CQ

DECEMBER, 1948

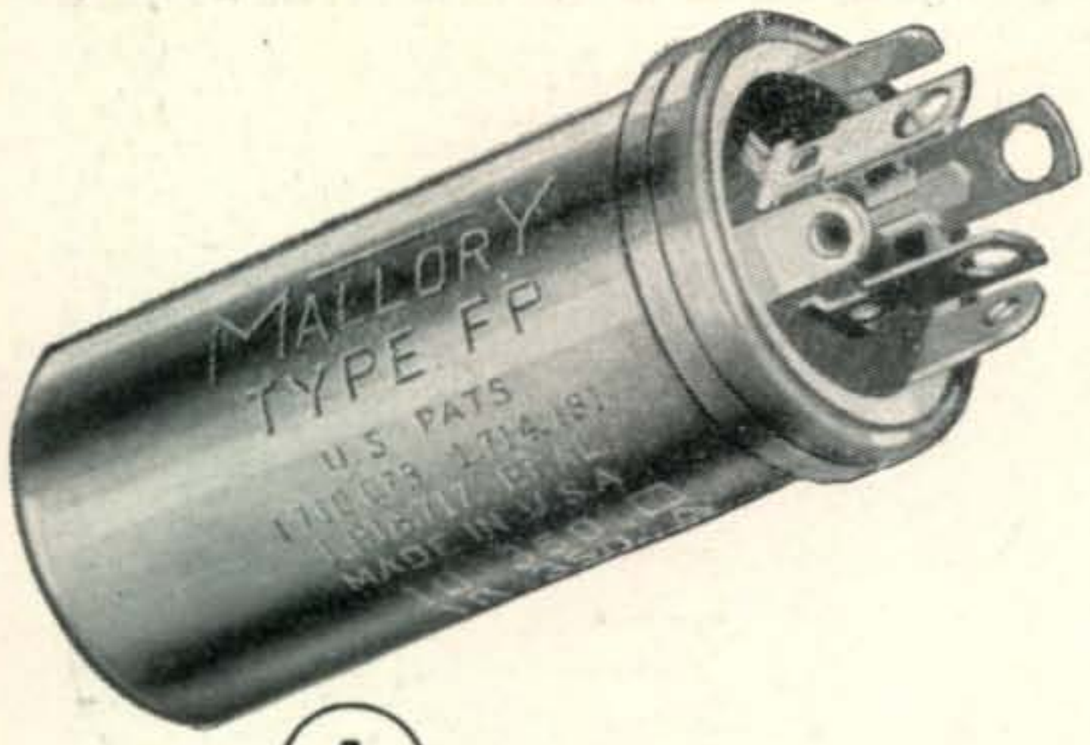
The Radio Amateurs' Journal

35¢

THIS MONTH

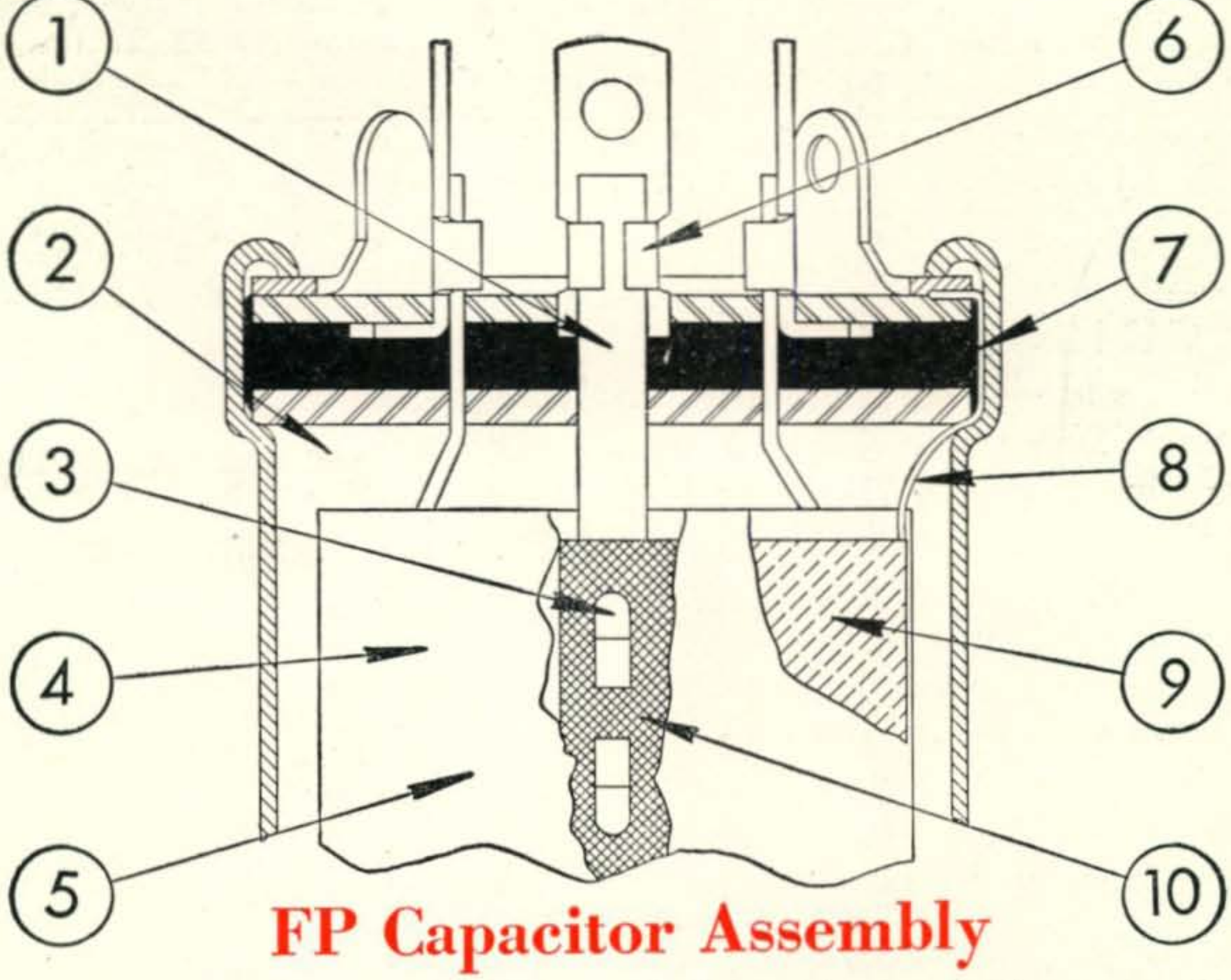
- Cubical Quad — Topic Number One!
- Beginners' Super for 80, 40 & 20
- Mobile Operation on 75-Meter Phone
- The "Final" Final — TVI Proofed

Published by RADIO MAGAZINES, INC. Subscription $3.00 a year



Mallory Electrolytics Are Better Than Ever

. . . New Improvements Make Your Dependable Old Friends Even More Dependable



FP Capacitor Assembly

① *New design anode tabs cannot break from vibration.*

② *Ample air space retained for gas expansion at elevated temperatures.*

③ *New staking method between anode and tab permits higher discharge currents.*

④ *Improved high surge separator material better at high temperatures.*

⑤ *Unique processing improvements provide still better performance at 85°C. No voltage derating required by Mallory FP capacitors at this temperature. (Including the 450V rating.)*

⑥ *Lower tab to terminal contact resistance for sensitive circuits.*

⑦ *Extra heavy rubber seal for high temperature and ripple conditions with venting feature preserved.*

⑧ *Heavier cathode tab for better tab to ring weld, lower resistance and more rugged mechanical construction.*

⑨ *Special etched cathode (all voltages) reduces loss of capacity under high ripple conditions, lowers RF impedance and remarkably reduces intersection coupling.*

⑩ *Increased FP anode ratio of 12 to 1 at 450V and 15 to 1 at 150V provides better design factors.*

Still cost no more. **Mallory FP capacitors have given exceptional performance at prices comparable to ordinary capacitors. These new improvements have all been accomplished without extra cost to the user.**

P. R. MALLORY & CO., Inc.
INDIANAPOLIS 6 INDIANA

P.R. MALLORY & CO. Inc.
MALLORY

PLAYS ANY POSITION

. . . and performs capably, no matter what its circuit assignment

GL-807 BEAM POWER AMPLIFIER

Without a peer as a utility tube, the GL-807 in CW r-f work will serve as:

- **oscillator, crystal or self-excited.**
- **buffer.**
- **doubler, tripler, quadrupler, etc.**
- **final tube, singly or in push-pull.**

Input (see ratings) is high enough to power a rig that's respected. Frequency is up to 60 mc at max ratings, or well above the 6-meter operating band.

The audio end also finds Type GL-807 a natural for modulator work and speech-amplifier service. You phone men may judge the tube's worth from the fact that a pair in Class AB_1 operation will put out 120 w, ample to modulate a quarter-kilowatt transmitter.

Two things especially make the GL-807 such a keen ham-rig performer. It's a tube designed with the amateur's needs in mind; so its ratings lie in the area of greatest usefulness. It's a beam power tube, and this means maximum output with minimum drive—in short, *efficiency.*

As for tube dollar-value—a GL-807 costs less than a pair of average receiving types! There's no better "buy"! Your nearby G-E tube distributor will be glad to quote you the low price, or write to *Electronics Department, General Electric Co., Schenectady 5, N. Y.*

Filament voltage		6.3 v
current		0.9 amp
Max ratings, ICAS:	Phone	CW
voltage	600 v	750 v
current	100 ma	100 ma
input	60 w	75 w
dissipation	25 w	30 w
Freq. at max ratings	60 mc	

Christmas Greetings

● Best wishes for a happy holiday season to all my ham friends! We can be proud of a past year of progress in amateur radio. 1949 will be marked by further important developments now foreshadowed by G-E electronics research. *My New Year's pledge:* always to keep you posted, through *Ham News,* on what's new, what's useful—and how to build and apply each device, looking to the improved performance of your rig.

Lighthouse Larry

ELECTRONIC TUBES OF ALL TYPES FOR THE RADIO AMATEUR

GENERAL ELECTRIC

161-GA12-8850

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Your BUD Distributor Has Them!

Scarcity of steel is a major problem today. Yet, right now . . . when it comes to sheet metal equipment . . . your BUD Distributor has this problem licked!

We at BUD RADIO, INC., make 337 different sheet metal products and 290 of them are available, at this time, for immediate delivery. That means that 86 % of the cabinets, chassis, utility boxes, carrying cases, etc. are either in stock at your distributor or available to him for immediate delivery, from us.

Don't wait . . . now is the time for you to satisfy your needs for sheet metal equipment.

See your BUD distributor today. Compare QUALITY. Compare AVAILABILITY. Compare PRICE. You, too, will agree that it is wise to.

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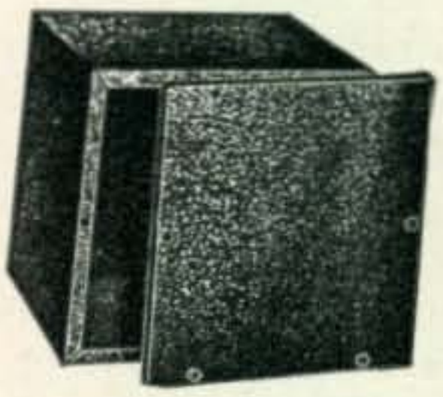

BUD Utility Cabinets

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BUD RADIO Inc.

2120 East 55th St.,
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CQ

The Radio Amateurs' Journal

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Vol. 4 **DECEMBER, 1948** **No. 12**

In This Issue

COVER—No antenna in recent years has excited as much comment as the "cubical quad." From coast to coast amateurs are talking about this beam that incorporates many advantages. And the proof of the pudding is in the eating, because quad users everywhere have been reporting excellent results. But most amateurs have never even see a quad. The one on the cover is very much in use by W8RLT, Larry Mueller, an outstanding phone DX man. Larry's quad has been out-performing his rotary which impressively dominates the background. For further notes turn to page 37.

1924 ★ Happy ★ 1949

New Year's Greeting

TO

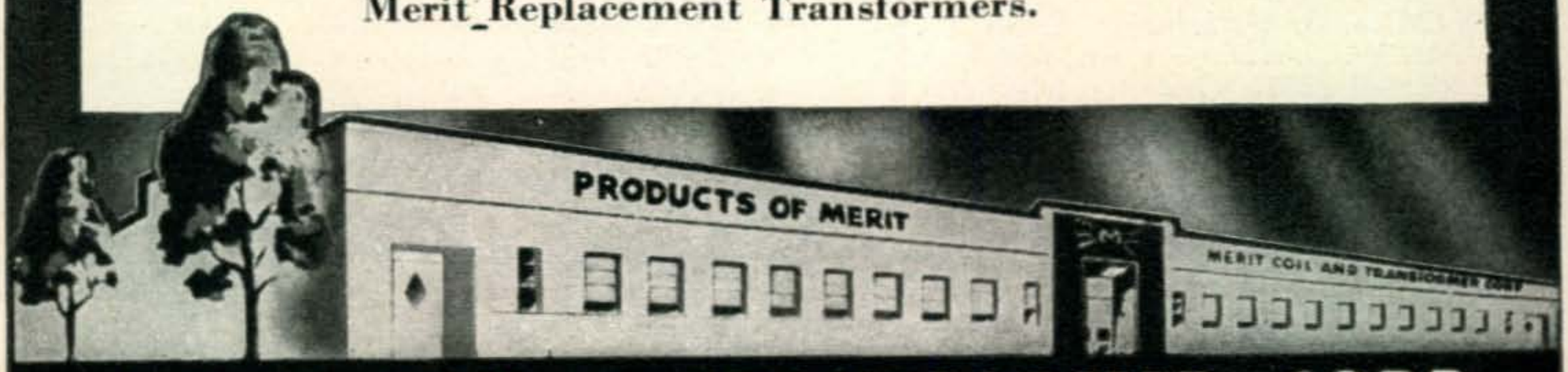
Merit's CUSTOMERS in

MERIT'S 25th ANNIVERSARY YEAR

It is an especial pleasure to send this message to all users, old, new, and prospective, of

PRODUCTS OF MERIT

This anniversary marks a quarter of a century of success and satisfaction with Merit's fine radio parts, and our promise to maintain and advance their superiorities as in the past. You are invited to inspect the new types for amateur and industrial use. Your distributor has them in stock. Merit Quality Transformers cover the widest range. See Radio Industry Red Book for full data on Merit Replacement Transformers.



MERIT COIL & TRANSFORMER CORP.

TELEPHONE

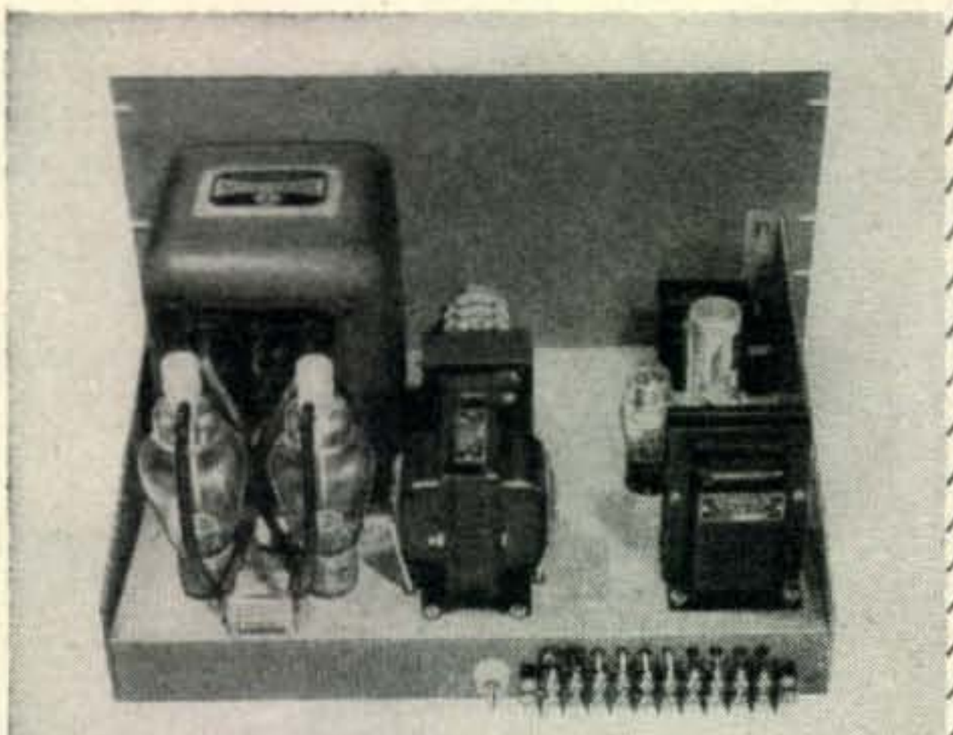
4427 North Clark St. Long Beach 6311 CHICAGO 40 ILL.

How Hams are using the HYTRON 5514

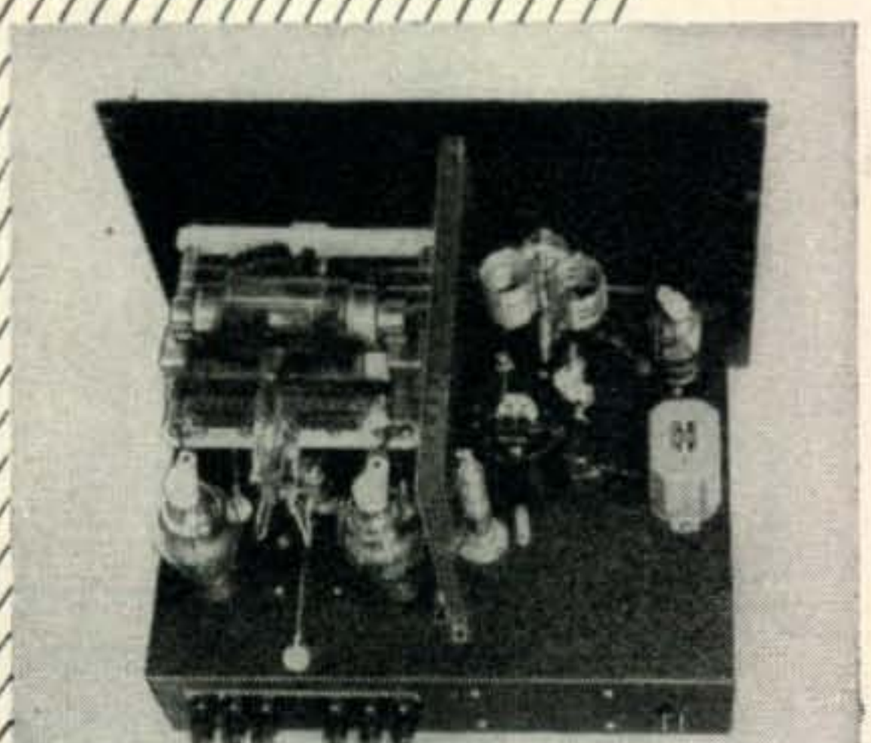
HYTRON
5514
$4.95

Most complete characteristics sheet for a transmitting triode; typical operation data for 8 plate potentials. Also class B Interchangeability Chart demonstrating comparatively the 5514's superiority over other triodes. Write for both.

W1PEK's complete 350-w, 3.5-to-28-mc, 'phone/c-w transmitter uses 4 Hytron 5514's — class B and C — and only 7 cubic feet of space. QST for Sept., 1947, pp. 37–46.



Two 5514's class B deliver 300 w at 1250 plate v, zero bias. (At 1500 plate v, −4.5 v bias, 5514's will give 400 w class B.) RADIO HANDBOOK, 11th Ed., pp. 336–337.



W1IVU/6's half-kw rig on single chassis. Economical zero bias throughout. All Hytron: 2E25 osc., 5514 driver, 5514 push-pull final. CQ for Oct., 1947, pp. 32–35.

Simple, economical, 3-stage, 3.5-to-28-mc outfit. Single 5514 gives 43 to 200 w output at 400–1500 plate v. THE RADIO AMATEUR'S HANDBOOK, 25th Ed., pp. 184–187.

Tube data sheets are helpful. Those for the Hytron 5514, unusually so. But *seeing* how the other fellow has put the 5514 to work is even better. The articles describing the illustrated transmitters bristle with "hot" ideas. It will pay you to review them. Write also for both of the 5514 data sheets. Discover for yourself why the Hytron 5514 is so popular: Low internal tube drop and consequent high efficiency at plate potentials from 400 to 1500 volts. Generous output, low drive. Ready interchangeability with other triodes. In short, an economical, all-purpose ham tube designed for hams. Plan to put the 5514 to work in your rig, too. See it — buy it at your Hytron jobber's.

GOT TVI TROUBLES?

Two 5514's in properly balanced Class B R-F — 1500 v at 350 ma plate, -4.5 v bias, 6.5 w grid driving power — deliver 400 w c-w output essentially harmonic-free. See National ad p. 85, July QST.

SPECIALISTS IN RADIO RECEIVING TUBES SINCE 1921

HYTRON
RADIO AND ELECTRONICS CORP.

MAIN OFFICE: SALEM, MASSACHUSETTS

★ ★ ★ Letters ★ ★ ★

Thanks W8QBF and W8IKA

Union Commerce Building, Cleveland 14, Ohio

Editor, *CQ:*

In the rush of modern living, too often we overlook the efforts of our fellow workers, which efforts have made our jobs easier, and quite often have made our successes possible.

We want to take time to call your attention to the efforts put forth and the work done by amateur radio operators during the National Air Races, September 4, 5, and 6, at Cleveland Municipal Airport.

During these three days, more than 5000 private planes from all parts of the United States and Canada landed and departed from this field, in addition to the great number of commercial ships, Army and Navy ships, and actual participants. The traffic problem thus created at the peak hours of landing and take-off was of major proportions. Decisions had to be made and instantly transmitted to the proper parties from a Control Jeep which might be anywhere within the limits of the field at any time.

Through the efforts of W8QBF and W8IKA, who gave freely of their time, equipment, and technical knowledge, transmitting and receiving equipment was installed at Registration Headquarters, the Airport Tower, in one Control Jeep, and in one other vehicle for further mobile control.

This made possible instantaneous communication among four key points, which undoubtedly was a major factor in allowing us to handle this volume of air traffic without one serious accident.

The above named hams are a credit to amateur radio, and have proven still further the value of this group of technical hobbyists in the protection of life in our country.

C. W. Grove, Chairman,
Itinerant Liaison Committee, National Air Races

Attention Connecticut Hams

Inf. I, Ward 3, Laurel Heights San.,
Shelton, Conn.

Editor, *CQ:*

I am in a hospital, where I became interested in ham radio, but have no equipment. I wonder if you would have a code oscillator so I could study code. There is no way I can study code now (I have no receiver) and I've waited over two years for a way to study code. I've asked local hams for help, but as my home is in New Hampshire I know no hams here and people don't always want to waste time on someone they don't know—hi!

Bob Obert

Here's a potential ham who could use some help from the gang around Shelton. This should serve as an introduction—Ed.

Information Please

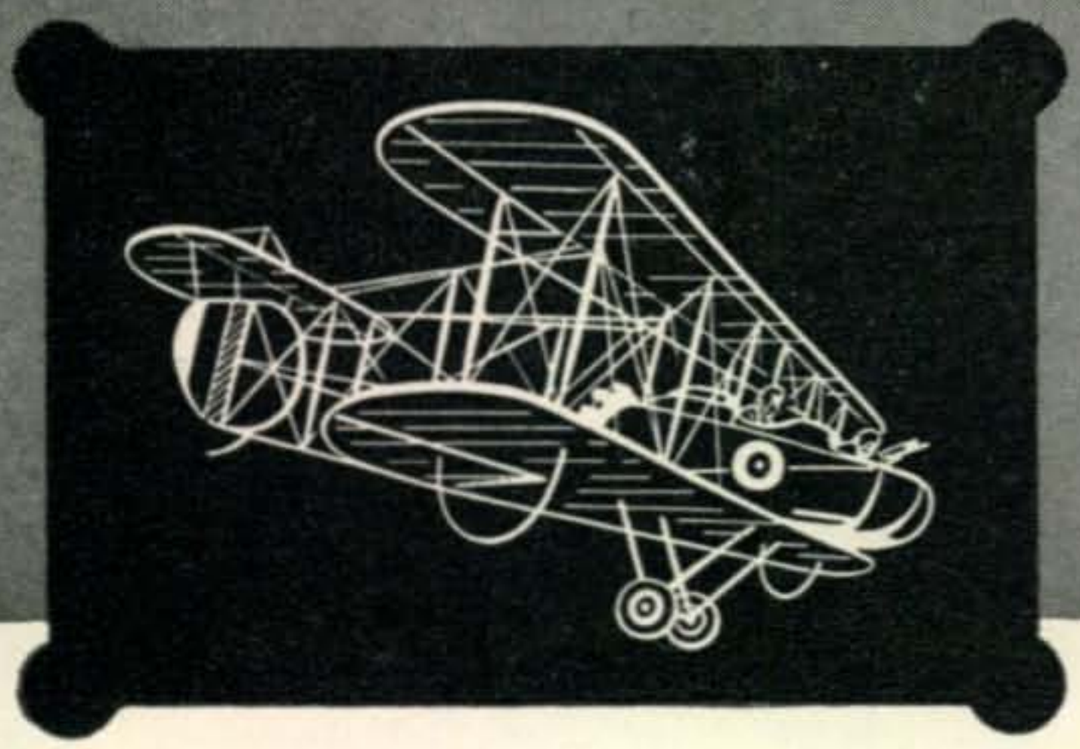
Hingham, Mass.

Editor, *CQ:*

My friend, G8TK, Al Browning, 4 Cell, Barnes Cottages, Tyttenhanger Lane, St. Albans, Herts, England, would like some kind-hearted ham to send him a copy of "G. E. Ham News," for Nov.-Dec., 1946, describing the R9'er. Since that issue is out of print, he will have to depend on the generosity of some ham for a copy. Would you please ask the gang via *CQ* for a copy?

Sylvester J. Connolly, W1MD

MODERN DESIGN IS COMPACT!



KEN-RAD

Compactness of Ken-Rad miniatures frees needed chassis space, with no sacrifice of tube efficiency or life. And you get higher-frequency operation!

