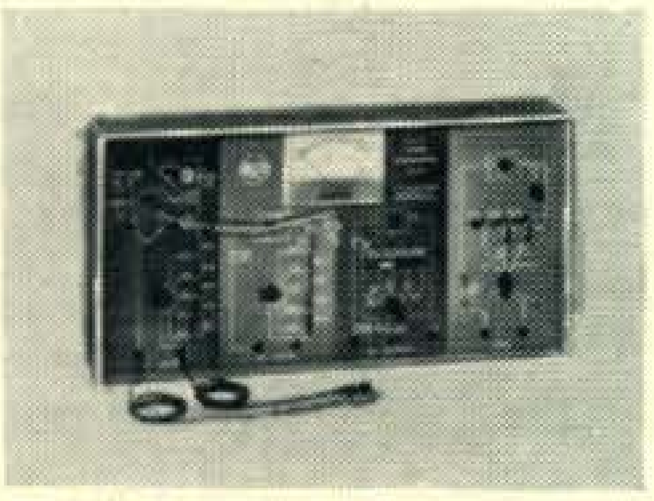
RCA RF SIGNAL GENERATOR, with sweep features. WR-50B(K). Kit price: $45.00*



RCA TV BIAS SUPPLY. For RF, IF alignment in TV sets. WG-307B(K). Kit price: $11.95*



RCA TRANSISTOR-RADIO DYNAMIC DEMONSTRATOR. For schools. WE-93A(K). Kit price: $39.95*



RCA V-O-M DYNAMIC DEMONSTRATOR. A working V-O-M. WE-95A(K). Kit price: $37.95*

See them all—and get full te cal specifications for each—at local Authorized RCA Test E ment Distributor. Or write fo formation to: Commercial neering, Section **I-15W** RCA E TRONIC COMPONENTS AND VICES, HARRISON, N. J.

*User price (opti

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N

RCA® **The Most Trusted Name in Electronics**