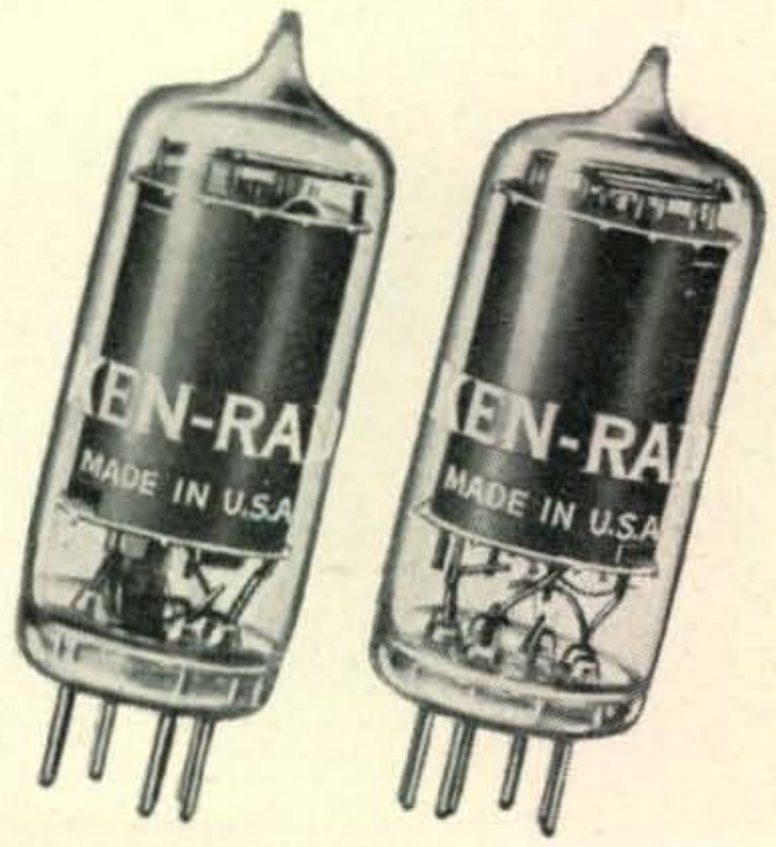
IT'S NICE to have room for new features you plan to add to your rig. Nice, also, to know that the space you've saved is net gain, with no loss in tube performance.

Furthermore, Ken-Rad miniatures are better for r-f work than the standard-size tubes they replace. They operate at higher frequencies . . . because their internal leads are so short.

Look closely at the 6BA6 and 6BE6. These tubes typify the advantages—small size, compact structure, real v-h-f operation—of the Ken-Rad miniature line. "Naturals" for ham experimental work, they fit neatly into h-f converter circuits, among other useful applications.

There the 6BA6 serves as an r-f amplifier, or even as an i-f amplifier, while Type 6BE6 will act as both mixer and oscillator. Don't let the unfamiliar type numbers bother you—the 6BA6 is substantially the 6SG7 r-f-amplifier pentode in miniature form (but improved, with a higher gain); and the 6BE6 is an ultra-compact version of our old friend the 6SA7-GT pentagrid converter.

Visit your Ken-Rad distributor or dealer to see, handle, "size up" the extensive group of Ken-Rad precision-made miniatures. Then check their low prices! These modern tubes . . . for best results . . . are *your best buy!*



6BA6 6BE6

Ratings of 6BA6 and 6BE6

Filament voltage	6.3 v
current	300 ma
Max plate voltage	300 v
Max screen supply voltage	300 v

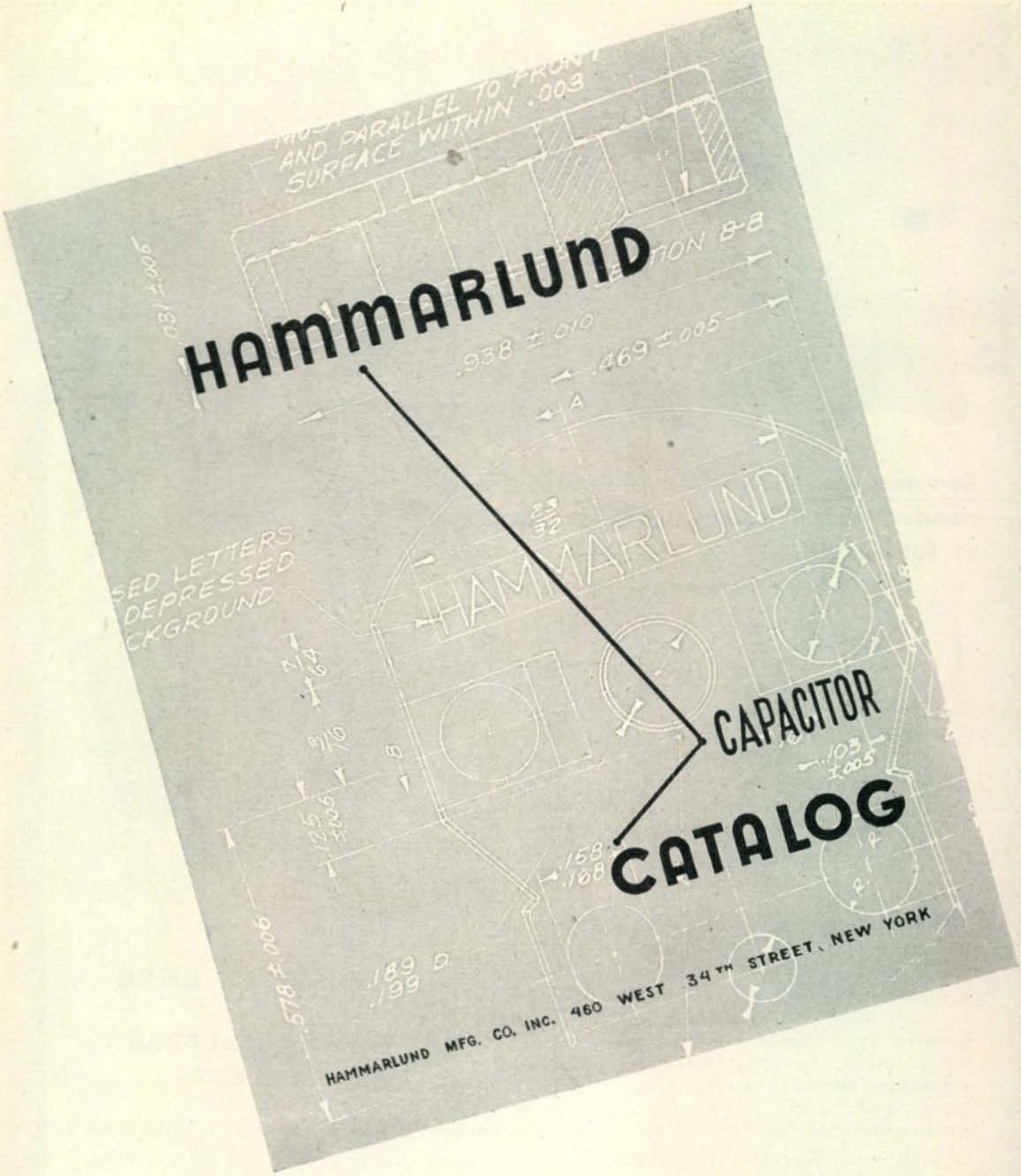
178-GA12-8850

KEN-RAD *Radio Tubes*

PRODUCT OF GENERAL ELECTRIC COMPANY

Schenectady 5, New York

Make the nearest Ken-Rad distributor or dealer your preferred source for amateur tubes



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Variable Capacitors

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MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

Happy Christmas

BILL PETERSEN. WØJRY

SINCE 1934

PETERSEN RADIO COMPANY, Inc.

2800 W. BROADWAY, COUNCIL BLUFFS, IOWA

SCRATCHI

Feenix, Ariz.

Deer Hon. Ed:

Scratchi are not having much time recently to be devoting his tecknical genius to pursuing radio mainly on acct. my YL are having foolish notions that peeple who are engaged should be seeing each other at least two—sumtimes three—times a week. This young lady, Lil O. Watanabe, and I are recently getting engaged. It are sounding like reel peachy idea at the time, but I are seeing that Scratchi are about to be reformed.

For examples, Lil and I are sitting in parlor recently after having come from local flicker palace and Lil are telling me that my radio station are old stuffs, that it are out of date and that if torn down it would hardly be making a 1/c collections of stuffs for a self-respecting junk box. I are becoming very incensed, and so I are asking her how comes, if my rig are not having the New Look, that she are always in my shack talking all around the country. Lil are coming right back at me—she plenty smart, that gal—and saying that it are still possible to write letters by chiseling the words out of a hunk of stone, but that it are move convenient to using pen and ink.

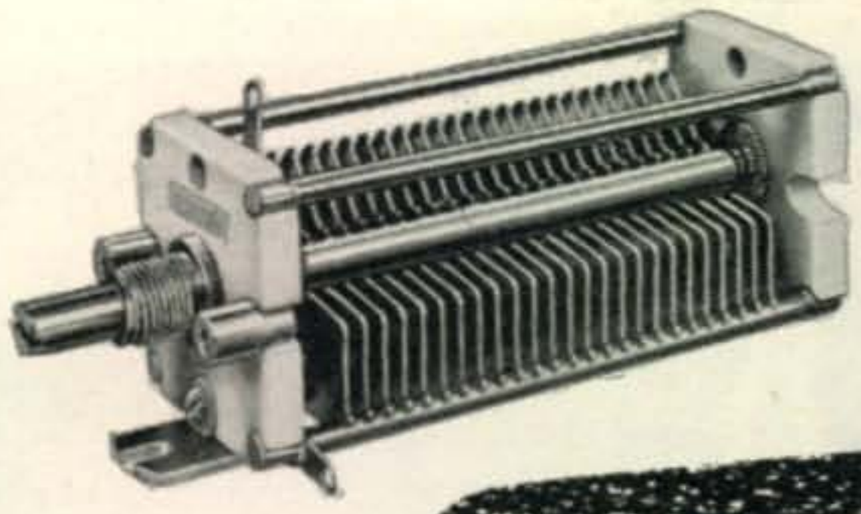
Because coils in transmitter are not being marked, the only way you can tell what band rig is on is to listen on receiver and see where receiver seems to be blocked the worst. Lil are also pointing out that in order to getting transmitter on the air it are neces sary to turn on five more switches (she are meaning exciter voltage switch, PA power switch, final power switch, speech amplifier power and modulator power). And this not getting much signal on either unless also remembering to change antenna from receiver to transmitter.

Upshoot of hole talk are that Lil are telling me that I should be getting out of dinosaur age and getting up to date, putting in single-sideband transmitter and receiver, etc. From tone of voice I are knowing Lil are meaning what she said. Lil are probably getting all these fancy ideas from reading your Hon. Magazine. Are there some way you can removing her name from subscription list? On second thought, better not, as then she are probably coming over and borrowing mine.

I are going to bed that night with trubbled conshush and as result Scratchi are having stupendous dream. I are dreaming that it is the year 1970, and I are in my ham shack. When I come in door, automatic photoelectric tubes turning on the toob filaments and turning on the receiver rack. Receiver are like nothing Scratchi are ever seeing before. We are evidentally having ham bands up to 37,000 megacycles.

The band switch on the receiver automatically energizes relays which connect proper antenna to receiver and also puts right transmitter in readiness to transmit. Each transmitter are push pull final

(*Continued on page 64*)



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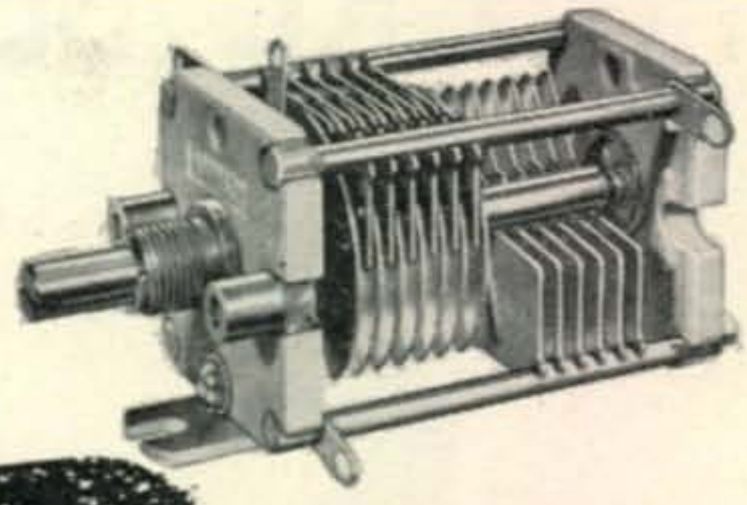

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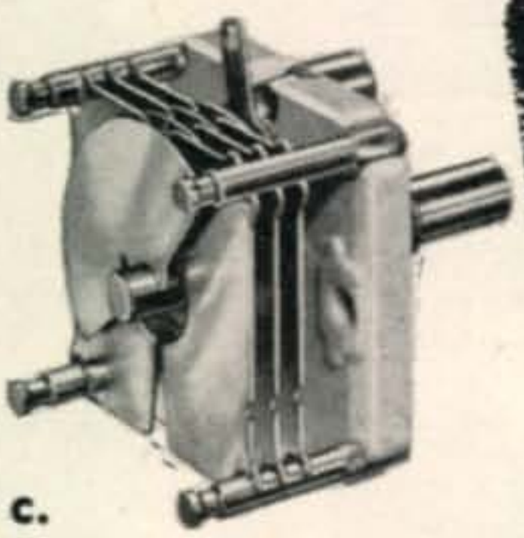

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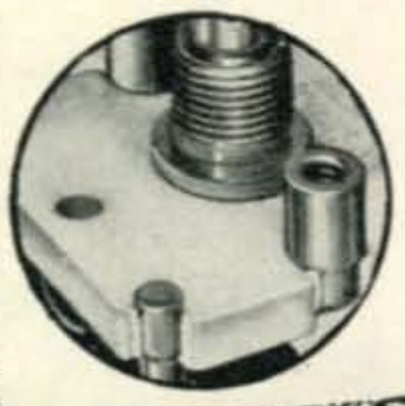
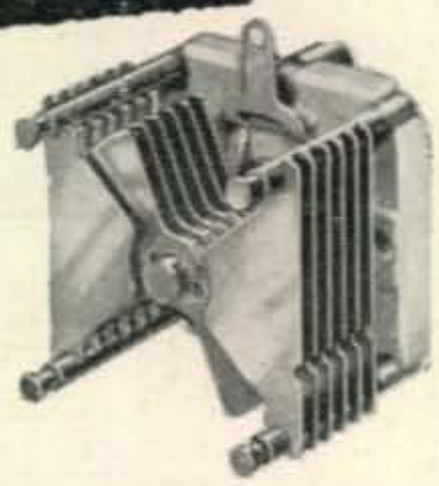
CERAMIC SOLDERED . . .



FOR STABILITY
AND STRENGTH



d.

Announcing the new JOHNSON 167 VARIABLES

BETTER FOR UHF - VHF - LF

With the introduction of this new line of air variables, JOHNSON brings you many important design advantages never before available.

Outstanding of these is the use of perfected ceramic soldering which assures absolute — and permanent — rigidity and strength, absolute — and permanent — maintenance of capacities!

There are no eyelets, nuts or screws to work loose, causing stator wobble and fluctuations in capacity. JOHNSON ceramic soldering leaves a bond which is stronger than the rugged steatite end plates themselves. There's nothing to come loose, because the stator terminals, mounting posts and rotor bearings are ceramic soldered!

Silent operation on the highest frequencies is assured with a split sleeve tension bearing that also prevents fluctuations in capacity.

These new variables are ideal for peak efficiency even under the severest conditions, such as portable — mobile operation. They are available in .030" and .080" spacings.

Two sets of stator contacts are provided for connecting components to either side of condenser without appreciably increasing inductance of the circuit. New bright alloy plating is used. It has high corrosion resistance, is easily soldered and possesses lower electrical resistance than other common platings.

These variables are available for all types of communications equipment having tuned circuits operating as high as 500 mc.

Features

1. Ceramic soldered for stability and strength
2. Soldered plate construction, heavy .020" plates, new bright alloy plating
3. Beryllium copper contact spring, silver plated
4. Split sleeve rotor bearings — no wobble to shaft
5. Steatite end plates
6. Long creepage paths
7. Low minimum capacity — maximum tuning range
8. Small size — end plate only 1⅜" square

Other capacities and spacings available on special order.

a. SINGLE SECTION VARIABLES

.030" Spacing

Cat. No.	Cap. Per Section Max.	Min.	Length Behind Panel
167-101	11	2.8	15/16
167-102	27	3.5	1-9/64
167-103	51	4.6	1-7/16
167-104	75	5.7	1-¾
167-151	99	6.8	2-7/32
167-152	202	11.6	3-33/64

Also Available In .080" Spacing

b. DUAL SECTION VARIABLES

.030" Spacing

Cat. No.	Cap. Per Section Max.	Min.	Length Behind Panel
167-501	27	3.5	1-13/16
167-502	51	4.6	2-27/64
167-503	99	6.8	3-⅝

Also Available In .080" Spacing

c. DIFFERENTIAL VARIABLES

.030" Spacing

Cat. No.	Cap. Per Section Max.	Min.	Length Behind Panel
167-301	11	2.8	15/16
167-302	27	3.5	1-9/64
167-303	51	4.6	1-7/16

Also Available In .080" Spacing

d. BUTTERFLY VARIABLES

.030" Spacing

Cat. No.	Cap. Per Section Max.	Min.	Length Behind Panel
167-201	10.5	2.8	1-3/64
167-202	26	4.3	1-7/16
167-203	51	6.5	1-15/16

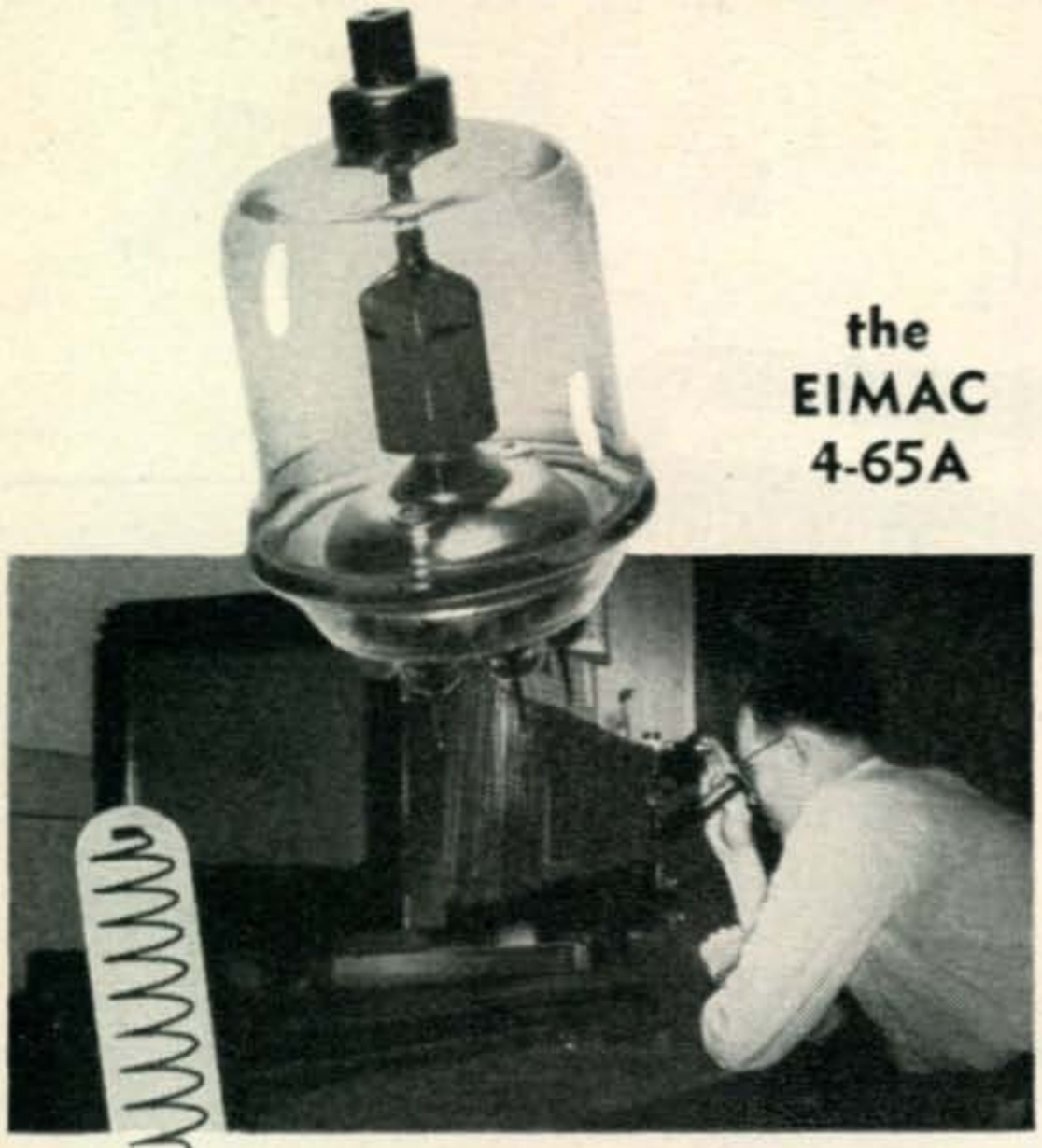
Also Available In .080" Spacing

Write For NEW JOHNSON 167 VARIABLE CATALOG

JOHNSON • • • *a famous name in Radio!*

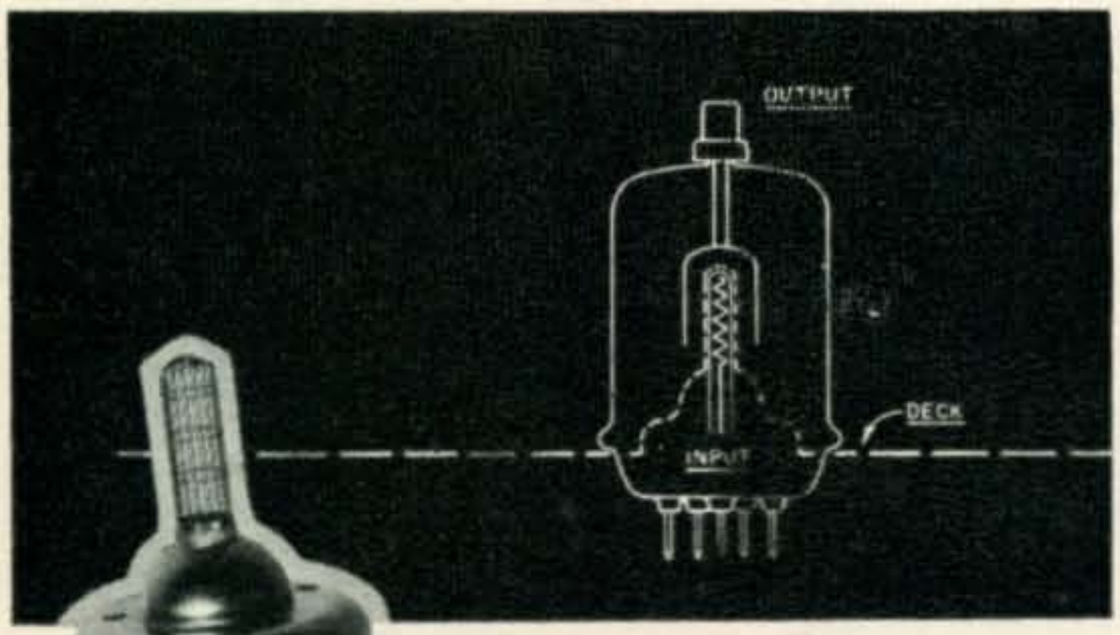
E. F. JOHNSON CO., WASECA, MINNESOTA

THEY'RE BETTER BECAUSE...



the
EIMAC
4-65A

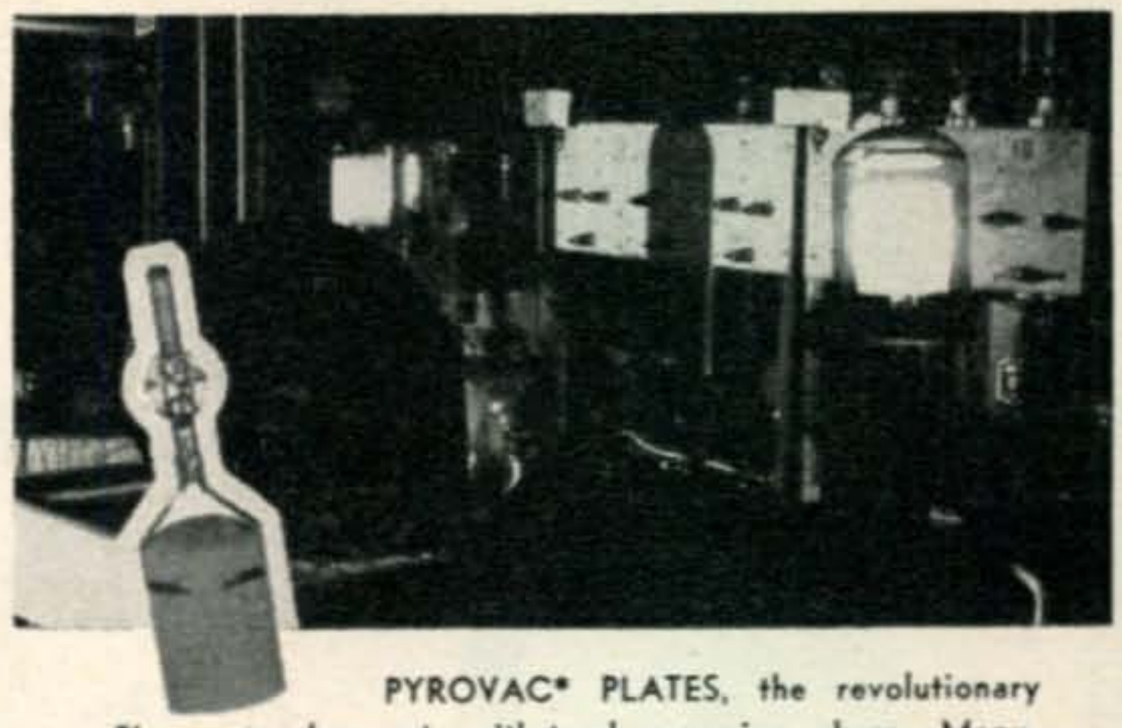
APPLIED RESEARCH by Eimac engineers has produced a thoriated tungsten filament with ample reserve emission. Its instant heating characteristics make the 4-65A well adapted to mobile application.



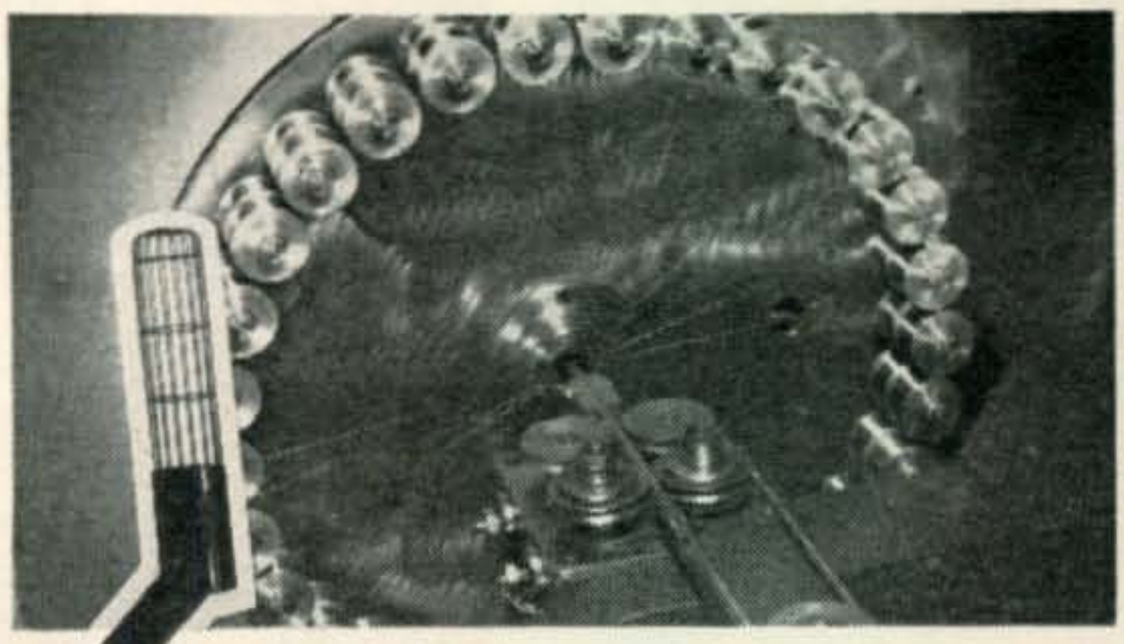
SPECIALLY DESIGNED screen grid effectively shields input and output circuits, within the tube, without excessive screen power. All internal structures are self supporting without the aid of insulating hardware.

These are but some of the features that combine to make the Eimac 4-65A a better tetrode. It is unexcelled in its category as a power amplifier, oscillator or modulator. For example, in typical operation as a power amplifier or oscillator (class-C telegraphy or FM telephony) one tube with 1500 plate volts will supply 170 watts of output power with less than 3 watts of driving power. A complete comprehensive data sheet on the 4-65A has just been released. Write for your copy today.

EITEL-McCULLOUGH, INC.
204 San Mateo Ave., San Bruno, California
Export Agents: Frazer & Hansen, 310 Clay Street, San Francisco 11, California



PYROVAC* PLATES, the revolutionary Eimac development, withstand excessive abuse. Manufactured by an advanced technique, these plates can handle momentary overloads in excess of 1000%, consequently they contribute appreciably to the tube's life.



EIMAC PROCESSED GRIDS, manufactured by an exclusive technique, impart a high degree of operational stability. Both primary and secondary emission are controlled.

CONTROLLED PRODUCTION practices include a slow oven-anneal to remove the last vestige of residual strains, and four to eight hours of testing under severe VHF conditions.

*Trade Mark Reg. U. S. Pat. Off.

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ZERO BIAS

EDITORIAL

CHRISTMAS TIME! And all over the world men of good will pause in their day's work to celebrate this holiday according to the custom of their land. In one nation it means one thing, in another country its interpretation is again different. But everywhere it should be a joyous time, for Christmas time is a holiday that we normally associate—in the United States anyway—with the exchange of greetings and gifts. And radio amateurs certainly are no exception to this American custom. But radio amateurs are different from their fellow citizens—not because of their ham tickets especially, but because they have intimate contact with their fellow hobbyists throughout the world.

It makes no difference whether or not we are DXers, rag-chewers, experimenters, or anything else in our hobby. Through our publications, in tuning the bands, and by constant reminders in dozens of ways, we are all acutely aware of the fact there are tens of thousands of amateurs all over the world. And most of these amateurs are not so fortunate as those in the United States.

Any conscientious decent American cannot help feel compassion for the suffering of other world citizens. They suffer from hunger, from poverty, from boredom; they suffer to a degree that is almost beyond the comprehension of man. And so man, in many cases, has turned his back on their suffering with a hopeless feeling that his little bit of good would scarcely ease the pain of the world. But we amateurs—we should be different! We have found in our hobby a bond that transgresses all boundaries. And this wonderful hobby of ours has given us a link between people, ordinary humans with families and interests not unlike our own. Through our hobby we have extended a hand of friendship, quite impossible by any other means. It has lifted some one individual in France, in Italy, in China, in hundreds of countries, above the great masses.

These amateurs everywhere are our friends. And at Christmas time it is appropriate that we think in terms of what we, as a group, can do for our fellow hams all over the world.

Don't let anyone tell you that much hasn't already been done. Take a look at the work of W6AL. W6AL is the guiding spirit behind the Amateur Radio International Friendship. ARIF was started as the result of a 10-meter QSO between G2WI and W6AL in the fall of 1947. G2WI was telling about the work of his XYL in caring for 30 little girls between the ages of four and five years while their mothers were out working. Many of the youngsters were not getting sufficient nourishment, and to almost all of them candy was something to read about in a fairy tale. One youngster in particular had them worried, the child of parents whose mother was the sole support, the OM having been blinded by a fly bomb in the war. W6AL obtained the QTH of the parents and several other needy people. These names were placed with some of his generous friends. All of them were assisted with gifts from their new-found American friends.

By ham radio word was passed to other amateurs that help was available to them. The requirements to obtain aid were simple; just send along the name, and of utmost importance, nothing must be said to the intended recipients of gift parcels about aid in order to avoid disappointment if help did not arrive. G2WI pledged himself to trace all packages that were not heard from within sixty days.

As might be expected the plan grew, and as the result of encouragement from W6PHX, W6RQL, W6FZC, W6PRD, and W6RBQ, ARIF developed into a sort of Amateur Radio Marshall Plan. No red tape, no overhead, no big shots—just sincere assistance from amateur world citizens.

Another example of assistance is that of VE3ARS in Paris, Ontario. From contacts he had with G3CCS a firm friendship was established. One thing led to another and G3CCS, his wife, and four-year old daughter are by now comfortably settled in the home VE3ARS obtained for them in Ontario. Through amateur radio, through its far reaching friendships, a British family is starting a new life in Canada.

Then, too, there are the countless little deeds. The sending of books and magazines, of spare radio parts, of an occasional box of food or candy for the youngsters. All these things have turned commonplace contacts—in themselves a precious link not afforded the ordinary citizen—into satisfying personal experiences. But these wonderful gestures on the part of a club, an individual, a group, while good, are not enough. Amateurs should assume a still greater interest in helping out their fellow hams —and fellow citizens. Exactly how? Well that is a question not lightly answered.

One concrete suggestion is to utilize the services of CARE if you desire to ship food. They will assume responsibility of guaranteed delivery at extremely reasonable cost. Keep your spare parts, the odds and ends that you may never use. If you're not a DXer, ask among your friends if they know a deserving ham. The important point that we are trying to make is that amateurs have been given the opportunity to become, in a way, citizens of the world. And Christmas time is a wonderful time of the year to start thinking about our role as world citizens.

To all our readers

Merry Chrtstmas

and

Happy New Year

Kenneth Klippel, WØSQO, in his ham shack at Iowa City, Iowa

The proof of the pudding is on the wall...

Newcomers in ham radio are greatly helped by the remarkable sensitivity, selectivity, stability, and the accurate calibration of the Collins 75A-1 receiver.

The more significant commendations, however, come from seasoned amateurs who, like WØSQO, have literally worked the world for years with less advanced, less thoroughly engineered equipment. This is true whether their chief interest is in DX or traffic.

The 6AK5 R. F. stage in the 75A-1 makes possible a threshold sensitivity far better than can be realized in normal installations. This threshold sensitivity corresponds to a receiver noise factor of from 5 to 10 db above a perfect receiver of the same bandwidth.

The very high accuracy and stability of the 75A-1 are due to (1) the use of quartz crystals in the first conversion circuit, (2) the inherent accuracy and stability of the vfo in the second conversion circuit, and (3) linearity and absence of backlash in the tuning mechanism. The stability is such that on c-w reception extreme variation in the supply voltage causes a change of only a few cycles in the note. Rejection to image frequencies is greater than 50 db for all bands.

See or write your Collins dealer. If you don't know him, we will be glad to give you his name and address.

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THE "FINAL" FINAL

Applying the Vacuum Variable

CLAYTON F. BANE, W6WB*

Modern components plus modern design have made possible this unusual power amplifier.

JUDGING BY the number of TV sets being sold today, there is slight doubt that interference with television reception is going to force most of us to make some rather radical changes in the design of our transmitters. While such changes are certainly inconvenient, a general tightening-up of our technical standards may ultimately result in improved transmitters of superior performance. In view of the excellent and complete treatment of the subject of TVI interference that has appeared in *CQ*, there is little point in attempting to enlarge upon this subject either from the theoretical or public relations standpoint. The main reason for any mention of this subject is that no new transmitter should be attempted without the inclusion of certain basic TVI corrective measures. Consistant with this reasoning, the material to follow will describe a new final amplifier having high-power capabilities, complete freedom from parasitic or fundamental oscillation and with circuit design and mechanical arrangement to minimize harmonic radiation.

Tetrodes for the PA

The type of tubes to be used should come first on the list in the design of any amplifier and the type ultimately selected will, of course, be dependent upon the amount of input desired. Plate dissipation ratings being equal, however, there is good reason for the selection of tetrodes over triodes if TVI is to be a factor. Triode equivalents to the tubes used in this amplifier will require a driver stage having an output power of 50 to 100 watts. Such a driver constitutes a husky little transmitter in its own right, and will therefore require the same treatment for harmonics and parasitics as the stage it is driving. There has even been discussion about the possibility of using Class A amplifiers as drivers to lessen direct harmonic radiation and to provide a driving source of low harmonic content for the output amplifier. Drive of 50 to 100 watts from a Class A stage is not easy to attain but the 3 to 5 watts of drive required by the 4-250A tetrodes for full output is entirely feasible in this mode of driver operation. Carried to extremes, the final itself can even be operated so that it draws no power from the driver stage and yet produces a very respectable output!

Dismissing the possibility of operating the final in Class A due to the high plate dissipation and lowered efficiency, there may still be occasions when it will be desirable to run the final stage in Class AB_2. This would definitely be the case in certain types of SSSC operation where the amplifier must run linear and this mode of operation, with its reduction of harmonics, might well make the difference between success and failure in some particularly obstinate instance of TVI. With tetrodes, any of these modes of operation are at your fingertips since it is only necessary to adjust the parameters of plate, screen and grid voltages. Here then, is the real reason for selecting a pair of tubes with 500

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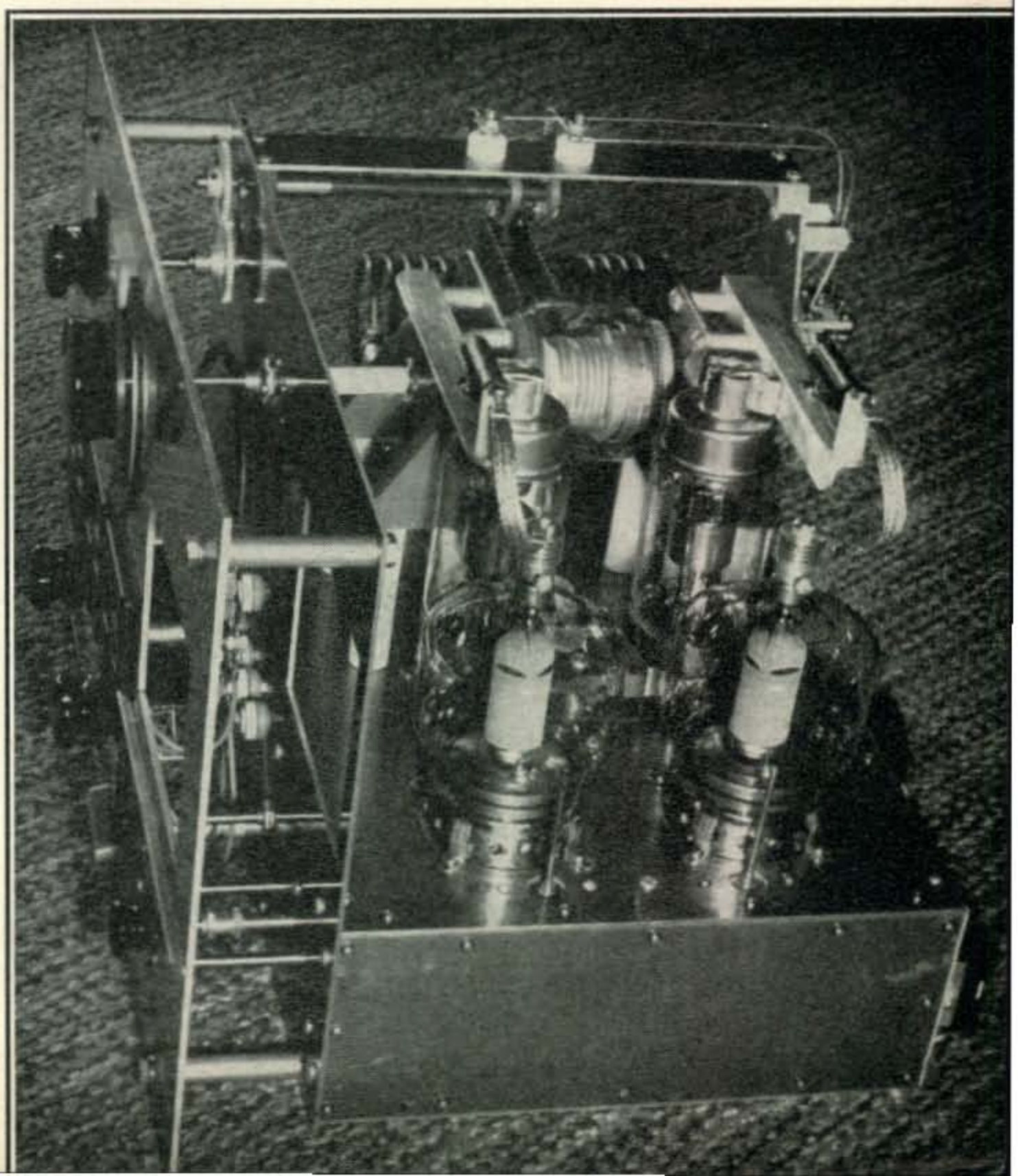


Nothing is above deck but the plate circuit and the neutralizing condenser rods.

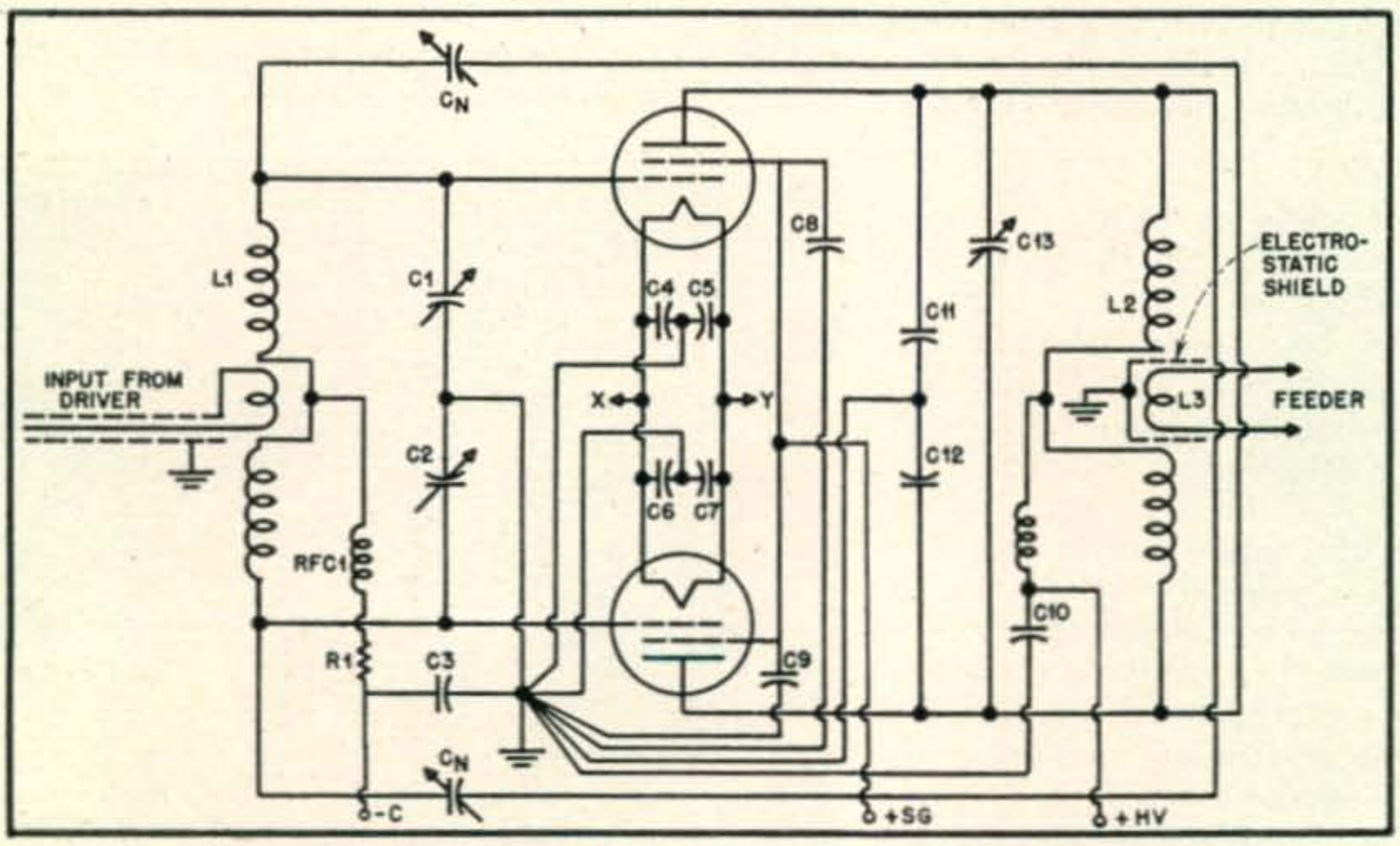
watts of plate dissipation. Granting the advantage of tetrodes over triodes from the standpoint of low driving-power requirements, the question of relative stability of the two types will inevitably arise.

"The 4-250A may be operated as a Class C FM or telegraph amplifier without neutralization up to 30 mc, *if reasonable precautions are taken to prevent coupling between input and output circuits external to the tube.*" This quotation is from the data sheet supplied with the tube; the italics are my own since interpretation of "reasonable precautions" can mean the difference between a rock-stable stage and one that will take off with the slightest provocation.

Tackling Self-Oscillation

Oscillation in most amplifier stages falls into three classes: low frequency (largely determined by the r-f chokes in grid and plate circuits), fundamental and u.h.f. All three fall into the tuned-grid, tuned-plate classification if the feedback is essentially confined to the tube itself. The low-frequency mode of oscillation seldom occurs in well-designed tetrode stages due to the fact that the very low plate-to-grid tube capacity is insufficient to support sustained oscillation at these low frequencies. (This doesn't mean that it *can't* occur—circuits external to the tube are a distinct possibility.) If feedback is confined strictly to the tube itself, oscillation at the resonant frequency is likewise improbable. It is only at the very high frequencies that the screening of the tetrode may fail to prevent oscillation. This is due to the fact that at these high frequencies the internal screen leads begin to show appreciable reactance thus tending to prevent the screen from approaching r-f ground potential. This effect can be readily nullified in stages actually operating at these high frequencies but since high power amateur work is seldom attempted in these ranges, the corrective measures have little place in this discussion. In any case, such u-h-f oscillation is generally of the t.p.t.g. type (these are our "parasitics") and the frequency is largely determined by the length of the grid and plate leads and the input and output capacities of the tubes. If feedback has been confined to the tube itself, such oscillation will yield to a simple corrective measure—lengthening the plate leads until the u-h-f plate circuit is tuned to a lower frequency than the grid. Practically, these long plate leads are coiled to form the familiar parasitic chokes.

Complete freedom from oscillation at the fundamental frequency can be achieved by conventional neutralizing but it is very probable that such neutralizing will likewise lessen the tendency toward u-h-f oscillation. However, neutralizing in a tetrode stage should be considered as an ultimate refinement merely to cancel out the very small feedback voltage existing between grid and plate due primarily to the fact that the screen will never be at exact zero r-f potential. After all, by-passes are not pure capacitors and some form of connecting leads must be used between the screen capacitor and ground. These remarks again bring us to the amplifier stage under discussion since here we can depart from the theoretical and obtain a fully practical picture of how those "reasonable precautions" have been successfully applied.



The circuit diagram shows the PA is simpler electrically than mechanically.

C1, C2—Part of split-stator grid tuning. 6-73 μμf (E. F. Johnson 75J12).
C3—Grid r.f.c. by-pass. .002 μf, 1000 v. working, mica.
C4, C5, C6, C7—Filament by-passes. .004 μf, 1000 v. working, mica.
C8, C9—Screen by-passes. .002 μf, 2500 v. working, mica.
C10—Plate r.f.c. by-pass. .002 μf, 5000 v. working, mica.
C11, C12—Fixed vacuum capacitors. Part of plate circuit split-stator tuning. 25 μμf, 20,000 v. d.c. (Eimac used in model).
C13—Vacuum variable. 10-60 μμf, 20,000 v. d.c. (Eimac).
CN—Copper rods (see text).
L1—Grid inductor for push-pull input. Model uses home-built coils made from B & W Miniductors. Conventional turret can be used.
L2—Plate inductor. Made from ¼" copper tubing.
Plugs are E. F. Johnson #106-73. Jack, #106-72.

Mechanical Isolation

Aside from a somewhat unconventional appearance and the inclusion of certain mechanical innovations, the significant thing about this final amplifier is the fact that *all* grid, screen and filament circuit elements are on one side of a closed-bottom chassis. Those exposed elements on the top of the chassis are strictly in the plate and antenna circuits—the noteworthy exception being the neutralizing capacitor rods which extend down through insulated bushings (mycalex) and cross-connect to the grids of the tubes. This is number one "reasonable precaution"—the grid, screen and filament circuits must be completely shielded from the plate circuits. It will be noted that the three meters (plate, screen and grid currents) are mounted on the front panel and shielded from the plate tank circuit by means of an additional sub-panel. One common source of external feedback in an otherwise well-isolated stage can be through the meter leads. Therefore, while it may not be necessary to follow our method, placement of the meters should come in for careful consideration in an initial design. The isolation in this amplifier is completed by the four grounding brushes which make firm contact to the metal base of each tube. It is very important that this precaution be observed since the metal base acts as a shield between the internal grid leads and the external plate circuit. Now thus far, the precautions have indeed been reasonable; glance at the close-up bottom view of the chassis and see whether or not the method of connecting the filament and screen by-passes to ground would be considered in the same category.

Risking criticism for repetition—it is the purpose of the screen in these tetrodes to act as a shield between grid and plate to reduce the capacity between these two elements (to prevent feedback) and to be effective in this regard, the screen must be established at approximately r-f ground potential. Ignoring the fact that most large mica capacitors likewise have some inductance in the knowledge that one can't do anything about it, the inductance of the connecting leads themselves must be kept to a minimum. Stating this another way, don't use wire and a soldering iron when wiring in the screen and filament by-passes; do the wiring with tin snips and copper strip! The supplementary drawing of the tube socket will show exactly how the connections are made in our amplifier. Incidentally, the copper connecting strips are very easy to make, particularly if one has access to a hand-punch to make the mounting holds in the soft copper strap. Alternately, the holes can even be pierced with a nail of appropriate size and the resulting burrs filed smooth.

Of further interest, and perhaps no little importance, is the fact that screen and filament by-pass capacitors return to a single ground point directly between the two midget capacitors which gang together to form a split-stator for tuning the grid circuit.

In addition to the necessity for complete isolation of the tetrode input and output circuits, the mechanical design of this amplifier was dictated by the necessity for a simple cooling system for the seals of the 4-250As. The man-sized filaments in these tubes develop heat and plenty of it, and, to prevent

Front panel view of the amplifier. Controls are as follows: Upper left corner, antenna coupling; upper center, tuning dial for vacuum variable capacitor. Meters are (left to right): plate, screen and grid. Panel opening on right is an inspection port for viewing the tubes from the front of the rack. Lower left, variable resistor for grid bias. Lower center, switch for metering individual screen currents. Lower right-center, band switch for grid coils. Lower right, grid capacitor tuning and grid drive balance adjustment. The finish is achieved by sandpaper drawn against a straightedge moved across the panel.

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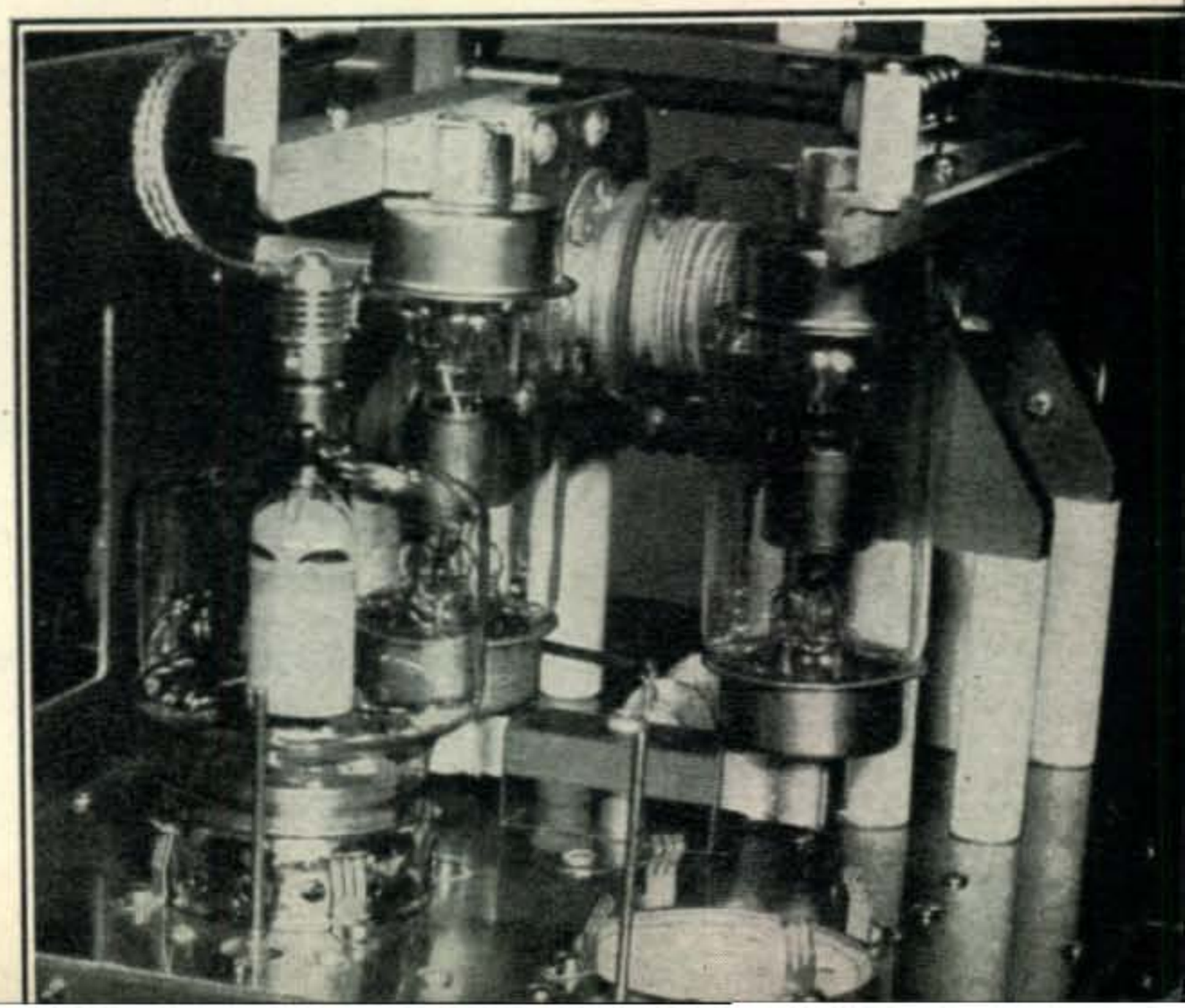
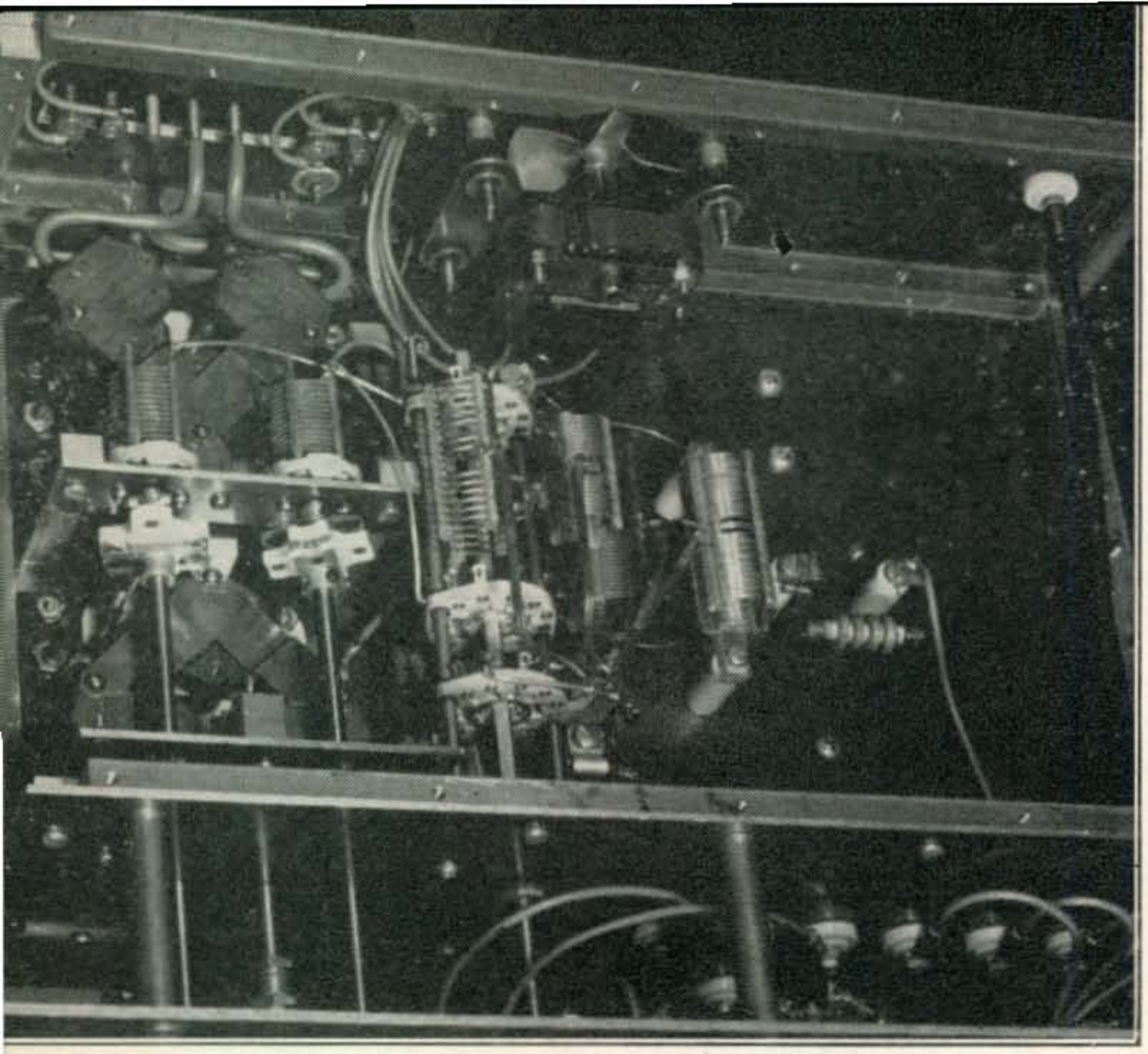
Close-up end view of the amplifier. In this view one 4-250A has been removed from its socket so that certain details can be observed. The neutralizing rods are directly in the foreground. These rods are of .125" diameter hard-drawn copper and slide up and down through insulated bushings (mycalex). They are arranged approximately one-quarter inch from the glass envelope of the 4-250A tubes and have about 2½ of their 3½" total length exposed for neutralizing this particular amplifier. The short and direct grounding connections of the two fixed vacuums can be clearly seen. The phenolic piece upon which the bottom clips for these capacitors are mounted is also used to mount the r.f.c. This choke is far removed from the antenna circuit and is mounted as close to the chassis as reasonable insulation will permit.





Bottom view of the amplifier. The bottom cover plate and one of the end pieces has been removed in this view. Chassis is fabricated from .085" dural plate fastened together with ½" x ½" dural bar. Chassis is 16½" long, 11" wide and 4" deep. Grid inductances are made from B W minicoils. The two-turn center link is made by clipping coi turns on either side of the two centel turns and linking the two outer halver by a jumper. The shock-mount for the fan is made from rubber grommets with centering-cup washers and insures freedom from motor vibration. The rear terminal strip is gasketed around its cutout top revent air leakage. (See text). The leads from the meters come through feed-through insulators for the same reason. If high-voltage is passed through these small insulators a piece of insulated sleeving must be used on the machine screw that passes through the two halves.

seal cracks, it is absolutely necessary to provide a continuous flow of air through the openings in the base of the tube. It can be readily observed in the photographs that the particular arrangement of filament and screen by-passes blocks the openings in the tube sockets in such a manner that forced air (from fans placed directly beneath each socket) would be scattered in all directions. The ideal, and not too difficult answer is to completely seal the chassis with the exception of an air-intake opening for the fan. By thus pressurizing the interior of the chassis, the only place the air can flow out is through the openings in the tube socket. The tubes themselves fit snugly against the chassis thus forcing the air to pass through openings in the bottom and hence out through similar openings in the side of the base. This cooling system has proven to be highly effective even though only a single, small Barber-Colman fan is used. The observing reader will note in the photograph that this fan appears to blow backward, but 'taint so. We reversed the complete assembly so that the fan would likewise blow across the field winding of the motor to keep the latter cool. To say that this reversal cannot be readily accomplished is an understatement, and it is not an absolutely essential step. Perhaps, however, fan motors can be obtained with the shaft extension on the correct side or with fan blades pitched to blow air in a direction the reverse of that normally encountered. Details of the shock mount for the fan motor can be clearly seen in the main bottom view photograph.

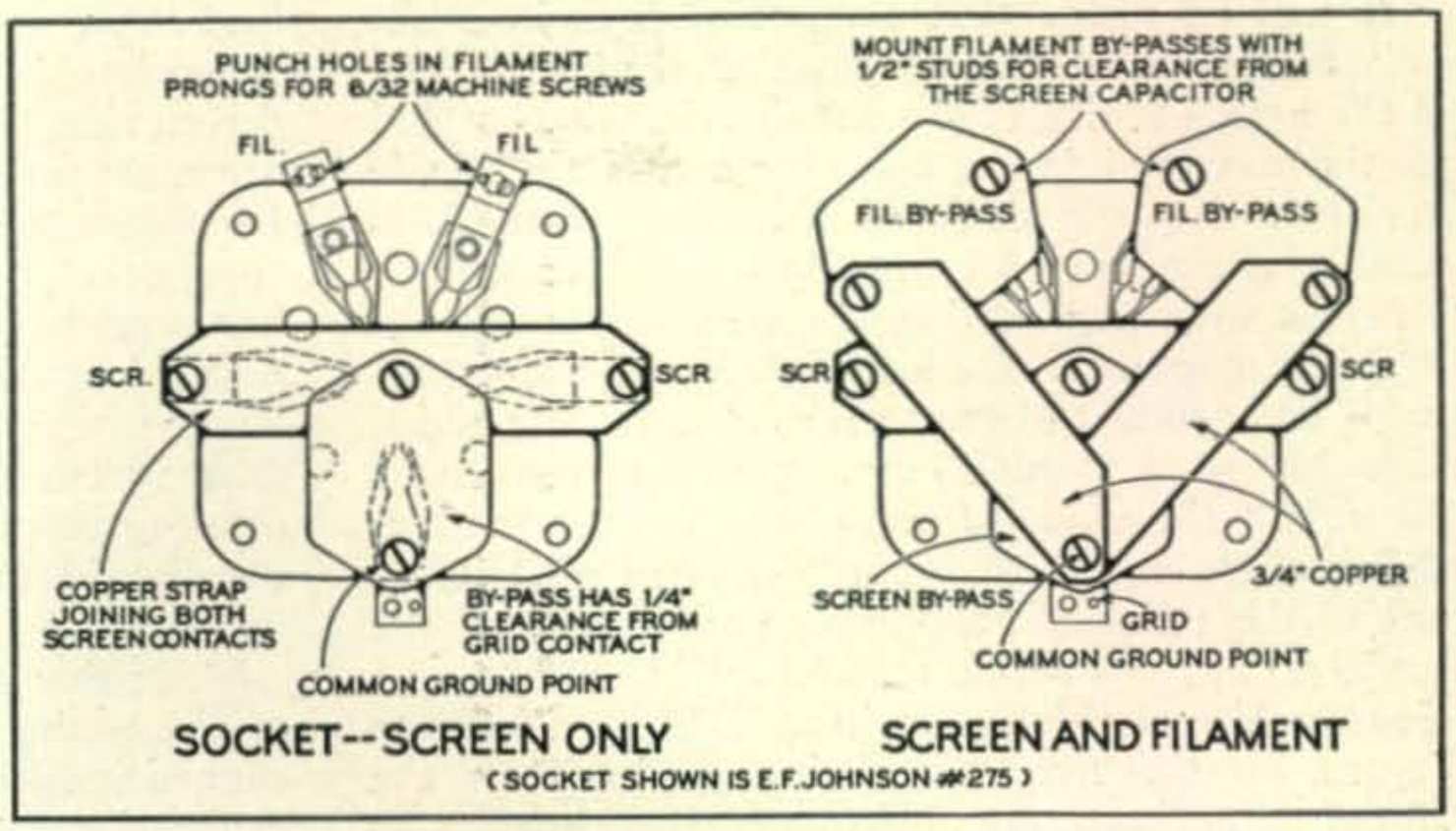
Balancing Out Harmonics

The 4-250As in push-pull were, of course, adopted to minimize the even harmonics developed in the plate circuit of the tubes. Ignoring for the moment the harmonic reduction due to the by-passing action of both halves of a split-stator capacitor connected across the plate tank, such cancellation can only be realized if both tubes are balanced to ground in the plate circuit. In this case, the even harmonics flow through both halves of the plate coil in opposite directions and thus (theoretically) cancel insofar as coupling to the antenna is concerned. The failure of this cancellation in many push-pull stages can possibly be attributed to unbalance in the plate circuit (nodal point not in the center of the coil) as well as to unbalance in the grid circuit. In this latter instance, one tube would be receiving more drive than the other, thus the amplitudes of the harmonics in the two plate circuits would not be equal. Admittedly, this whole thing is controversial—Owens' article attests to this [1]; however, there can surely be no objection to attempting a complete balance if for no other reason than to make certain that no one tube is doing all the work. The capacity-to-ground balance of a center-tapped plate circuit can be rather easily checked by the following method.

First, remove *all* voltages from the stage! Connect a crystal-detector meter combination directly across the r-f choke in the high-voltage center tap to the plate inductor. R.F. may be introduced by connecting the grid excitation line from the driver to the variable antenna pickup coil. Try *very loose* coupling to start. With the coupling set for some convenient reading on the indicating meter, tune the final amplifier capacitor to resonance as normally indicated by a definite dip in meter indication. Add capacity to one side of the circuit or the other until a minimum meter reading is obtained. The two halves of the plate coil constitute two arms of a bridge; the other two arms being composed of the plate-to-ground capacity of the tubes shunted by the split-stator and circuit capacity. If the *L/C* circuit is resonant and capacities are equal on both sides, the center point of the coil will be at ground potential and there will be no potential difference

1 Owens, "Down With Harmonics!" *CQ*, Feb., 1948.

Details of the method of mounting filament and screen by-pass capacitors.



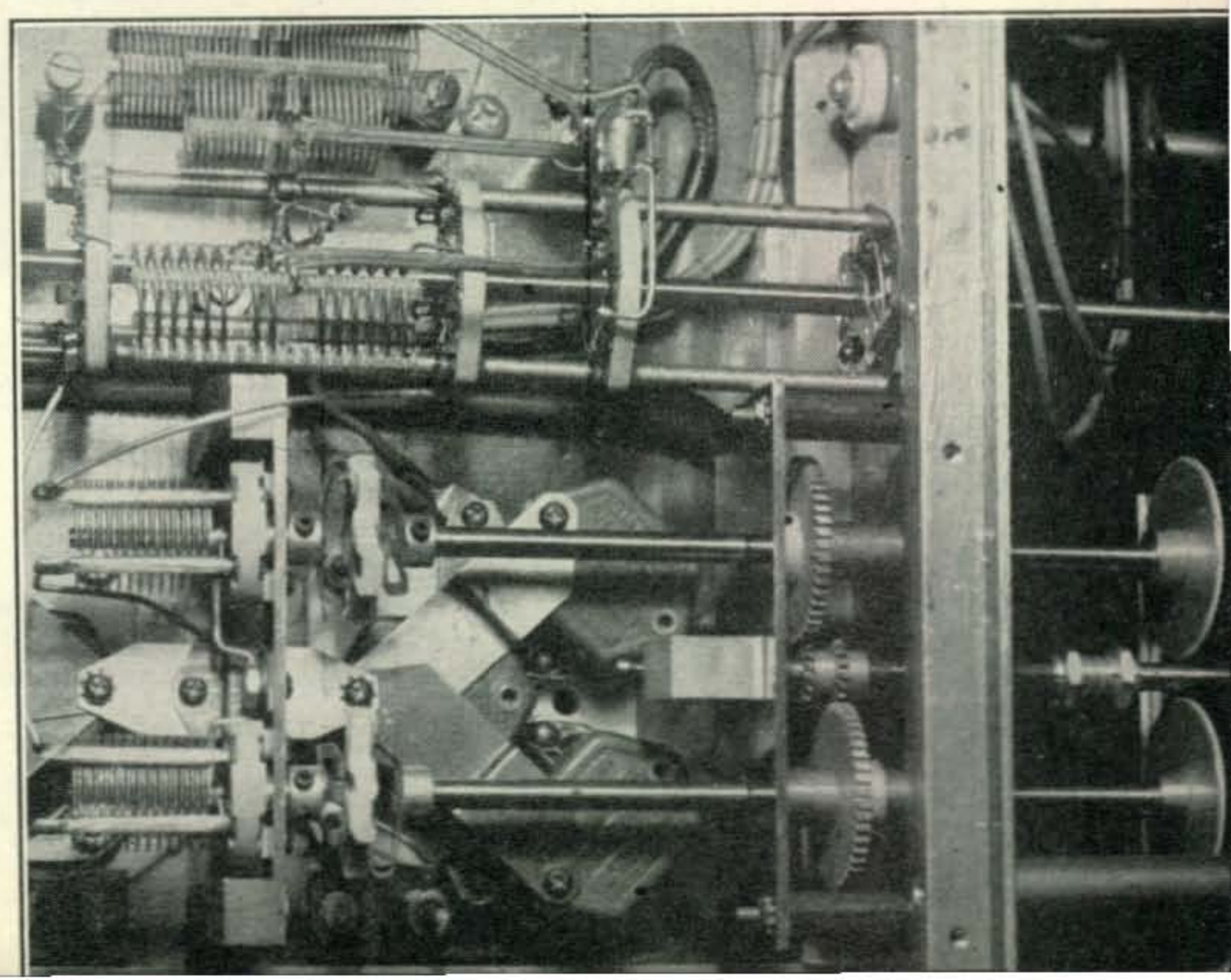
across the r.f.c., consequently no reading on the rectifier meter. Make certain that the tank circuit is at definite resonance at all times and take particular care that the leads from the r.f.c. to the crystal-meter combination do not introduce stray pick-up. In our amplifier, the upright metal bracket which supports the antenna relay is placed adjacent to one side of the tank coil to compensate for some of the capacity unbalance unavoidably introduced by the proximity of the coil and capacitors to the front baffle plate.

Assuming perfect balance in the circuit, the fact remains that the even harmonics flow through the lead from the center-tap of the coil to the r.f.c., *in phase*. It is very important that this lead be made short and that the combination of leads and r.f.c. be prevented from coupling energy to the antenna circuit. Ideally, both the choke and its connecting leads should be shielded.

Although the methods suggested may be effective in reducing the strength of the even harmonics, the odd harmonics must definitely be taken into account. It is mandatory that a low impedance path for harmonics be provided from the plates of the tubes to ground and this is conventionally accomplished with a split-stator capacitor. Such a split-stator by-pass to ground is, of course, inherent in the tubes themselves, being provided by the plate-to-ground tube capacity, but its effectiveness is questionable in view of the relatively low capacities involved. The physical size and grounding point arrangement of the split-stator capacitor to be used plays an important part since, as Bach has pointed out,[2] it is easily possible to run into trouble from the inductance either in the capacitor itself or in the grounding leads. It is believed that trouble of this sort has been definitely avoided in the amplifier being discussed.

In this amplifier, the split-stator harmonic by-passing portion is composed of two fixed vacuum capacitors arranged to form a direct, low-inductance path to the chassis. Note in the photograph that the holding clips for the chassis side of the fixed capacitors terminate on an insulated phenolic block and are strapped to the chassis with copper strip to provide a short low-inductance ground connection. The reason for originally insulating the bottom of these capacitors was to be able to experiment with the possibilty of making these two capacitors into series resonant circuits at one of the more objectionable TVI harmonic frequencies. While the capacitors are 25 $\mu\mu$f each and represent a fairly low reactance to the higher order harmonic frequencies, a series resonant circuit would provide a substantially lower impedance. Time has not permitted this experimental work to be carried out to a successful conclusion.

[2] Bach, "You Can Live with TV!" *CQ*, June, July, 1948.



The two small capacitors drive together through the gear-train. The small gears on the main tuning shaft are engaging both of the larger gears thus driving both capacitors from a common shaft. If this drive shaft (with the two small gears afixed) is pushed to the rear, only one of the capacitors may be rotated. If pulled past center to the front, the other capacitor can be tuned. Once the correct setting has been determined (see text) the shaft its snapped back into the position shown and both capacitors operate together. The driving shaft has appropriately spaced grooves on its rear extension and these grooves act in conjunction with a ball-bearing spring combination to form a positive index. This insures proper meshing of the gears in any of the three possible positions. The gear ratio is 3.1; the diameter of the gears being 1½" and ½" respectively. Pitch is not important.

It will be noted that these two capacitors act only as fixed harmonic by-passes and play no part in the actual tuning of the circuit other than to add to the fixed minimum capacity across the single variable. If a conventional split-stator variable is used, the amount of harmonic by-passing will be different with each setting of the capacitor whereas in this arrangement, the harmonic by-passing capacity is independent of the setting of the single-ended capacitor used to tune our amplifier to resonance. Since half the value of one of the fixed capacitors (along with half of the plate-to-ground capacity of one of the tubes and the minimum capacity of the variable) appears across the full coil, it will be seen that the size of these capacitors is dictated in some degree by the frequency being used. Thus the 25-$\mu\mu$f units shown are about as great a capacity as one should use for 14 or 28-mc operation. Taking stray capacities into account, along with the minimum capacity of the variable, the total minimum capacity across the coil will approximate 30 $\mu\mu$f. Bear in mind that the harmonic by-passing capacity remains constant at the value of the fixed capacitor used in the split stator regardless of the band being used or the capacity setting of the variable. This means that the reactance of these by-passes will remain exactly the same at some particular harmonic frequency regardless of whether operation is on 10 or 80.

The New Vacuum Variable

The main final amplifier tuning capacitor is one of the new Eimac vacuum variables and its extremely compact construction has made it possible to build a complete high power amplifier on a chassis small enough to fit within the channels of a standard relay rack. Additionally, it has been most comforting to know that there will be no flashover across the tuning capacitor regardless of the humidity, accumulated dust, or the amount of plate voltage used on the amplifier. This vacuum variable was designed for circuits in which one side of the capacitor could be directly grounded and therefore has a single mounting flange from which the unit would normally be mounted to either front panel or chassis. The barrel of this capacitor is glass and it is almost impossible to provide a dual mounting wherein both ends are securely held without putting undue strain on the glass envelope. This was avoided in our amplifier by making up two identical mounting plates so that end capacities-to-ground would be equal, but using a self-centering beryllium copper contacting element on the normally free end. When the end plate and supporting insulators are placed into position, this circular contacting brush automatically centers the capacitor in the mounting plate. The brush in turn is brought up snugly against the end plate by a sub-plate (see photo). Contact loss is entirely negligible and no strain is placed on the glass portion of the capacitor.

Such a mounting arrangement will tend to increase the minimum capacity of the condenser, but not unduly so, since only the edges of the supplementary mounting plates are in close proximity to the chassis. With both ends floating in this manner, an insulated coupling will be required to drive the lead-screw and therefore the driven side will have a somewhat greater capacity to ground than the non-driven side. This will show up when balance measurements are made but can be easily compensated. Do not, under any circumstances, attempt to use the conventional, short flexible coupling with the capacitor working above ground! The coupling *must have a long leakage path;* this can be readily understood when sparks about two inches long can be drawn from the capacitor side of the coupling. As a safety precaution, make certain that the shaft on the dial side of the coupling is metal—and grounded—but good!

Since this capacitor requires about sixteen turns of the tuning knob to cover its capacity range, a conventional dial is meaningless for purposes of calibration. The dial we used is a brand-new one manufactured by the Heliopot Corporation of Pasadena, Calif., and employs a clever, crown-gear arrangement on the inner face of the knob to cause the outer scale to move one index division with each complete 360 degree rotation of the inner scale. This type of dial would be equally desirable for use with any lead-screw device.

A Plug-in Electrostatic Shield

Further harmonic attenuation is achieved in this amplifier by using an electrostatic shield between the antenna pick-up coil and the amplifier plate coil. The design problem involved in the construction and use of such a shield with a balanced circuit is naturally complicated by the fact that the shield must be placed in the center of the plate coil and still permit coil change. It would be entirely possible to construct a shield to be permanently attached to the antenna swinging link and move with it. However, Bach says,[2] and I heartily agree, that there is little use in using an electrostatic shield if you are going to require a long lead to connect it to the chassis. This latter scheme will therefore be ineffective unless possibly the antenna pick-up coil can be mounted near the deck and swing upward. In any case, we solved the problem by making the shield plug-in by four banana pins on the corners of the base. This base is not over one inch from the chassis and all four grounding points are connected in parallel. Not much inductance in this arrangement. Actual tests show approximately 15 db reduction in second harmonic; the higher order harmonics giving insufficient indication to provide reasonable measurement data.

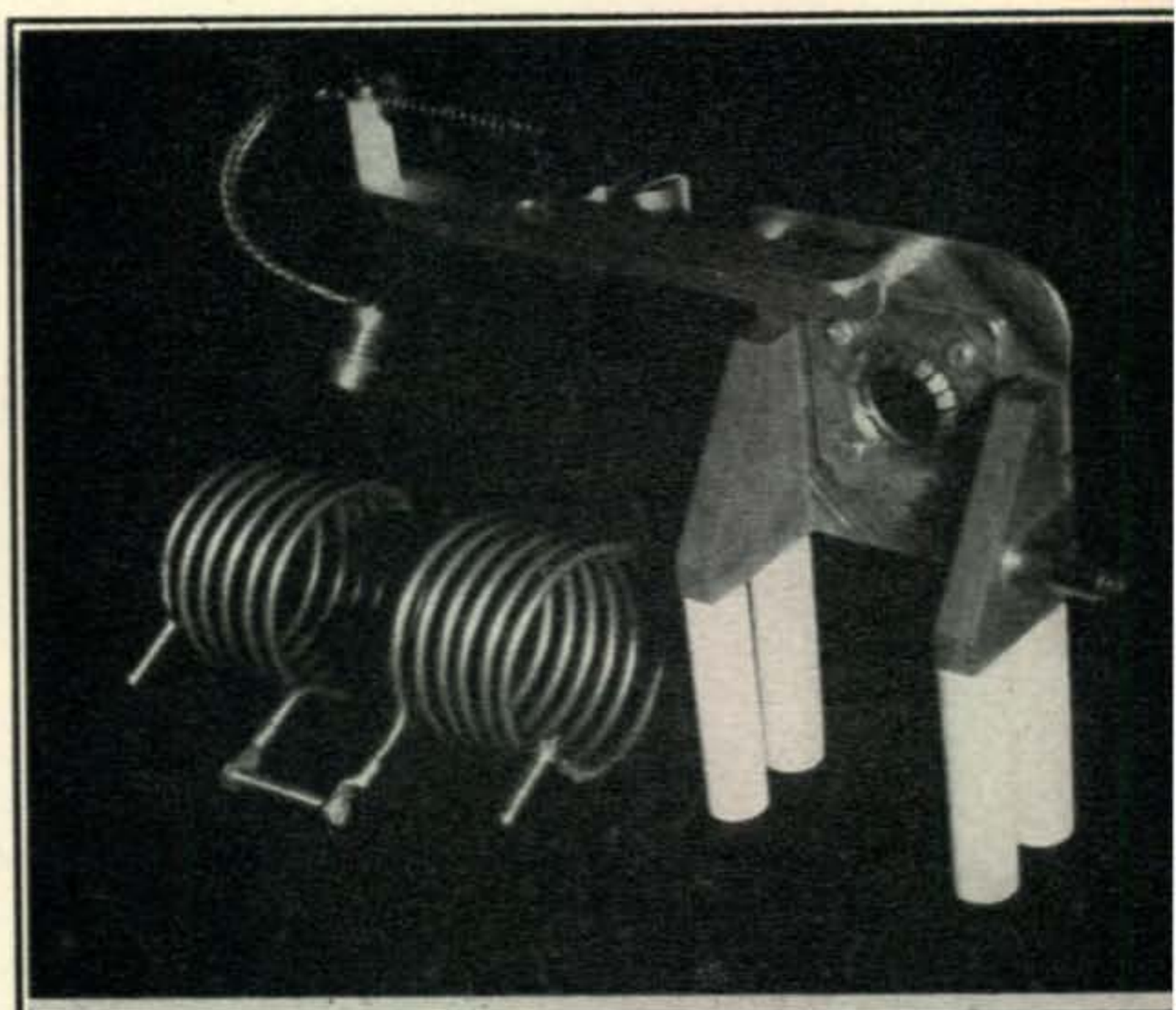
Some method of balancing the drive to both tubes is almost a necessity in any push-pull amplifier and we believe that the method used in ours has some merit. It was initially decided that, rather than to attempt to split the grid coil to get at individual grid currents, measurement of the individual screen currents would serve as the criterion of the drive that each tube was receiving. Individual screen currents are obtained by a metering switch in the screen supply circuit.

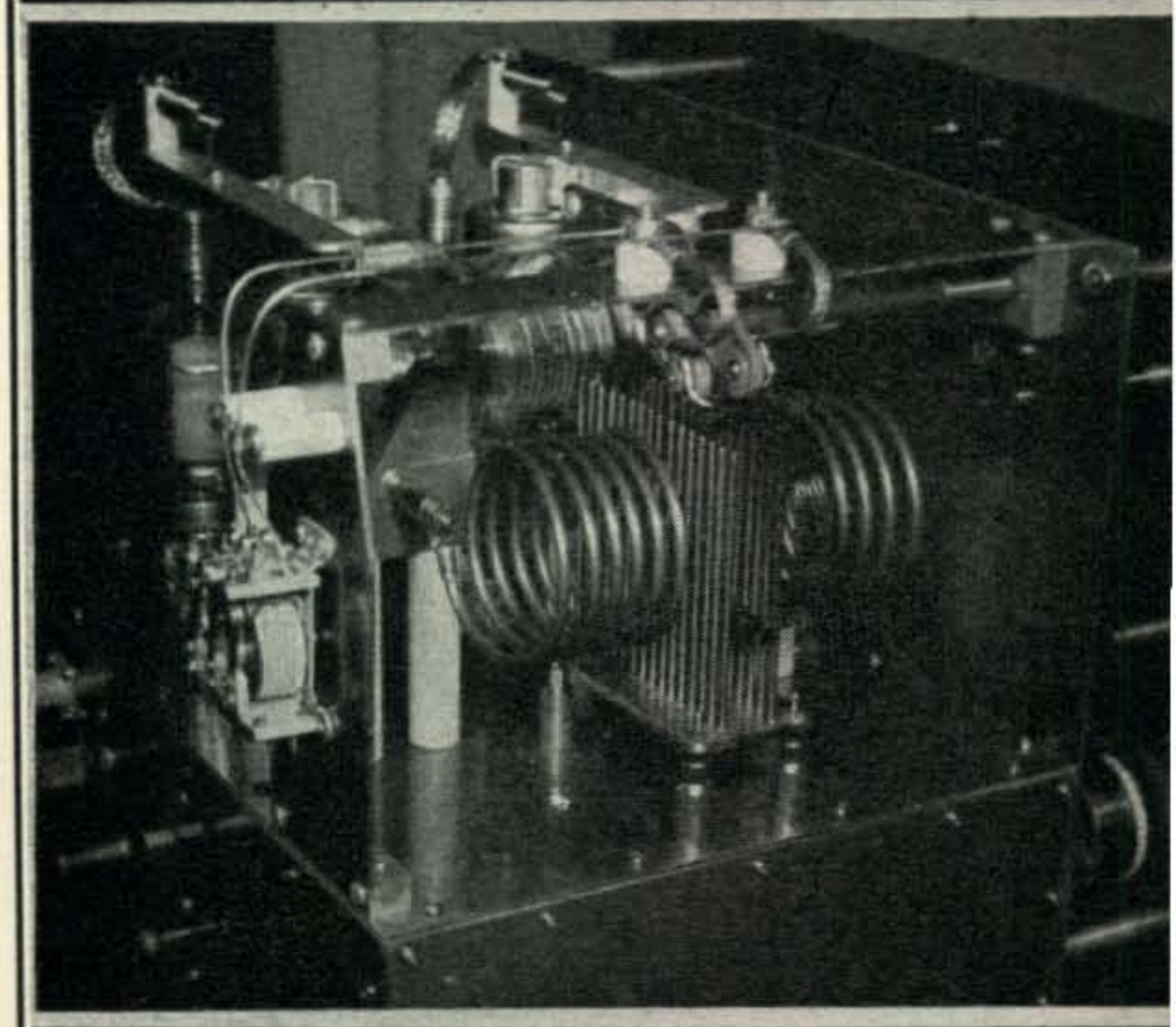
Balancing the Grid Drive

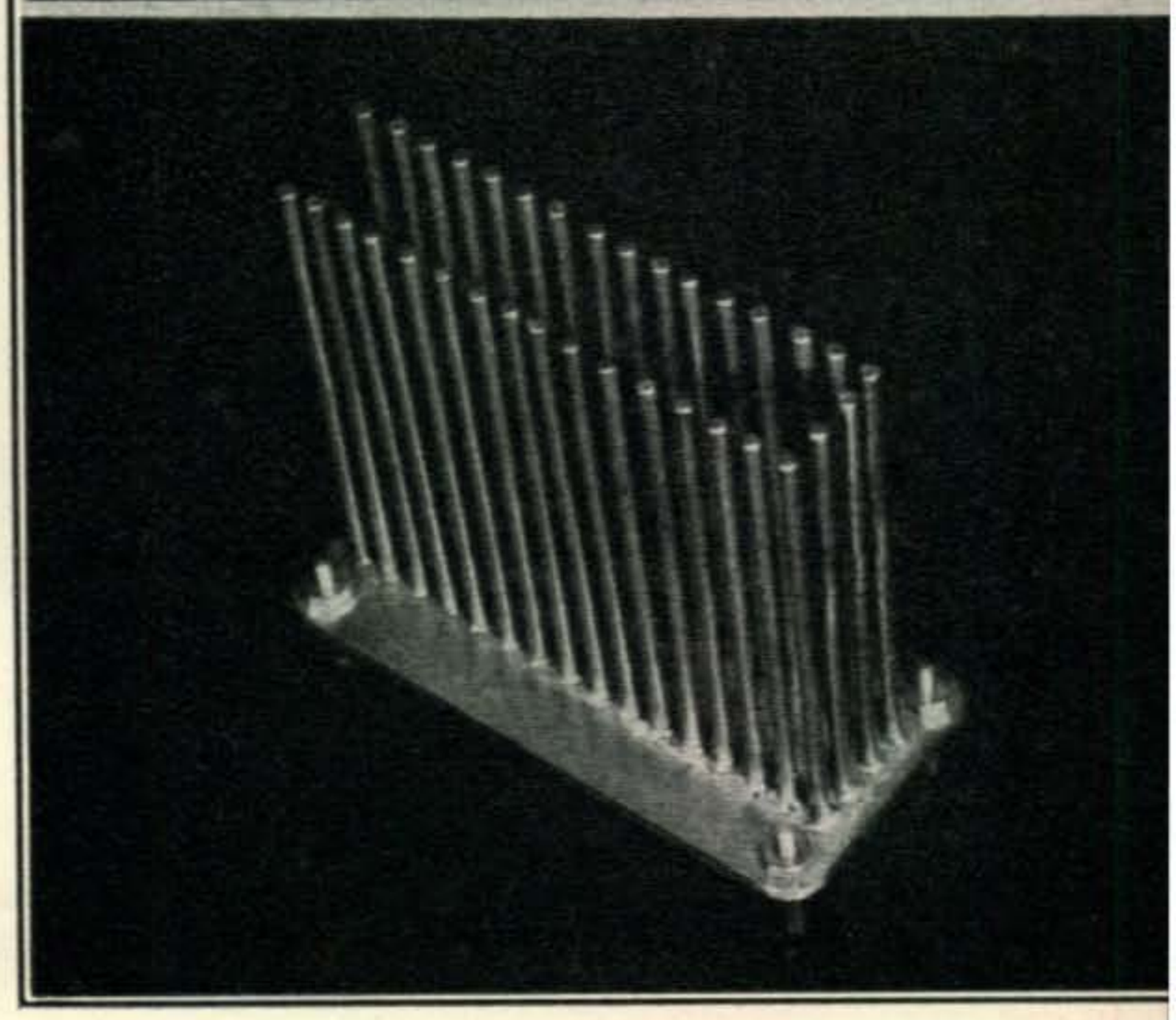
Balancing the grid drive is simple enough in concept, not so simple in application. If the normal split-stator tuning capacitor is permitted to estab-

lish the nodal point on the grid coil by acting as a capacitor divider (the necessary center-tap connection is kept "floating" by an r.f.c.) we have the basis for drive adjustment. Adding capacity to one of the split-stator sections will change the ratio of the divider and thus shift the nodal point to one side or the other. The essential difficulty with this simple method is that one must know in advance which side of the split stator has the greatest capacity in order to shunt the proper side. There is a possibility of using a supplemental variable shunting capacitor and switching it from one side to the other with a low-capacity rotary switch (one side remains common at all times). We use a mechanical method for the desired result that has few limitations in its ability to shift the node point to either side. Our split-stator is made up of two separate capacitors linked by a sliding gear arrangement so that either capacitor can be individually set and the gears then arranged so that both capacitors will track together thus maintaining the ratio. The details of this arrangement are clearly shown in the photograph.

(*Continued on page 73*)



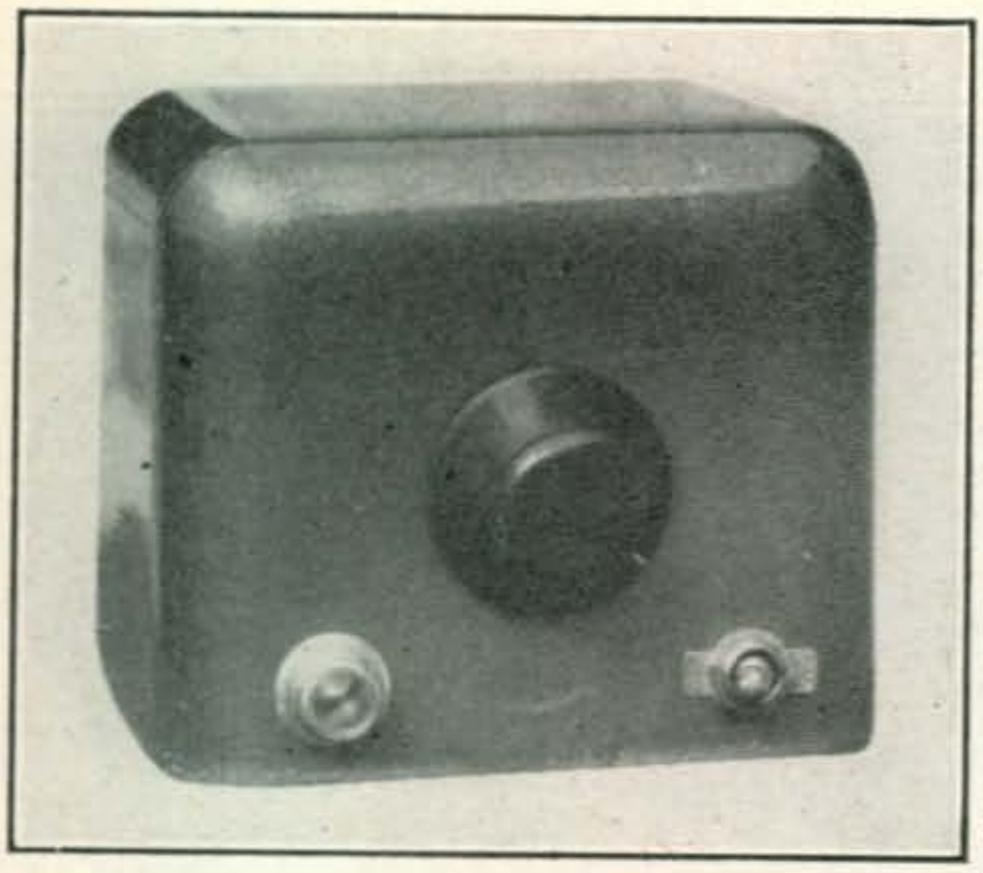




Top: Vacuum-variable mounting assembly. Attention is called to the Beryllium Copper brush which makes contact to one end of the vacuum variable. The four mounting holes in this contact are enlarged to permit the capacitor to center itself; the heavier holding plate is then tightened to hold the thin contact in position. This latter is a standard item made by James Millen and was originally used as a circular contact element for lighthouse tubes. Male plugs on the coil and female receptacle on the angular phenolic support on the end mounting plate are by E. F. Johnson. The four bottom stand-offs are of high-grade ceramic and are three inches in length. The spacing rod in the center of the inductor (to permit introduction of the electrostatic shield) is of brass and snaps into a Littlefuse clip mounted on a 3″ stand-off.

Center: Close-up of plate coil with electrostatic shield in position. The antenna pickup coil is variable and is gear driven from a front panel control. Pickup coil has five turns of No. 12 enamel wire. The mounting plate for the antenna relay serves also to introduce extra capacity to one side of the plate circuit (see text). The metal strip from this bracket to the front panel is used as a shield between the leads to the relay and the plate coil thus reducing capacitive coupling of harmonic energy between these two circuit elements. The antenna relay is mounted close to the antenna pickup link rather than somewhere in the feeder to avoid reflection difficulties.

Plug-in electrostatic shield. The vertical rods are or hard-drawn copper, .125″ diameter. Center-to-center spacing between rods is .250″. Spacing between the two end rods is .750″. Base is made from ⅛″ brass and is 2″ wide and 4¼″ in length. Height of rods is 4″ over-all. (⅛″ being taken up by the base). Holes in base are drilled undersize and reamed to .125″ for snug fit to rods. Holes are slightly countersunk on bottom to give a seat for solder. Soldering is done by heating plate over gas flame until solder will just flow. Don't get it too hot. Cover portions to be soldered with soldering paste. Wipe smooth with cloth just before the solder entirely sets.



The modulation meter attachment to the CRO is simple to build and compact in size.

ELLIOTT A. HENRY, W2SYD, EX-W9FEN*

A Direct Reading

CRO MODULATION METER

The cathode ray oscilloscope, once used, is indispensable. For the many amateurs who already own one, here is a useful auxiliary attachment.

THE METHOD of amplitude modulation measurement to be described, and used in the present equipment, is not new, having been used as far back as 1943 in the test of some war gear.

The system is based upon the use of a high-speed shorting switch to provide a zero reference level and thus to provide on the CRO screen an indication of unmodulated carrier as well as positive and negative modulation peaks. The system has been widely used to indicate percentage video modulation in television broadcast station modulation monitors.

Theory of Operation

Figure 1 pictorially describes an unmodulated (*a*) and an amplitude modulated (*b*) wave. After passing through a linear peak detector, the unmodulated wave appears as a steady d-c voltage whose value is proportional to the peak voltage of the unmodulated wave, while the modulated wave produces an incremental voltage whose peak at any given instant is proportional to the peak modulated carrier voltage at that instant. This is shown graphically in *Fig. 2* and the percentage modulation is defined as:

$$\text{Percentage modulation} = \frac{E_{max} - E_{min}}{E_{max} + E_{min}} \times 100$$

For 100% symetrical amplitude modulation, (called a modulation index of one) the instantaneous voltage varies between zero and twice the value of the unmodulated carrier wave. For any other modulation percentage there is a linear relationship between E_{max}, E_{min}, and Ecarrier. The relation between E_{max} and Ecarrier determines the percentage positive peak modulation while the relation between E_{min} and Ecarrier determines the percentage negative peak modulation.

For example, at 50% modulation E_{max} would be one and one half times greater and E_{min} would be one half of Ecarrier. If E_{max} was twice Ecarrier while E_{min} was one fourth Ecarrier, it would indicate 100% positive peak modulation and 75% negative peak modulation, a condition that might exist where the audio was polarized with the human voice.

Therefore, to measure modulation percentages we are concerned only with the magnitude of these voltages with respect to each other and not with their absolute magnitudes. By providing an indication, on a CRO screen, of the magnitude of the unmodulated carrier voltage, a reference is established whereby the relationship may be observed, and the percentage modulation, both positive and negative, read directly from a calibrated linear scale.

To show how this unmodulated carrier voltage

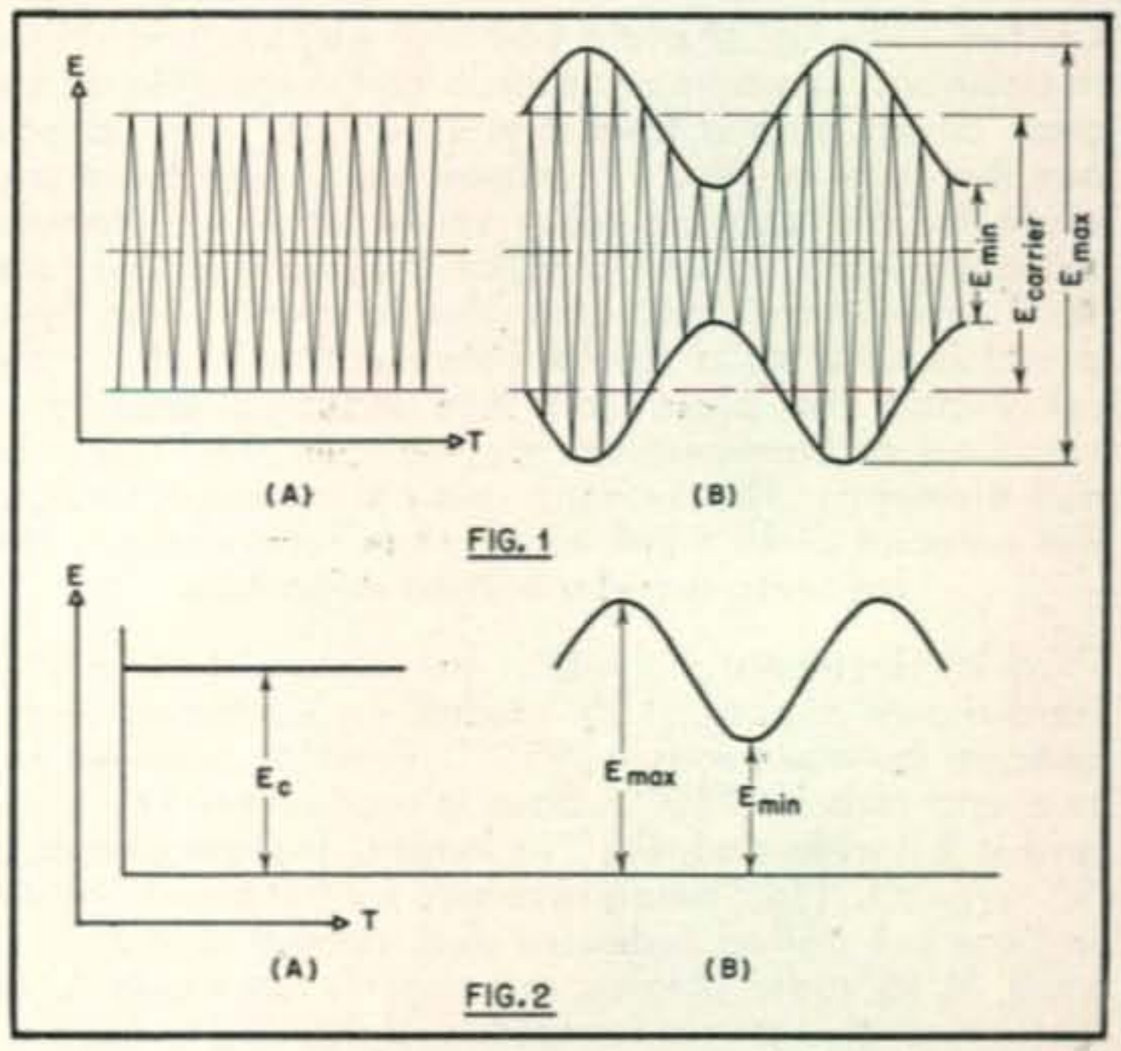


Fig. 1. Pictorial illustration of unmodulated (a) and amplitude modulated (b) wave.
Fig. 2. Graphic illustration of condition shown in Fig. 1.

* *c/o Globe Products Corp., 870 Maplewood Ave., Brideport, Conn.*

indication is obtained, reference is made to *Fig. 3.* When the switch S_1 is closed, with the battery polarity as shown, there is a rush of electrons from plate "A" of condenser C_1 to plate "B." To reach condenser plate "B," the electrons must pass through R_1, S_1, the battery, and R_2. The direction of current, or electron, flow is therefore such that during the period of current flow, or charge of condenser C_1, the grid of T_1 becomes positive with respect to ground. This condition continues until C_1 becomes fully charged at which time electron flow ceases and the grid returns to ground potential. The time of current flow is controlled by the time constant of the network, in this case essentially R_1, R_2, and C_1. Now, as the voltage developed across R_2, resulting from the charging current, makes the grid go positive, the "spot" on the CRO screen will move upward. As soon as C_1 is fully charged, however, current ceases to flow and the "spot" returns to its former position, remaining there as long as conditions remain unchanged.

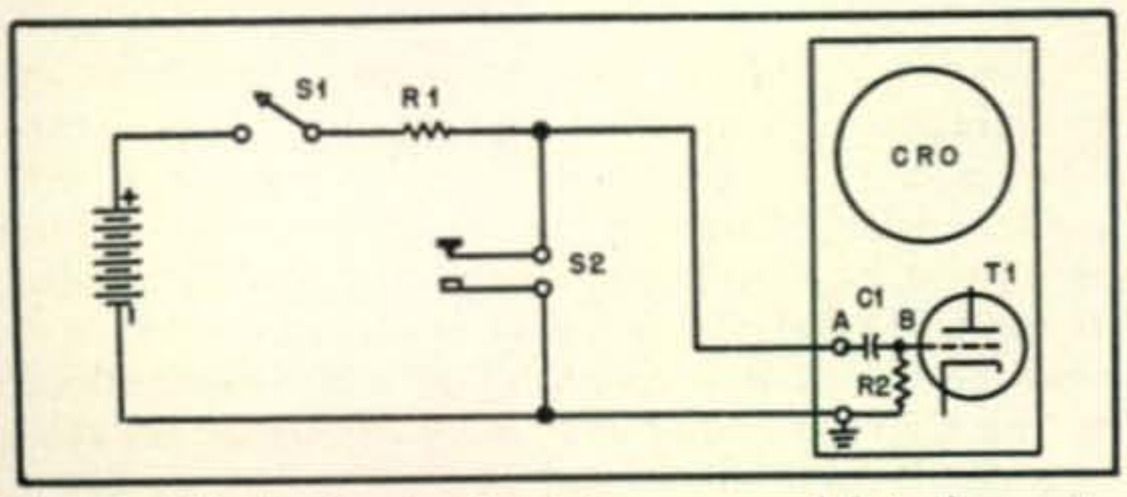


Fig. 3. Method of obtaining unmodulated carrier voltage indication.

If S_2 is momentarily depressed, C_1 will be rapidly discharged, while the battery will be protected from damage by the resistor R_1. The direction of current flow will now be from condenser plate "B" to "A" through R_2. This will make the grid go negative during the discharge period and the "spot" on the CRO screen will move downward. Therefore, the spot displacement will be proportional to the battery voltage, as C_1 has had a charge varying between zero and full battery voltage. If S_2 is made to operate rapidly and no time base is used on the CRO, two spots will appear on the screen, one above the other, and the distance between them is absolutely proportional to the battery voltage. With the CRO time base expanded, the pattern on the screen would appear as a series of pulses the duration of which is dependent upon the "on" time of S_2 and whose repetition rate is equal to the rate of operation of S_2.

By replacing the battery with the load of a linear diode rectifier and having S_2 operate automatically, a means is provided to show the carrier voltage reference on the CRO screen and the relationship of E_{max} and E_{min} to the carrier reference. *Figure 4* shows graphically the action of the shorting switch on the incremental output voltage of a linear diode detector as it would appear on a CRO screen with (a) and without (b) a time base. The modulation envelope would appear, under the latter condition, as a heavy vertical trace and the reference carrier level would be two dots located at the zero and negative 100% points, using a scale such as shown in *Fig. 5.*

Circuit Description

The circuit diagram is shown in *Fig. 6.* R-F energy from the final amplifier tank circuit is picked up by a coupling loop and fed to the pilot light, used as a visual level indicator. A 1N34 crystal rectifier is employed with R_1-C_1 forming the diode load. The time constant of the values shown is suitable for modulation frequencies up to 5,000 cps.

The value of resistor R_2 is not critical but should be approximately four to five times the value of R_1. R_2 is used to prevent the diode load from being shorted out during the switch "on" time.[1] The shorting switch is a Western Electric Co. mercury wetted contact relay, and is operated on what is essentially a half sine wave at 60 cps. Voltage from the 117-volt line is used to operate the relay, with condenser C_3 used in place of a dropping resistor. Resistor R_3 is used as a vernier adjustment to control the "on" time of the switch. The operating coil is shunted with a midget selenium rectifier which makes it essentially a polarized relay or, by by-passing the unwanted portion of the 60 cycles, provides the half sine wave for the relay operation. The relay, therefore, acts like an automatic switch operating sixty times per second.[2]

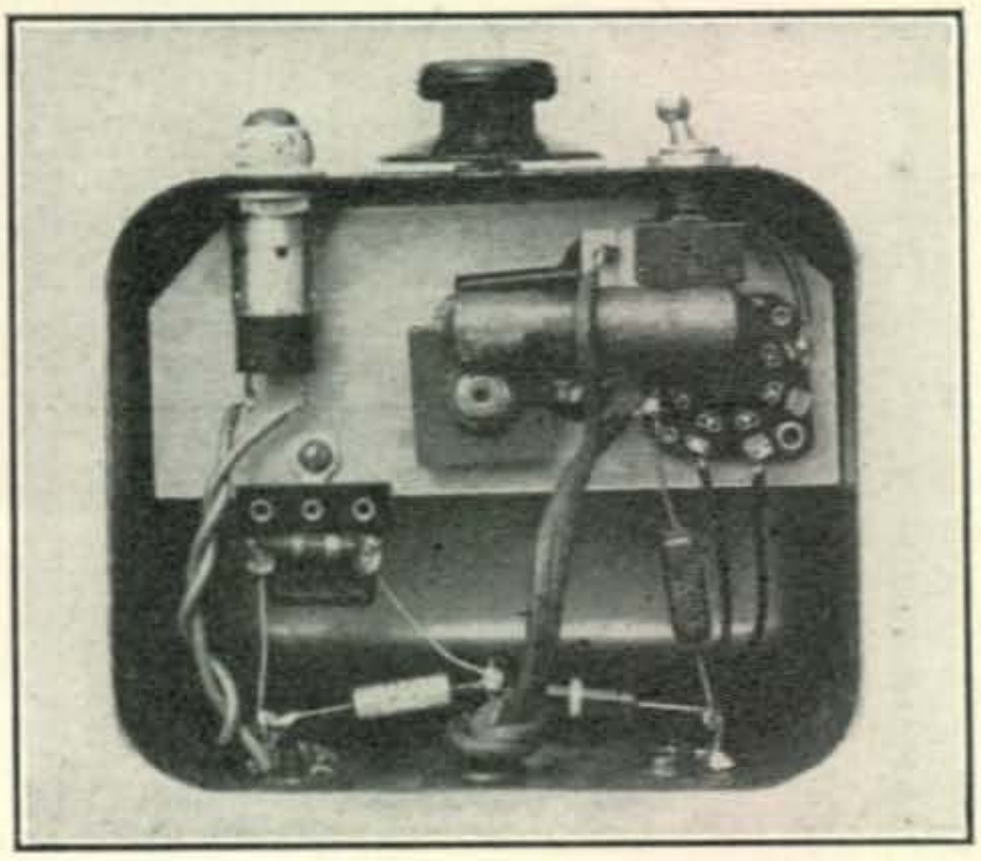
A diode tube could, of course, be used in place of the 1N34 crystal rectifier but the "emission pressure" of the tube would superimpose a voltage on the rectified output. Compensation for this condition could be made but it's far simpler to use the crystal diode. The "emission pressure" may be defined as the voltage developed across the diode load as a result of the high-velocity electrons reaching the diode plate when no external input voltage is applied.

Construction

The indicator may be made as an individual unit, as shown in the photograph, or may be built as an

1 The value of R_2 should not be so large that due to the capacity from point "A" to ground the higher modulating frequencies are attenuated more than a few degrees by the low-pass filter comprised of R_2 and the capacity from A to ground. It is important to realize that attenuation of audio modulating frequencies provide a percentage modulation indication that will be lower than the actual value. Poor transient (or square wave) response at the switching frequency may cause an erroneous indication—*Ed.*

2 Other switching means are discussed in the article by T. J. Buzalski, "A Method of Measuring the Degree of Modulation of a Television Signal," *R.C.A. Review*, June, 1946.



Placement of parts is not critical and physical layout may be altered to suit individual requirements.

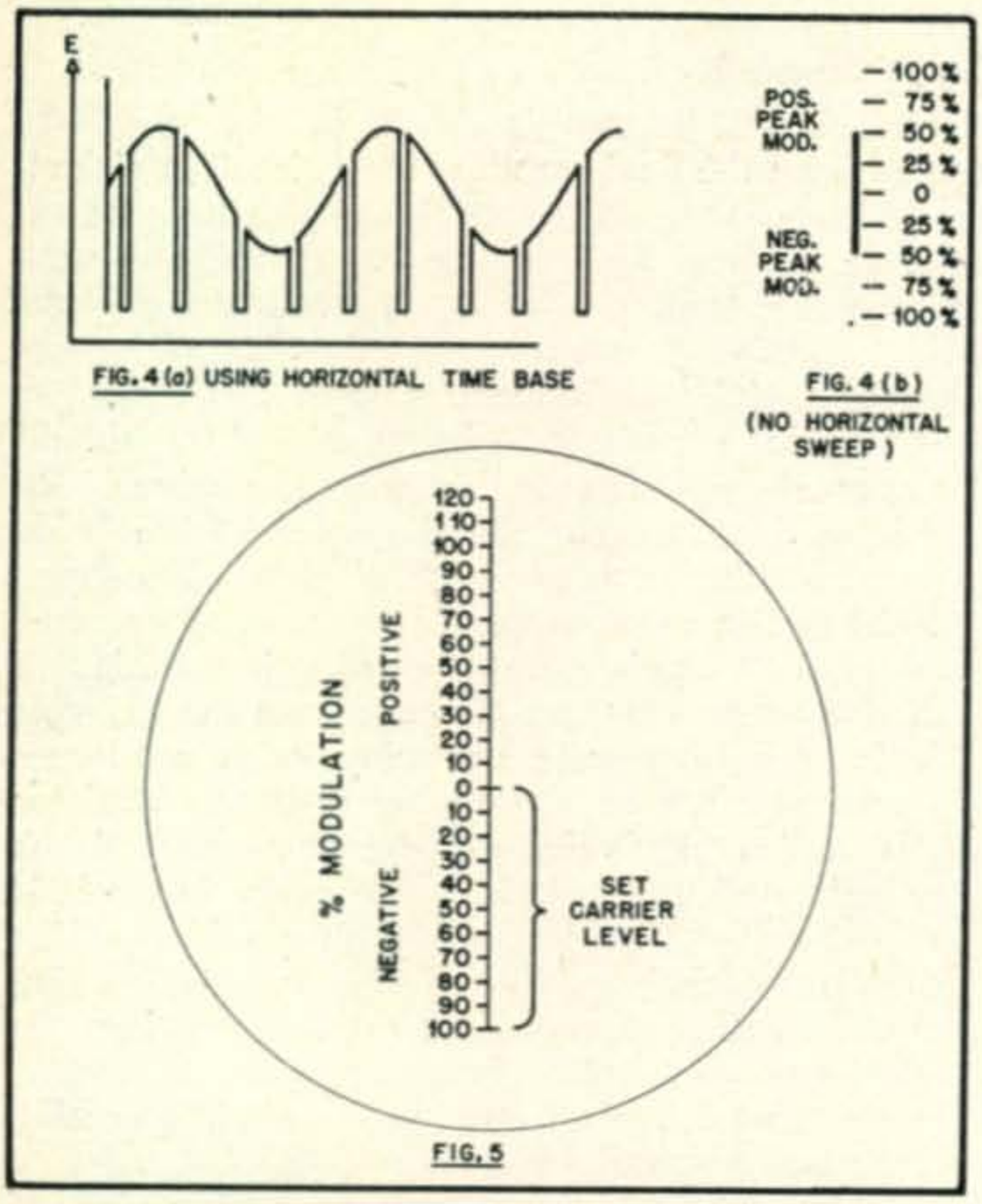


FIG. 4 (a) USING HORIZONTAL TIME BASE

FIG. 4 (b) (NO HORIZONTAL SWEEP)

FIG. 5

4. Incremental output voltage with (a) and without (b) a time base.
Fig. 5. Recommended CRO scale for measuring modulation envelope.

integral part of the transmitter. Short leads, good soldered connections, and the relay mounted in a vertical position with the pins down is all that is essential. The unit shown was built in a surplus transformer can 5¼" x 4¼" x 4¼". A shielded output cable to the CRO is recommended to prevent stray pick-up. The shielded cable should be short in order to avoid attenuation of h-f audio components or values of R_1, R_2, and C_1 must be modified (see footnote 1).

Installation and Operation

With the unit placed in operation and connected to a CRO, couple the input to the final amplifier tank until the pilot lamp shows about half brilliancy. With the transmitter modulator turned off and the CRO time base set to approximately 30 cps, increase R_3 until a series of negative pulses appear. Advance R_3 a few degrees beyond this point and then no further adjustment should be necessary. Turn off the CRO time base. The pattern will then be two vertical spots with perhaps a very faint trace between them. Adjust the centering and gain controls until the upper spot is on zero and the lower spot is on negative 100%. If there is hum on the carrier, which is modulation, it will not be possible to get a good upper spot. If you don't want to bother to eliminate the hum, then center the short heavy vertical line on zero.

With the modulator turned on and modulation applied, a heavy line will be seen to extend both upward and downward from the zero spot. If the modulation is symmetrical, the line will extend equally in both directions and the positive and negative percentage peak modulation may be read directly off the linear scale. No further adjustment is required as long as the carrier strength remains the same. Any change in either the carrier strength or CRO gain will be noted by shifting of the reference spots and may be readjusted with the CRO gain control.

The Shorting Switch

The shorting switch,[2] or relay, is the most important part in the equipment. It is strongly urged that either the relay specified or one of the mercury wetted contact type be used if satisfactory operation is desired. This relay has the appearance of a metal 6F6 tube and mounts in a standard octal socket. The three main requirements for a relay in this class of service are fast operation, low contact resistance, and freedom from bounce or chatter. This type of relay is the only type that meets the above requirements among those the writer has had the opportunity to test.

If the unit is to be used above 100 mc, it is recommended that the 1N38 crystal diode be used in place of the 1N34 as its frequency range extends to several hundred megacycles, according to the manufacturer.

Oscilloscope

The requirements for the CRO to be used with this modulation measurement equipment are moderate. They are reasonably good transient response, adequate frequency response up to the highest modulation frequency, and condenser input should be used. If the CRO does not have an isolating condenser, it may be added externally. The transient response of the CRO amplifier may be checked by shorting out the crystal diode and placing a 1½ to 6-volt battery across the input terminals of the modulation meter. Observation of the pattern will show whether "overshoot," phase shift, or "ringing" is present.

The calibrated scale may be one of the transparent rulers sold at most stationery stores or can be a "film positive" from a photograph of a drawing similar to the one shown in *Fig. 5*.

The action of the shorting switch may be considered as a "d-c restorer" or "clamp circuit" or as transforming the d.c. into a pulse or square wave, which the a-c amplifier can pass. This technique is useful in many other measurement problems involving small d.c., as well as incremental, voltages and currents. By a simple modification it can be used to provide a baseline for gain measurements in visual alignment systems.

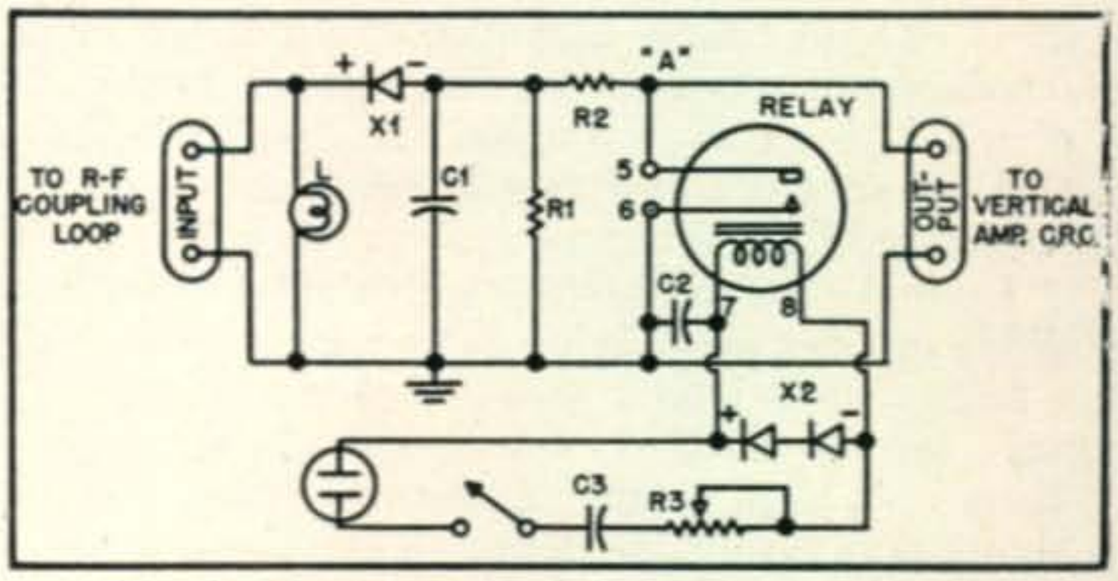


Fig. 6. Complete modulation meter circuit.

C1, C2—.005 μf.
C3—0.1 μf, 600 v.
R1—27K ohms.
R2—100K ohms.
R3—50K ohms, 1-watt pot.
L—General Electric No. 47 or equal.
X1—1N34 crystal diode.
X2—Selenium rectifier (Federal No. 402D3200 or equal).
REL—Western Electric Co. No. D-163781.

Monthly DX Predictions-December

OLIVER PERRY FERRELL*

THE METHODS described in National Bureau of Standards Circular 462 ("Ionospheric Radio Propagation")[1] making use of the C.R.P.L.-D series ("Basic Radio Propagation Predictions")[1] permits a fairly accurate estimate of radio transmitting conditions to be predicted in advance. Also of special interest to the radio amateur are the modifications outlined in an article in the November, 1948, issue of *CQ*.[2] Using the method described in this latter text the following analysis was prepared based on these parameters:

A. 1000 watts effective radiated power.
B. Antenna gain factor = 1.
C. Noise discrimination factor = 1.
D. Service gain factor c-w to phone = 14 db.
E. Receiving location free from man-made noise.

West Coast to South Africa

40 meters: High atmospheric noise level at far end of the path. South African signals may be heard, but only the strongest American signals will get through the noise. Peak time 1730 to 2000 hours PST. *20 meters:* Conditions build up slowly after 1345 PST. Best time from 1700 until 1845 hours PST. C-W signals should be strong and fairly steady. Readability of American phones limited by atmospheric noise at far end of the path. *10 meters:* Weak signals after 0630 hours PST. Possible sharp peak in conditions from 1030 until 1130 PST. This is not a good month for working this path at this frequency due to the very high absorption ratio in the southern hemisphere.

West Coast to Southeastern Asia

40 meters: Reception at far end limited by atmospheric noises sources around Timor. Path workable between 0230 and 0430 hours PST. Strong signals will be heard on West Coast around sunrise, but noise will generally be 4 to 6 db stronger than received signals at far end of path. *20 meters:* Irregular opening predicted 0830 to 1015 hours PST. Considerable day-to-day variation expected, though when band is open all signals will be strong. Phone signals easily readable in both directions. *10 meters:* Short opening commencing about 1545 hours PST. Signals strongest during first hour of opening with band closing with day-to-day variations between 1700 and 1730 PST.

West Coast to Middle East

40 meters: Conditions unfavorable. No openings are predicted due to normal auroral zone absorption. Band might open sporadicly shortly (i.e., 24 to 30 hours) before onset of ionosphere storms, but this is unreliable. Secondary limitation is atmospheric noise level at far end of path. *20 meters:* Erratic opening starting about 0645 PST. Signals fair, but fluttering fades. Signal strength decreases slowly till band closes shortly after 1000 PST. Phone signals probably unreadable due to atmospheric noise at far end of path. Few stations with high power and good directional antennas may get through on phone. This is unusual opening due to solstice effects in northern hemisphere. *10 meters:* No openings predicted this month. A few scattered signals may be heard around 0800 PST, but the MUF should not regularly exceed 24 mc.

West Coast to Western Europe

40 meters: High auroral absorption precludes regular openings. Few scattered signals around midnight. Very very weak. *20 meters:* Solstice effects decrease afternoon MUF. Erratic opening starting about 0645 PST. Strengths decrease, but build up again around noon. Strictly a fairly poor c-w opening. *10 meters:* Good opening starting about 0745 PST. Signals good strength except during ionosphere storms. Band closes shortly after 1000 hours PST. Phone signals readable with fluttering fades.

West Coast to South America

40 meters: High noise at far end. Signals will be heard along West Coast after 2100 PST. High power may get through, but peak opening expected to extend from 2330 until 0100 PST the following morning. *20 meters:* Good signal strengths from 1700 until shortly after 2300 hours PST. *10 meters:* Band opens regularly around 0700 PST with fair signals. Strengths drop off 4 to 6-db during late morning, but build back up after 1400 PST. Peak signals 1530 until band closes at 1730 PST.

East Coast to East Indies

40 meters: High noise level plus direct path absorption limits opening to short period between 0630 and 0715 EST. Not to be depended upon! *20 meters:* MUF limitation over great circle route. Band may open erratically with weak signals after 0815 EST. Closes around 0915 EST. Strictly a poor c-w opening. *10 meters:* Good likelihood of a fair opening from 1045 until 1215 EST. Opening and closing times likely to vary as much as 45 minutes in either direction. Signal strengths should be good, phones always readable.

East Coast to Eastern Asia

40 meters: Auroral absorption limiting factor. erratic signals between 0400 and 0600 hours EST. However, these will be very rare over the direct path. *20 meters:* Band appears likely to open around 1715 EST. Signals weak, but may peak from 1915 until 2000 hours EST. Strictly a poor c-w opening. Solstice effects, no morning openings. *10 meters:* Short peak opening about 1745 to 1900 EST. Possibly sporadic, but when band is open signals will be good strength with phones readable.

East Coast to Australasia

40 meters: Fairly strong signals along eastern seaboard from 0400 until 0830 EST. Far end of path has noise level about 10 db above kilowatt incident field. Static will decrease after 0530, possibly good contacts between 0700 until 0830 hours EST. *20 meters:* Opening will begin suddenly around 0730 hours EST with fairly strong signals in both directions. Best period extends from 0730 until 0915 EST, although stronger c-w signals may be heard

(*Continued on page 56*

**Assistant Editor, CQ.*

1 Available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

2 "A New Method of Predicting Band Conditions," O. P. Ferrell, *CQ*, November, 1948, page 26.

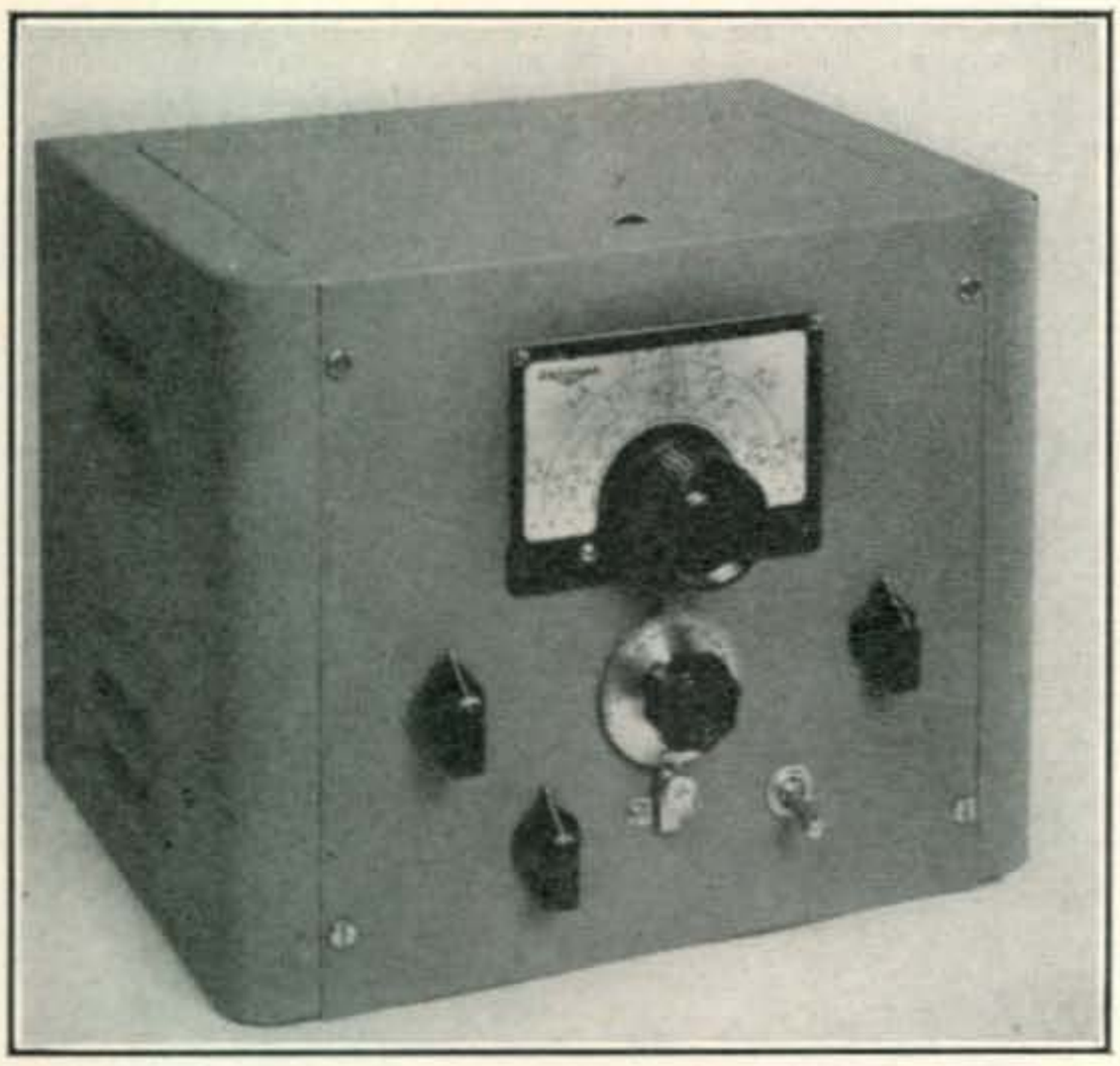


Fig. 1. Front view of the superheterodyne receiver. Typewritten figures, cemented to the paper dial plate, provide calibration of the 100-kc points in the 3.5, 7 and 14-mc bands. Once set on the band and locked, the band-set dial is not adjusted. The mixer tuning condenser, C1, needs only retouching to peak the band in use. The "send-receive" switch controls B+ to the receiver and is also connected to a pair of terminals on the rear apron which may be employed to control the associated transmitter.

A. DAVID MIDDELTON, W1CA*

Beginners' Superhet for 80, 40 & 20

Good c-w reception will make it far simpler for the newcomer to get his code speed up. With the ticket in hand, this same receiver will serve as the foundation unit for good communications.

THE SUPERHETERODYNE receiver is not necessarily a complex piece of receiving equipment. For the amateur who desires good reception at a minimum cost here is a simple but effective communications receiver. It is not a "toy" to be constructed for experience and then relegated to the junk box. It will do a man-sized job on the crowded ham bands, yet can easily be built by the newcomer without elaborate test equipment or previous experience with this type construction.

This superheterodyne receiver consists of a 6SB7Y mixer, a 6J6 oscillator, a 6SH7 combination intermediate-frequency amplifier and regenerative second detector, a 6J5 triode audio amplifier and a VR150/OB3 voltage regulator tube. Plug-in coils provide bandspread coverage of the 14, 7 and 3.5-mc bands, and general coverage from 3 to 18 mc.

Front-panel controls include: slow-motion dial drive for the bandspread condenser (with calibrated scales) bandset dial, mixer tuning knob, mixer gain control, regeneration control (second detector) and SEND-RECEIVE switch. These controls are placed for maximum operating efficiency. Located on the rear apron are: antenna terminals, the headphone jack (insulated from d.c.), "ground" terminal and two terminals connected to the "send" side of the front-panel standby switch which may be used to control a transmitter.

The receiver is arranged for the connection of either a single or two-wire antenna feed system. Ample output is provided for headphone operation. No provision was made for loudspeaker operation since this receiver is intended for c-w reception which is logically carried out using headphones.

*23 River Glen, Farmington, Conn.

Receiver operation is essentially "one dial" as no adjustments are required (on c.w.) after the band-set condenser is properly adjusted, mixer tuning set, and the non-critical regeneration adjusted.

The receiver components are mounted on an 8" x 8" steel panel and a 7" x 7" x 2" steel chassis. These two units are fastened together and fit into a suitable cabinet.

This receiver uses the same type power supply as that shown for the simple two-tube receiver. This was fully described in February, 1948, *CQ* on page 23. Any power supply capable of delivering 275 volts d.c. at approximately 50 ma and 6.3 volts at 2 amps will be adequate.

In this receiver the local oscillator is placed on the *high* frequency side of the incoming signal as follows (based on an intermediate frequency of 1700 kc):

Band, mc	*Mixer, kc*	*Oscillator (tuning range), kc*
3.5	3500 to 4000	5200 to 5700
7.0	7000 to 7300	8700 to 9000
14.0	14,000 to 14,400	15,700 to 16,100

Tuning ranges for other portions of the spectrum may be found by *adding* the value of the intermediate frequency (1700 kc) to that of the incoming signal. It is, of course, possible to operate the receiver with the oscillator placed on the low frequency side of the incoming signal, but it was found advisable to keep it on the high side at all times.

The coils are not complicated and no critical cathode taps are required. The mixer coil and its associated antenna link are simple coils wound without taps on a 1-inch form. The 3.5-mc mixer coil is wound on a 1¼" form. The oscillator coil, a two-terminal unit, requires only one tap, that for the

bandspread condenser. The placement of this tap requires care to prevent shorted turns but this is not difficult to accomplish. Use of an r-f choke in the cathode of the i-f-second detector eliminates any conversion of the i-f transformer, which is used "as is."

Assembling the Receiver

First, locate and fasten the tube and coil sockets in place. (Location of the socket "keys" is shown in *Fig. 4*). Do not place the i-f transformer until later. Soldering lugs are placed under most of the socket mounting nuts, for future use. Place a soldering lug on top of the chassis as well as underneath on the *inside* mounting screw holding *S1*. Place the front panel components in their respective positions and fasten their locking nuts. Assemble the tuning condenser on its plate and fasten this in place on the rear of dial-drive assembly. This assembly should be carefully adjusted before tightening the mounting screws to prevent binding of the control.

After the top chassis and front panel components are in place, fasten the panel to the chassis by means of the shank on the potentiometer, *R2*, and the SEND-RECEIVE switch, *SW1*. The band-set dial lock is put on after the dial is in place. The panel-chassis assembly may appear insecure and wobbly but after it is fastened in the cabinet it will be very firm and strong.

Small threaded bushings are added to the bottom rear of the chassis to keep it level. The bushings compensate for the ½-inch lift of the chassis required to clear the lower edge of the cabinet.

Place three four-lug tie strips as shown in *Fig. 4*. Clip off the unused leads to *L3*, and place it in position with the leads coming from the chassis side of the unit. This high-impedance choke is made from a replacement push-pull audio transformer, and the unused leads are "plate," "B-plus" and secondary "center tap." The only leads required will be marked "grid-grid" or *GG*. If desired, the location of the proper leads may be checked on an ohmmeter. The proper secondary windings will measure a higher resistance than any of the unused portions of the transformer.

Wiring the Receiver

A. Ground the following: pin 7 of sockets *S2*, *S5*, and *S6*, pin 1 of *S1* and *S3*, pin 3 and 5 of *S4* and pin 2 of *S7*, pin 1 of *S2*, *S5* and *S6*.

B. With insulated wire, connect the following points together and connect tie-lug *C3* ("hot" filament): pin 2 of sockets *S2*, *S5*, *S6*, and pin 4 of *S4*.

C. With insulated wire connect stator (stationary plate) *C1* and pin 4, *S1*. Ground rotor (movable plates) *C1*, *C12* and *C13* to top chassis lug. Connect pin 4, *S1* and pin 5, *S2*. Twist two 8-inch pieces of insulated wire together and connect one wire to each of the two antenna terminals on rear apron and to pin 2 and pin 3 of *S1*.

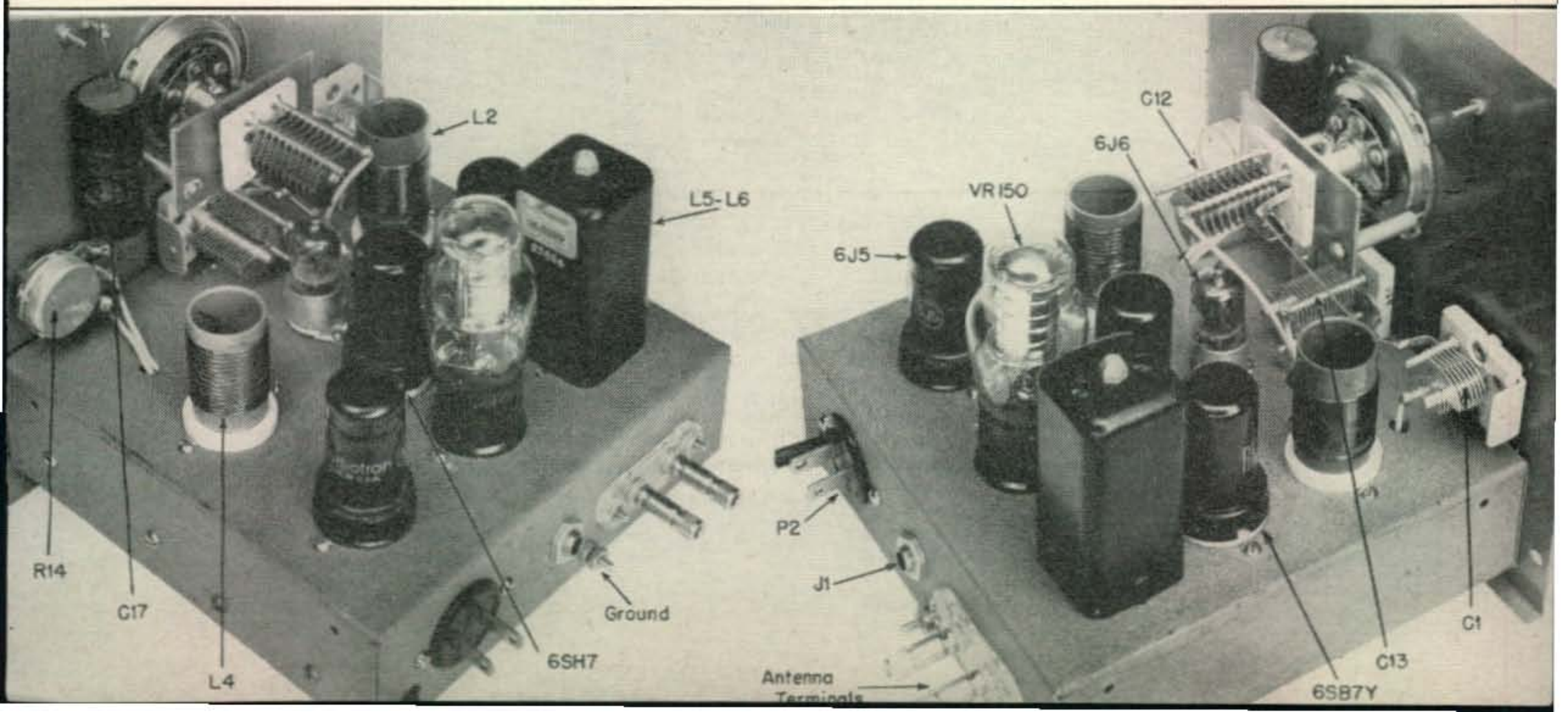
D. Connect *R1* between pin 6, *S2* and *lug A1*. Connect terminal *KK* of *R2* (see *Fig. 5*) to *lug A1*. Ground terminal *JJ*, *R2*. Connect *C2* between pin 6, *S2* and ground. Connect *R3* between pin 8, *S2* and ground. Connect *C3* between pin 8, *S2*, and pin 7, *S4*. Connect *C4* between pin 4 of *S2* and ground. Connect *R5* between *lugs A3* and *A2*. Connect *R4* between *lugs A2* and ground. Connect pin 4, *S2* to *lug A2*. Install i-f transformer (*L5-L6*) and connect Blue lead (*L5*) to pin 3, *S2*. Connect the red lead (*L5*) to *lug A3*. Connect *C16* between *lug A3* and ground.

E. Connect stator, *C12* to pin 2, *S3*. Connect stator, *C13* to pin 3, *S3*. Connect pin 3, *S3* to pin 6, *S4*. Connect *C14* between pins 2 and 6 of *S4*. Connect *R9* between pin 7, *S4* and ground. Connect *R10* between pins 1 and 2 of *S4*. Connect *R11* between pin 1, *S4* and *lug B2*. Connect *C15* between pin 1, *S4* and ground.

F. Connect *lug B2* and pin 5, *S7*. Mount *R12* with provided device on side apron of chassis (see *Fig. 4*). Connect *R12* (wire-wound resistor with slider) between *lugs B2* and *B3*. Connect lugs *A3* and *B3*.

G. Connect green lead of i-f transformer (*L6*) to *lug B1*. Connect *C5* and *R13* in parallel and connect between *lug B1* and pin 4, *S5*. Connect *RFC 1* in parallel with *C6*, and connect between pin 3, *S5* and ground. Connect *C17* between terminal *HH* (see *Fig. 4* and *Fig. 5*) and ground other lead on upper right-hand mounting screw of dial assem-

Fig. 2. Left: Left-side view of the receiver chassis. Note the mounting of the bandspread condenser, C12, on its metal bushings. The two lower dial-mounting screws fasten the bushings to the front panel. The dial drive is mounted on the rear of the front panel. Right: Right-side view of the chassis. The mixer-tuning and the band-set condensers are fastened to the front panel, but are grounded to a common soldering lug on top the chassis. This lug is held down by the inside mounting screw on socket S1.



bly. (Note: This is *not* an r.f. by-pass but is a "smoothing condenser" for *R14*, and thus it is permissable to ground it to the panel.)

H. Connect pin 6, *S5* to *HH* on *R14*. Connect terminal *II*, *R14* to one end *R15* and connect other end *R15* to *lug B2*. Connect *C7* between pin 8, *S5* and ground. Connect *RFC 2* between pin 8, *S5* and *lug B4*. Connect *C18* from *lug B4* to ground.

I. Connect one lead, *L3* to *lug B4* and other lead *L3* to *lug B2*. Connect *C9* between *lug B2* and ground. Connect *C8* between *lug B4* and pin 5, *S6*. Connect *R6* between pin 5, *S6* and ground.

J. Connect *R7* between pin 8, *S6* and ground. Connect *positive* lead *C10* to pin 8, *S6* and ground negative lead *C10*. Connect *R8* between pin 3, *S6* and *lug B3*. Connect *C11* between pin 3, *S6* and tip connection, *J1*.

K. Connect terminal *AA SW1* (see *Fig. 5C* to *lug B3*. Connect terminal *CC, SW1* to *lug C1*. Connect terminals *FF* and *BB, SW1*, to terminals of P2 on rear apron.

L. Connect four-wire battery cable as follows: Red wire to *lug C1;* yellow wire to *lug C3*, ground black and brown wires. On plug (*P1*) end of cable, connect as follows: red wire to pin 2, brown wire to pin 1 and black wire to pin 3, yellow wire to pin 4.

Winding the Coils

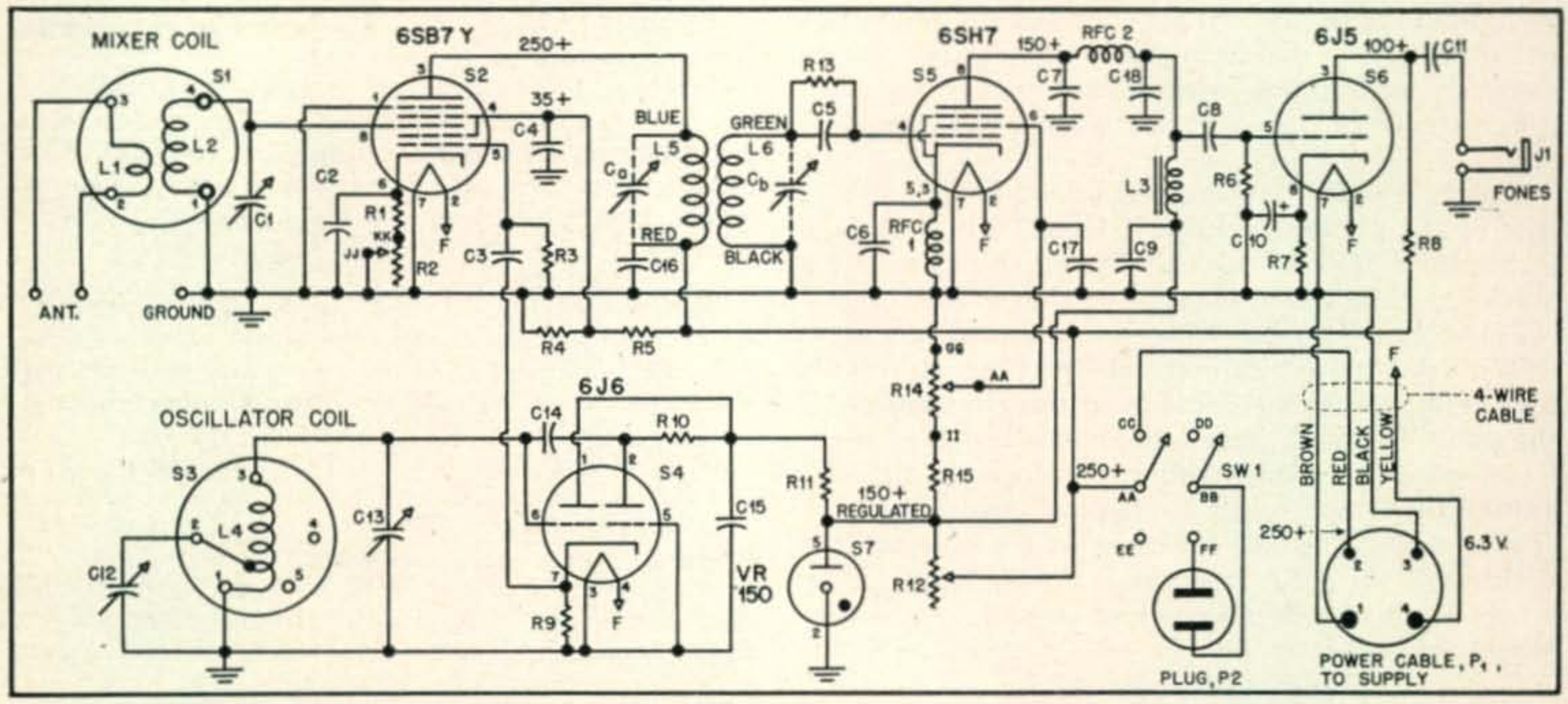
Coils for the beginners' superhet are wound with No. 22 enameled wire as shown in *Table I*.

L1 connects between small pins 2 and 3 on the four-prong form. *L2* is wound in the same direction as *L1* and connects between large pins 1 and 4. *L4* connects between pins 1 and 3 on the five-prong form and the bandspread tap connects to pin 2.

Testing the Receiver

After wiring the receiver, it is best to make a few simple tests before attempting to place it in actual operation. Make a careful inspection of the wiring, checking it against the diagram and the recommended wiring procedure.

Remove the rectifier tube from the power supply. Plug the power cable into the power supply and the a-c cord into a fused receptacle. Then, with the tubes in place in the receiver, turn on the power supply. The filament glow of the 6J6 should be visible and the other tubes should become warm. If this check is satisfactory, replace the rectifier tube in the power supply. Place the send-receive switch



Schematic diagram of the complete superheterodyne receiver for 14, 7 and 3.5 mc.

C1—35 μμf, midget variable (mixer).
C2—.005 μf, mica.
C3, C14—40 μμf, mica.
C4, C8, C9, C11, C15, C16—0.01 μf, paper.
C5—250 μμf, midget, ceramic.
C6—250 μμf, midget, mica.
C7, C18—100 μμf, midget, ceramic or mica.
C10—10 μf, midget electroloytic.
C12—30 μμf, midget variable (bandspread).
C13—75 μμf, midget variable (bandset).
C14—40 μμf, mica.
C17—0.5 μf, paper.
R1—470 ohms, ½ watt.
R2—25,000-ohm potentiometer.
R3, R10—47,000 ohms, ½ watt.
R4, R5—250,000 ohms, ½ watt.
R6—470,000 ohms, ½ watt.
R7, R9—2200 ohms, ½ watt.
R8, R15—100,000 ohms, ½ watt.
R11—10,000 ohms, ½ watt.
R12—10,000 ohms, 10-watt variable, wire wound.
R13—1 megohm, ½ watt.
R14—50,000-ohm potentiometer.

L1, through L4—See text.
L3—Push-pull audio transformer, midget replacement type for connection, see text.
L5, L6—Intermediate-frequency transformer, 1600 kc replacement type. (Meissner 16-8099 or equal).
J1—Single-circuit jack, midget.
SW1—DPDT toggle switch, bat-handled.
S1—4-prong Steatite socket.
S2, S5—8-prong Steatite socket.
S3—5-prong Steatite socket.
S4—7-prong minuature tube socket.
S6, S8—8-prong Bakelite sockets.
P1—4-prong male cable plug.
P2—2-prong male chassis plug.
Two antenna terminals, polystyrene-insulated.
Three 4-lug tie strips.
Midget dial, 0-100 degrees.
Dial, slow-motion (National MCN).
Dial lock.
Three pointer knobs, 1 inch with ¼ inch hole.
6/32 x ½ inch machine screws, brass.
6/32 nuts.
2—4/36 x ¼ inch machine screws.
2—4/36 nuts.
2—1⅛ x ¼ inch bushings, threaded 6/32.
2—½ x ¼ inch bushings, threaded 6/32.

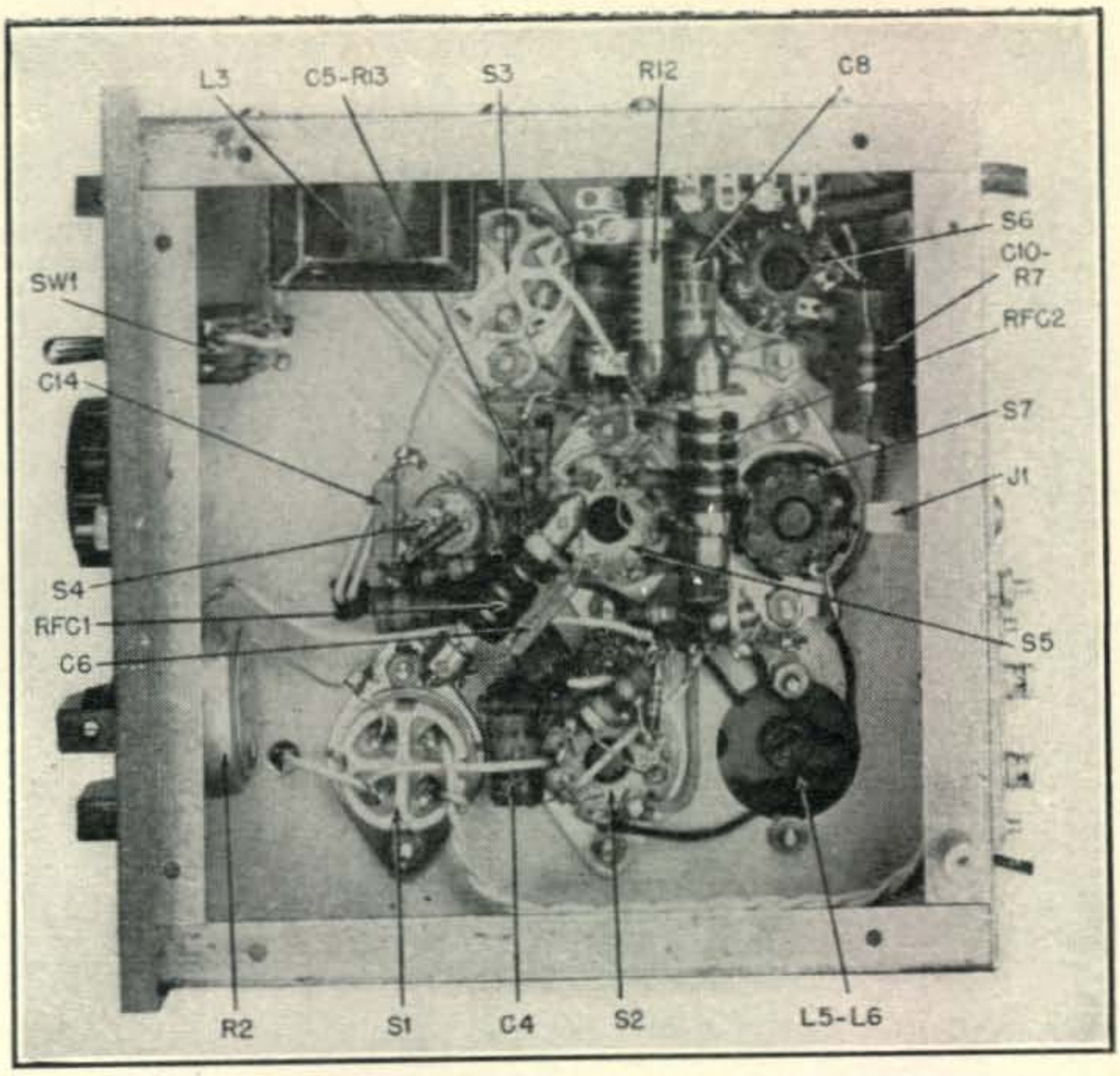


Fig. 3. Below-chassis view of the receiver showing the location of most of the components.

◆ ◆

SW1 "on" (lever up) and adjust *R12* until the voltage rectifier glows. Too much resistance in *R12* will keep the tube from striking and no glow will be present. With the *VR150* operating, the voltages should be approximately as follows, measured with the *negative* lead connected to the chassis:

Pin 3, *S2*	250 volts
Pin 4, *S2*	35 volts
Pin 8, *S5*	150 volts
Pin 3, *S6*	100 volts
Pin 5, *S7*	150 volts

Plug in a pair of headphones. A hiss should be heard as *R14* is operated clockwise to about 2 or 3 o'clock. This is the normal regenerative hiss of the 6SH7, the i.f.-second detector tube.

If a broadcast-band receiver is available, place it near the receiver under test. Connect a short length of wire to the bc set antenna post. Bring this wire close to the i-f transformer and, with the 6SH7 oscillating, attempt to pick up the faint signal on the bc receiver in the vicinity of 1700 kc. It will be necessary to adjust one or both of the trimmers *Ca* and *Cb* (inside the i-f can) to place the intermediate frequency correctly on about 1700 kc. If a local station appears on this frequency, choose some other adjacent frequency, clear of local interference. Adjust the two trimmers until the 6SH7 goes into regeneration smoothly and without a howl or thump. The *exact* intermediate frequency is not critical and it is not absolutely necessary to use a bc set in adjusting the i-f lineup. If desired, merely adjust the trimmers until smooth regeneration is obtained regardless of the frequency. However, when the receiver is operating, no interfering i-f signal should be heard in the i-f system. If such a signal does appear, move the intermediate frequency slightly by adjusting the trimmers until the interfering signal disappears.

With the i.f. and second-detector operating satisfactorily, plug in a set of coils. The 7-mc band is a good one to start on. Note: The dials on *C12* and *C13* should be arranged with the condensers "full in" at 0 on the dial. The knob on *C1* should be adjusted with the knob pointing to the *right*, with the condenser full in.

Adjust the miniature dial on *C13* (band-set condenser) to about 25° or 30°. Connect a short (10-50 feet) antenna to one of the antenna terminals.

With the regeneration control on the 6SH7 turned up until regeneration is obtained, and with the r-f gain control, *R2*, turned about mid-point, rotate *C1* and listen for an increase in background noise or in an incoming signal. By tuning *C12*, signals should be heard. Once signals are heard, locate the 7-mc band by adjusting *C13* carefully. Or, pick up a strong local signal from a frequency meter, or a low-powered transmitter of known frequency. By adjusting *C13*, and by operating *C12*, the 7-mc band should be spread over the tuning dial.

Another way to locate the oscillator tuning range is to pick up the low-powered output of the oscillator on another receiver, one covering the range of the oscillator; i.e., 7000 plus 1700 or 8700 kc; or 1700

TABLE I

Band, mc	L1	L2 (4-prong form)	L4 (5-prong form)
3.5-4.0	3 turns, 1/16" from *L2*.	45 turns, close-wound, 1⅜" long, on 1¼" form.	29 turns, close-wound, with a ⅛" gap between 18th and 20th turns. Tapped 19 turns from ground end of coil. 1" form.
7.0-7.3	2 turns, ⅛" from *L2*.	30 turns, close-wound, ¾" long. 1" form.	16 turns, space-wound, 1⅛" long. Tapped 7 turns from ground end of coil. 1" form.
14-14.4	2 turns, ⅛" from *L2*.	15 turns, space-wound, ¾" long. 1" form.	9¼ turns, space-wound, 1" long. Tapped 3 turns from ground end of coil. 1" form.

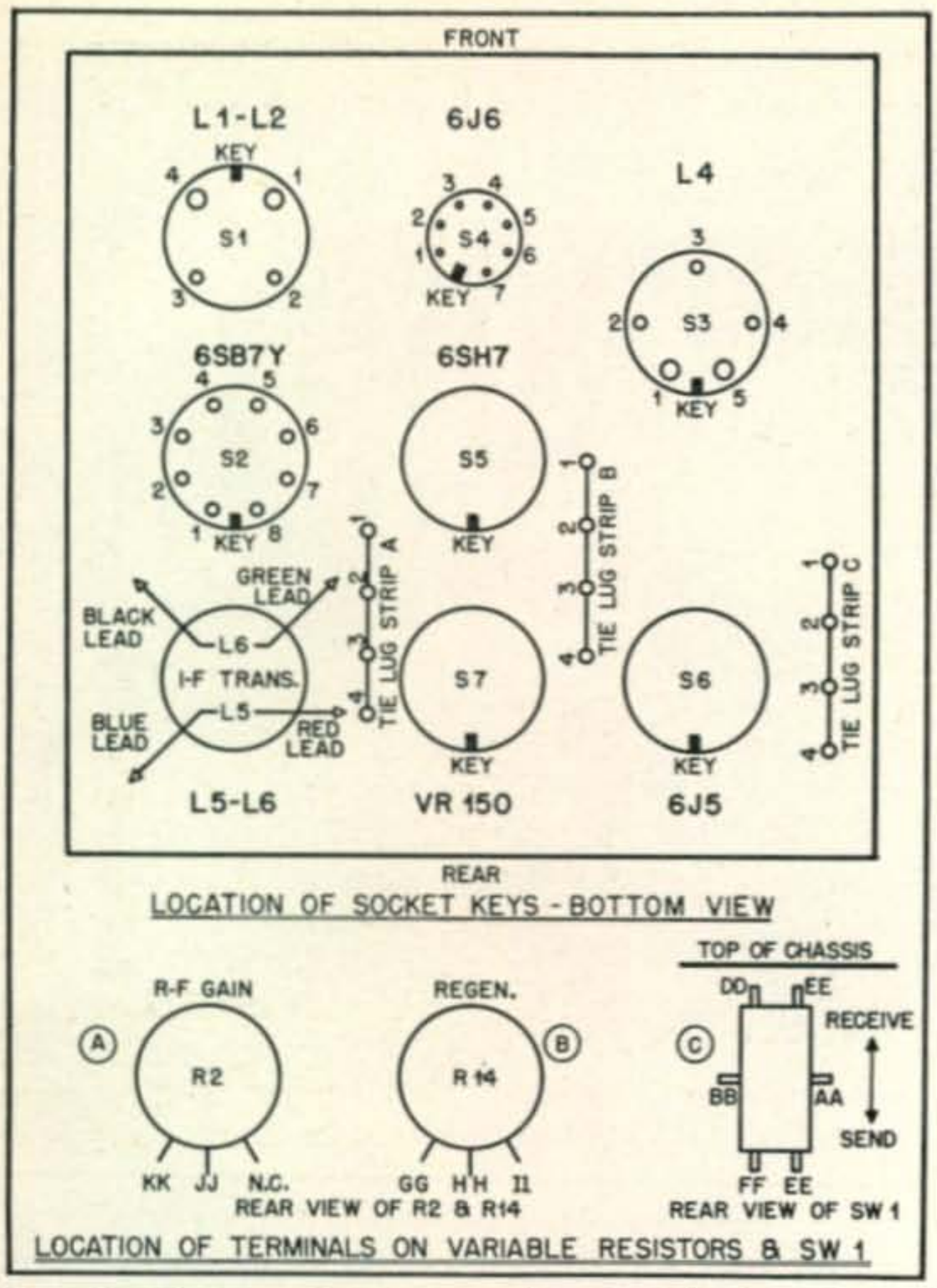


Fig. 4. Bottom view layout showing the location of socket "keys" and the placement of the tie-lug strips. Fig. 4a. Rear view of R2 indicating the terminals by letter, to correspond with connections in Fig. 1. Fig. 4b. Terminals on R14. Fig. 4c. Terminals SW1.

plus 7300 or 9000 kc (signal frequency *plus* the intermediate frequency). However, the band can usually be found by careful adjustment of *C12*. Once located, the band can be spread across the dial by adjusting the tap on *L4*.

C-w signals will be heard *only* when the regeneration control, *R14*, is adjusted to produce oscillation of the 6SH7. Radio phone signals will be heard without oscillation but maximum signal strengths will be obtained just below the point of oscillation.

Setting of Bandset Condenser

With the coils wound as shown in preceding paragraphs and with an intermediate frequency of approximately 1780 kc the bandset condenser (*C13*) was adjusted as follows:

3500–4000 kc band	60°
7000–7300 kc band	26°
14,000–14,400 kc band	55°

Zero degrees on *C13* indicates full capacity and 100 degrees indicates minimum capacity.

The mixer tuning and gain controls, *C1* and *R2*, are not critical but should be properly adjusted to obtain maximum results. *C1* will help to eliminate unwanted signals as it tunes the mixer to the frequency of the desired incoming signal. The mixer gain control can be adjusted to give the desired signal level in the headphones.

After obtaining satisfactory performance on the 7-mc band, repeat with the 3.5 or 14-mc coils, and locate these bands. Keep in mind that in isolated locations the 3.5-mc band will usually produce signals during the dark hours of the day and 14 during the daytime hours.

(*Continued on page 77*)

The Drooping Ground-Plane Antenna

B. A. ONTIVEROS, W6FFF*

The sketch shows a useful modification of the ground plane antenna that is easy to build, not too conspicuous and one that has excellent electrical characteristics.

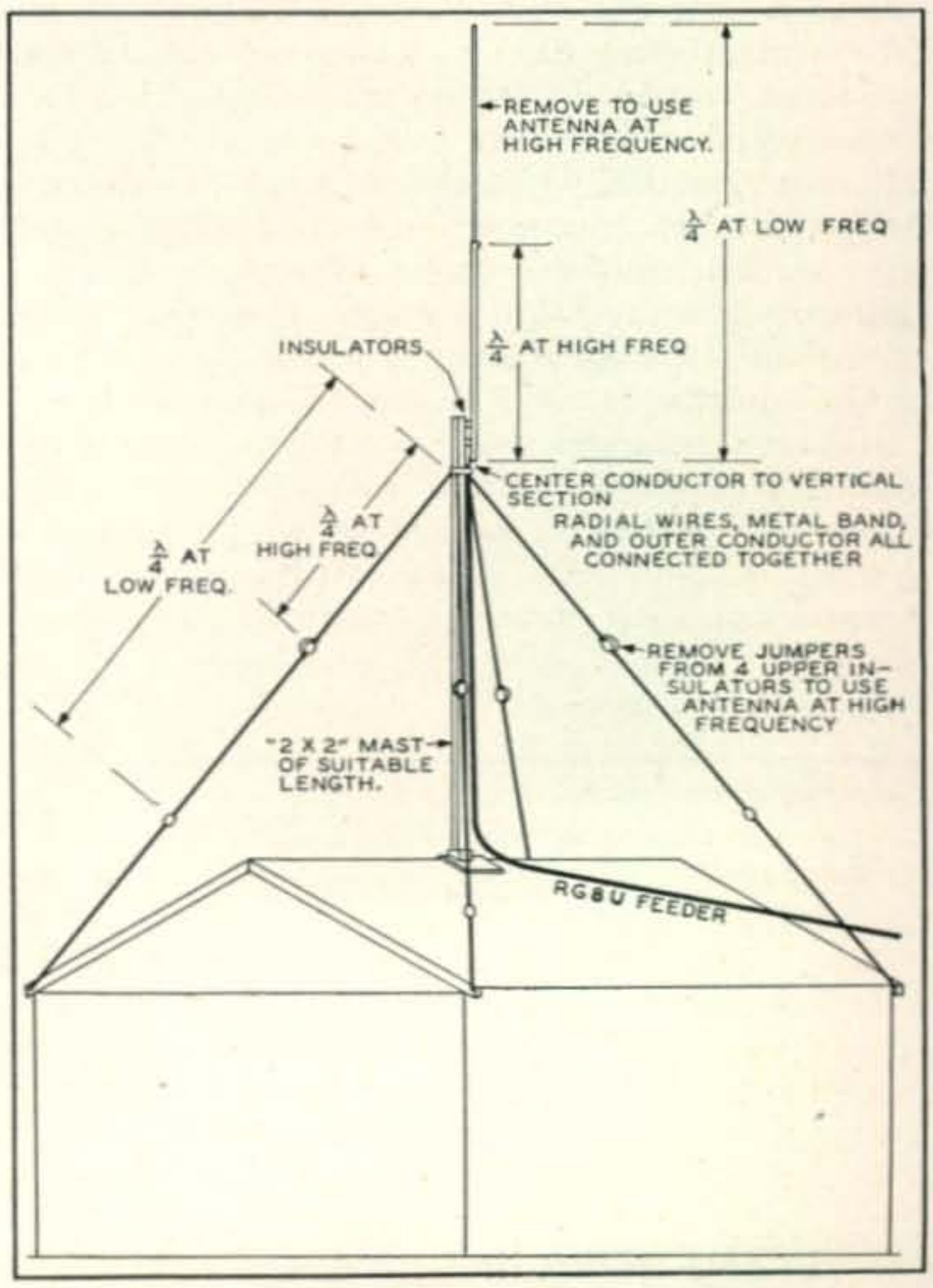
There are a lot of us who like to work 10 and 20 meters but are restricted as to antenna space. Many amateurs are further restricted by a landlord or neighbors who are quick to yelp about anything as complex as a tower and rotary beam, not to mention a couple of stacked rotaries!

The drawing shows a method of using the drooping ground plane on two bands without too much work to make the change from one band to the other. It is an easy one-man job to loosen one guy wire, lay the pole down, make the changes and push the pole up again. A single band 10-meter version can use an automobile whip for the vertical part and a slimmer pole for support. This then looks a great deal like a simple bc whip antenna—a natural where ham radio isn't welcome.

Half-inch aluminum electrician's conduit was tried on the lower part of the vertical, but proved to

(*Continued on page 70*)

**118 S. Alisos St., Santa Barbara, Calif.*



For sensitive neighbors, try this ground plane.

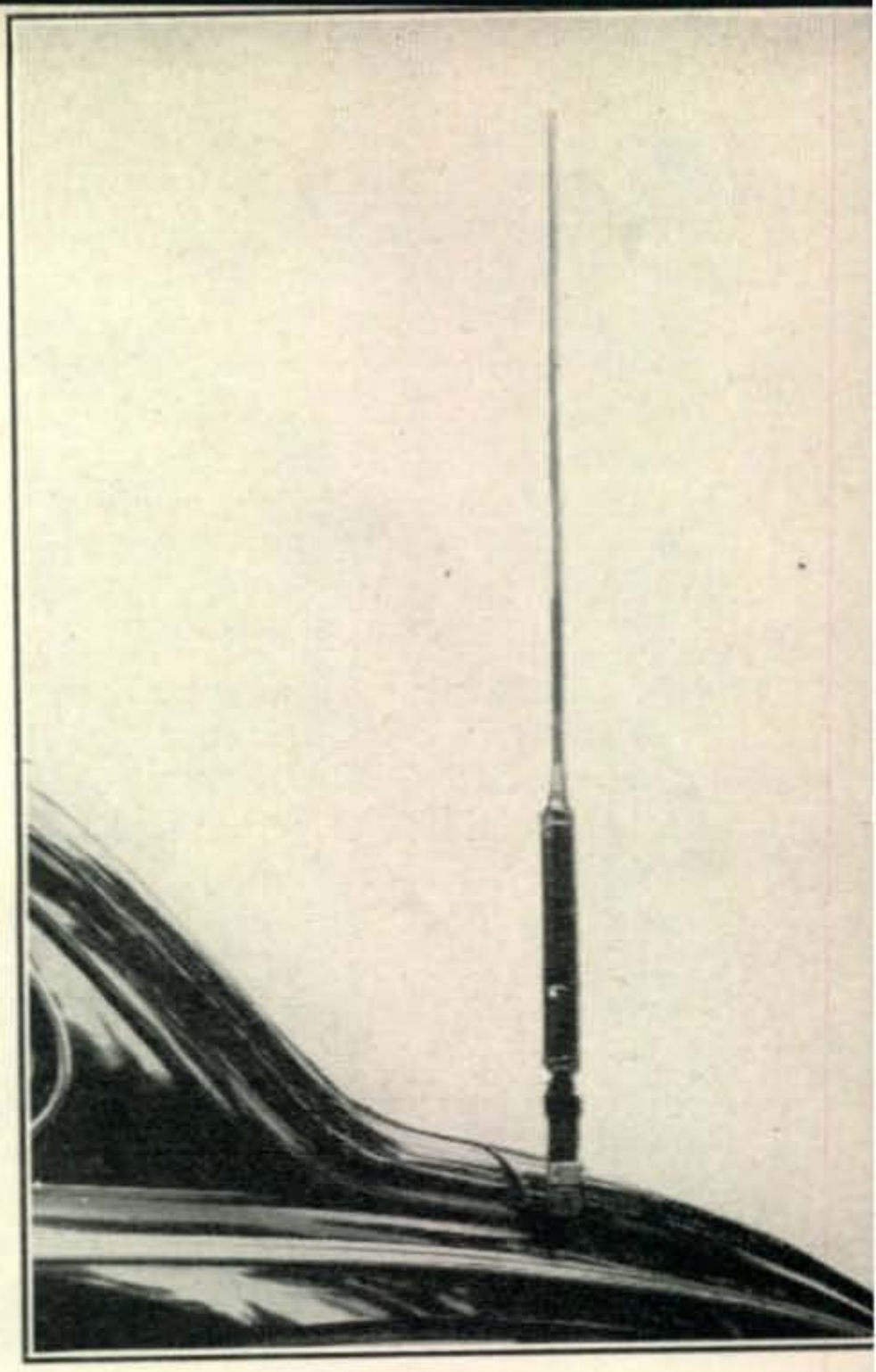


Fig. 1. The loading coil inserted at the bottom of the eight-foot whip. For ten meters, the same antenna is used without the coil. The over-all insulation is plastic tape, and contributed appreciable loss, but is essential to protect the coil in wet weather.

MOBILE ON 75

GEORGE M. BROWN, W2CVV*

Measuring signal readability in miles instead of db.

MOBILE OPERATION on the v-h-f amateur bands has been well investigated and its capabilities and limitations thoroughly charted over an extended period of years. The decision by the F.C.C. on July 14 that amateur mobile operations should be permitted on the lower frequency amateur bands, however, opened up a new field of endeavor. Little, if any, amateur operation has taken place on the lower frequencies using modern techniques and antennas of sizes suitable for mounting on passenger automobiles.

Believing that 75 mobile offered attractive possibilities, little time was lost at W2CVV in giving it a try. The results that have been obtained so far indicate that it has a number of advantages not possessed by the higher frequency bands. This is not surprising to those who have been operating on that consistent and reliable short and medium-haul band for many years, but the fact that an antenna capable of being mounted on a car could be made to radiate such low frequencies sufficiently well to make mobile operation practical has come as a surprise to many.

As an example of what can be done, on July 21, W2CVV left North Tarrytown, N. Y. at 7:30 a. m., having already called in to the usual 3990-kc roundtable. All stations on the frequency were able to copy the signal from the mobile transmitter, and for the next nine hours and 250 miles, until signing off in Hyannis, Mass., contact was maintained with from one to six or more stations throughout New York and New England except for some 20 minutes in Providence, when overhead trackless trolley QRN was just a little too much competition. Signals fell off during the middle of the day, but they did not drop out. No definite skip zone was observed, although when leaving a station, signals dropped down to a rather low value by 15 or 20 miles, then started to build up again. The important thing is that they were continuously readable, although rather excellent conditions were necessary at both ends to avoid a few miles of 25 to 50 per cent readability. On the return trip the next day, similar results were obtained until dusk, then skip QRM began to override the car transmitter signals, although reception in the car was still good. This condition became rapidly worse, and by dark, although strong signals were received in the car from all distances up to 500 or 600 miles, the car transmitter was helpless in competition with a solid bandfull of potent QRM.

This represents the results obtained on two reasonably typical summer days, and the mobile antenna used was only a simple 7-foot whip, with all loading internal to the transmitter. Subsequent loading system investigations have indicated that substantial improvement in efficiency can be made.

The extent of interest in 75 mobile and the number of new mobile stations that are appearing on the band daily mean that development of improved equipment and techniques should be rapid. With the hope that some information on an operating station and a few suggestions on using available equipment will be of value in getting started, the following is offered.

Receiver

The two-band converter described in August 1948 *CQ* is used at W2CVV and leaves little to be desired. The conventional automobile broadcast receiver into which it works does not fall into the same classification. A double series gate noise limiter has been added to it, but is not a "must" as it is on 10. Such ignition noise as there is on 75, and it isn't bad even on jammed Westchester County parkways, does not tear the signals apart as it does

*14 Kingsland, N. Tarrytown, N. Y.

on 10. Transmission line noise is bad along some lines, and trolleys are even worse, but these are not the types of noise that respond well to limiting, although it does help some. The best bet seems to be to stay away from such noise generators when weak signals must be received.

Where the bc receiver really falls down as an i-f amplifier is in selectivity. If 75 mobile turns out to be useful mostly by day, as presently indicated, this will be no severe limitation, and a little listening on the band after dark is not encouraging. No doubt the answer is a small, simple "Q5'r," but that is still on the docket for future developments.

The W2CVV converter is somewhat beyond the capabilities of most amateur workshops, but one expedient quite satisfactory for 75 only, involves cutting in two a 3 to 6 mc 274-N receiver, discarding the rear deck, the 12A6, the 12SR7 and the third i-f transformer. The second i-f transformer is then link coupled to the antenna input of the car bc receiver. The 1415 kc i.f. may be used as is, tuning the bc receiver to that frequency, or to be a bit more elegant it may be shifted to 1500. It will, of course, be necessary to replace the remaining tubes with their 6-volt equivalents, and rewire their heaters for parallel operation. Plate power can probably be obtained from the bc receiver power supply.

The original 274-N receiver could be converted for 6 volts and used as a complete receiver, but the selectivity of the 1415 kc i.f. is even worse than the usual bc receiver, and would be a severe handicap.

Transmitter

The 75 mobile transmitter installation is identical to the 10 meter one described in January 1948 *CQ*, with the exception that the BC-457, modified for 10, is replaced by a BC-696, also modified but to a lesser degree. Since the two transmitters are plug-in, and may be pretuned, band changing is quick and simple. The modification of the BC-696 is straightforward, but the main steps are listed for reference:

1. The original antenna relay is awkward to use for switching the antenna to the receiver, and it is suggested that it be replaced by the small one mounted beneath the chassis, which is easier to modify.[1] When making the modification be sure to replace the two fibre insulating cylinders around the contact assembly screws, and the one fibre contact insulator with similar ones made from polystyrene, since the output voltage may be high enough to break down the fibre. Rewire the oscillator plate directly to the power plug, instead of through the relay.
2. Rewire the heaters for parallel operation. One side of each PA tube heater will be grounded, and it is well to ground the cathodes directly also. This may be done by running a copper strap from one side of the chassis skirt to the other, picking up pins 6 and 7 of each socket on the way. This will provide a low impedance ground and tend to stabilize the PA.
3. File three of the holes in each 1625 socket to permit the insertion of 807s.[1] Use the same socket pins, 1 and 7 for the heaters, pin 4 for the grid, 2 for the screen and 6 for the cathode. Then jumper 2 and 3, and either 807s of 1625s may be interchanged with appropriate heater voltage. One pin 2 is originally used as a tie point, and the connections to it must be removed. For 6-volt operation, the 1626 oscillator tube should be replaced by a 6J5. Be sure pin 1 of the oscillator socket is grounded, to avoid a floating shell if a metal 6J5 is used.
4. At normal mobile power levels, one 807 will be capable of taking the full plate input, and there is no need of using two. With one, the 15,000-ohm grid resistor (mounted across the crystal socket) should be replaced by something like 25,000 ohms. The screen should be fed from the modulated plate voltage, through a dropping resistor. 20,000 ohms is about right for 450 plate volts.
5. A PA plate current jack should be installed, and another for reading PA grid current is useful for indicating oscillator condition. It is recommended that the plate current jack be insulated and connected in the high side, to read plate current only, without the screen.
6. The gang tuning arrangement is good, and with careful adjustment of the loading coil the PA will stay pretty well on resonance over the band with various loads. Nevertheless, after due and deliberate consideration of the mental hazard of wondering whether the PA really was right on the nose the PA padding capacitor was equipped with a short shaft extension and a dial and lock.
7. After all changes are complete, the oscillator should be recalibrated. It is merely necessary to adjust the trimmer capacitor across the circuit to bring one point back on, and unless there was something wrong with it before modification, the rest of the band will be on also. Do not change the position of the iron slug in the coil. If the top trimmer on the oscillator does not have enough range to compensate for the elimination of one PA tube, the plug in one end of the oscillator can should be removed, the little screw thus exposed loosened, and the oscillator padder lock moved to bring the "flat on" point somewhere near the center of the trimmer range.

[1] See January, 1948, *CQ*.

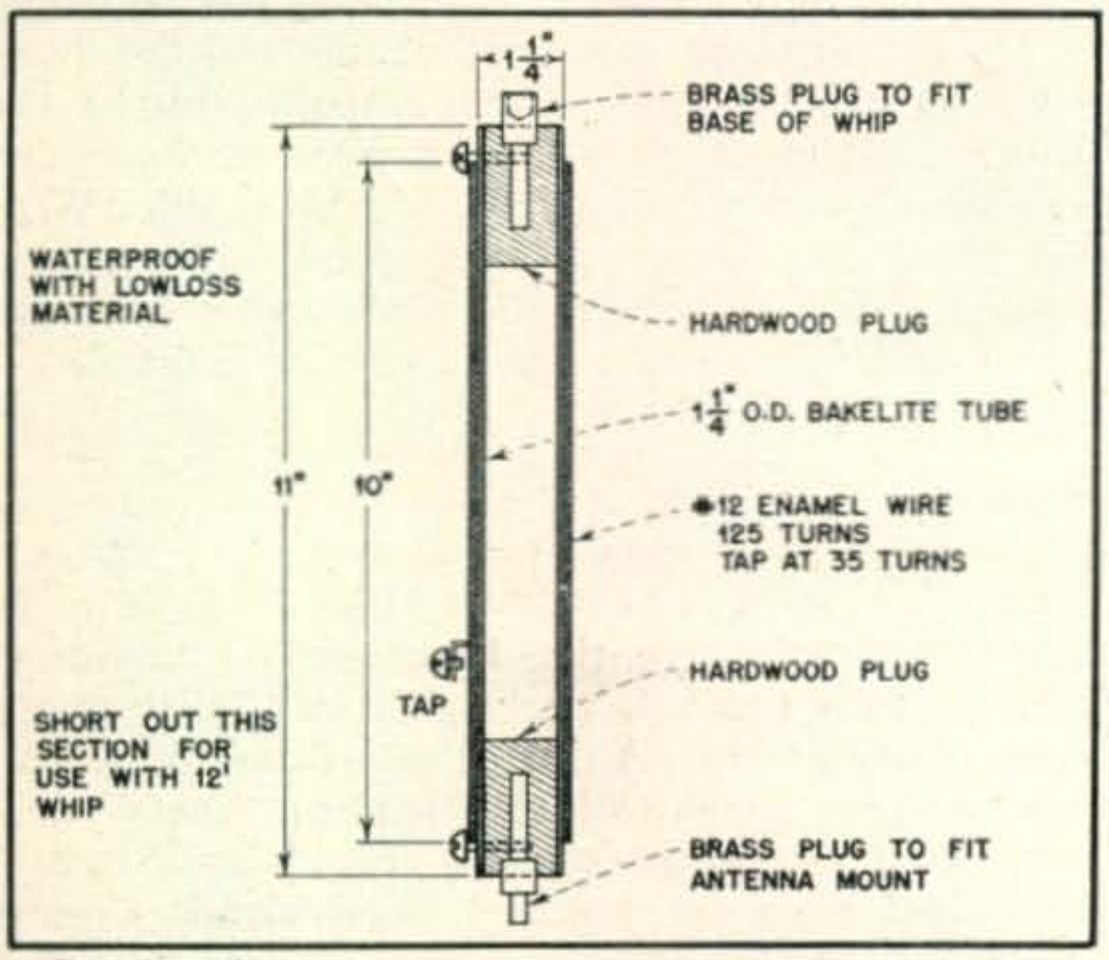


Fig. 2. Cross-section of the finished loading coil.

Antenna System

The antenna system is the weak link in the mobile station, and thus the one where the greatest improvements can be made. A whip antenna, usually 8 or 10 feet long at the best, must be artificially lengthened electrically or "loaded" to a full quarter-wave in order to take power from the power amplifier. Transmitters such as the 274-N series, designed for operation into random short antenna lengths, contain an internal continuously variable loading coil. The antenna may then be resonated by adjusting the loading coil for maximum PA plate current, or antenna current while maintaining the PA plate tuned to minimum. This can be done most effectively by reducing the antenna coupling to the minimum which will indicate loading, since this condition provides maximum sharpness and the PA tuning is little disturbed by the loading coil adjustment. After the antenna is resonated, the loading should be locked, the coupling adjusted for normal load, and the PA tuning rechecked.

When a whip antenna much shorter than a quarter wave is required to radiate power, both the current nto it and the voltage appearing on it are much higher than is the case with a longer antenna. Both of these conditions contribute to the high losses and low efficiency common to excessively short antennas. The high voltage increases the loss in any insulating material in transmission lines or used to support the antenna. The high current, of course, results in even more loss, in flowing through conductors having resistance, not the least of which are the many turns of the loading coil.

With as short an antenna electrical length as we are considering, the high voltage appearing on the antenna is essentially uniform throughout its length, and in fact is also present on the entire antenna system, including the transmission line, on the antenna side of the loading coil. Any capacity to ground beyond the loading coil thus has this high voltage across it, and carries a correspondingly high capacity current. This current, in addition to the actual radiation current, must flow through the loading coil, further contributing to the power loss. With the limited amount of power we have to start with in the usual mobile transmitter, we don't have to go very far with this process before we have little left to radiate from the antenna.

Here's just how serious this can be: With a seven-foot whip, and two and a half feet of RG8/U between it and the 274-N, using the built-in loading coil, results as mentioned previously were obtained. During some experimental antenna work, the transmitter was tuned up and loaded with *no* antenna connected to the end of the transmission line. There was no difficulty in obtaining full load, and the only departure from normal tuning was that two or three extra turns of loading coil had to be used. The *total* power output of the transmitter was dissipated in increased losses in the transmission line and loading coil.

The moral of all this, of course, is to keep the stray capacity to ground beyond the loading coil and the resistance of the entire antenna system as ow as possible. This does not strictly apply to top-loaded or center-loaded antennas, where the capacity serves a useful purpose in improving the current distribution which may more than compensate for the increased loading coil losses.

The usual methods of keeping the resistance down are applicable, but there are a few tricks we can play on the capacity. Since it is only the capacity beyond the loading coil that is doing us dirt, the most obvious thing to do is to take the loading coil out of the transmitter and put it beyond some of the capacity.

One expedient frequently used on small boats is to make the antenna from a cane or bamboo pole, wound with a spiral of wire. This is a form of continuous loading, and can be varied by using different turn-spacing along the pole. In some cases, this may be the best compromise for a 75 mobile

75 METER MOBILE

antenna, but where trees are low, it would probably have a limited life. An experimental antenna was made by winding a solid layer of #18 dcc wire over the full length of a nine-foot whip, with taps included to permit shorting out various portions of the winding. It was found that shorting all but 12 inches at the bottom produced resonance with only a turn or two in the transmitter loading coil, and the improvement over a simple whip was nothing less than amazing.

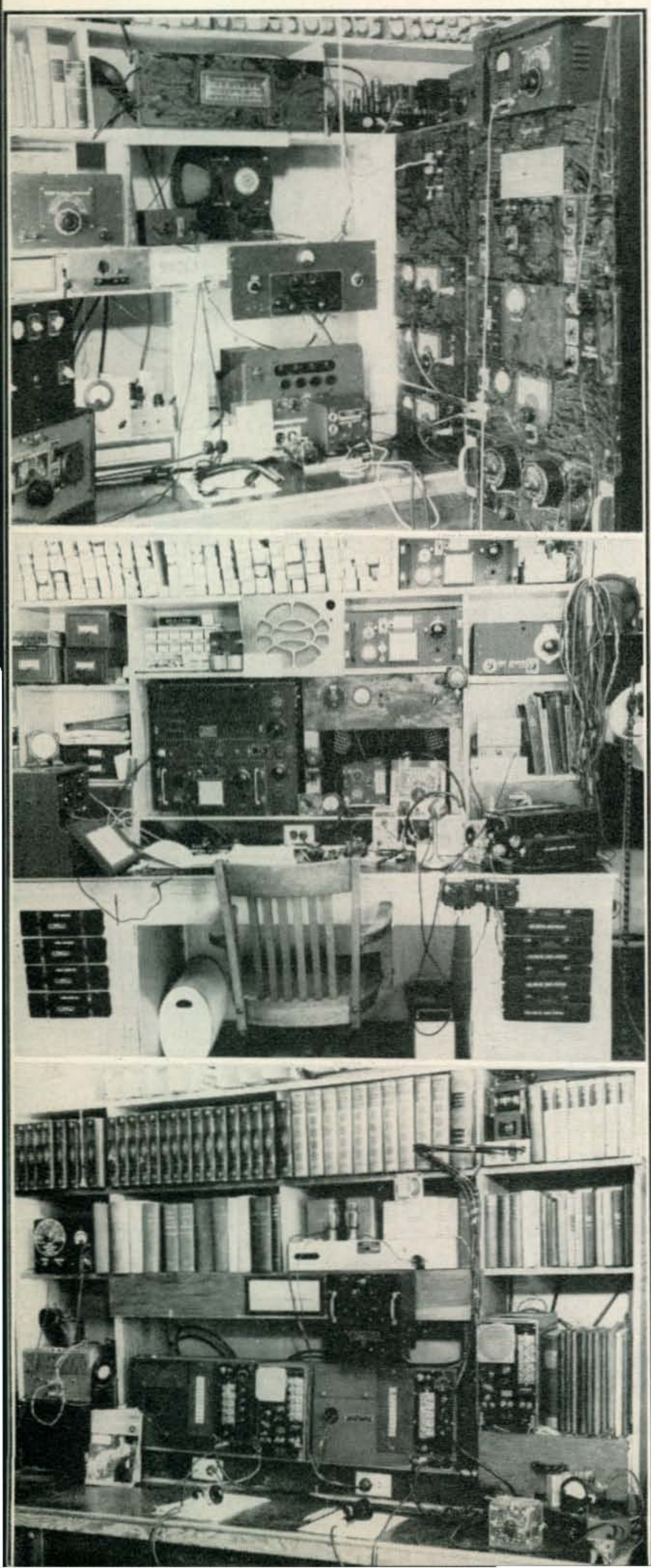
With this as a start, two versions of a demountable base-loading coil were built, and found to perform equally well. *Figures 1* and *2* show the final version, which is capable of loading an eight-foot whip to resonance at 4 mc with the help of two or three turns of the built-in transmitter loading coil. It would, of course, have been possible to use no loading at all in the transmitter, by carefully adjusting the base-loading coil, but that would have meant making it variable to cover more than 10 or 15 kc, and would probably have added more loss than it would have taken out. A tap is provided on the coil, to permit shorting out the bottom 35 turns and resonating a 12-foot whip, for a little better performance where the longer one can be used.

Field strength measurements, using a receiver with an accurately calibrated S-meter, showed that the final loading coil gave a gain of 9 db over the same 8-foot whip without the coil. Measurements without the coil were made by shorting it out, to retain the same total antenna length. Similar measurements with a 12-foot whip gave gains of

(*Continued on page 77*)

The Other Fellow's Station-*W6DEG*

ONCE A HAM always a ham. Jim Kirk, W6DEG, a real old-timer, is typical of the amateur in radio most of his life. Not so typical is the unusual station, designed and built as three independent studios.



Briefly, the apparatus in the top photo, "Studio A," consists of, on the left end of the bench, a super-het receiver; on top, a panoramic adaptor; in back, an i-f amplifier including a Q5er or NBFM adaptor to be switched in at will. Above that on the first shelf, is a 6, 10, 11-meter converter using Guillotine coils, an audio filter from *CQ*, and a large dynamic speaker. The next shelf contains a broadcast tuner and a 7-tube audio amplifier that can be switched to any receiver. This is followed by a Millen 2, 6, 10, 11-meter transmitter and a BC 1068A 2-meter receiver. In front, on the operating bench, is a semi-electronic bug. On top of the rack and panel on the bench is a shielded battery-operated monitor. Top panel is a power pack, then comes a 20-meter v.f.o., a 7-mc and 3.5-mc v.f.o. On top of the next rack is a band-switched wavemeter. The top panel is a control panel, next is another monitor and an antenna coupler. Under that is a speech amplifier and modulator followed by a final amplifier and a power supply, variable to 1,000 volts.

In the center photo, the "B" control position, is a BC-221 frequency meter, converted BC-375 with plug-in drawers, a wavemeter, a converted GF-11, and a 20-meter converter working into a BC-455A that can be used as a 40-meter super or an i-f system for the converter. On the shelf is a crystal secondary frequency standard. On the bench is another semi-electronic bug, a converted RU-17 receiver with plug-in drawers (mounted on the front of the bench). Controls for the GF-11 and RU-17 are mounted on the front edge of the bench.

The third operating position, studio "C," contains, from left to right, 12 v. d-c supply and pocket scope and band-switched all-wave grid-dip oscillator. The transmitters are a converted BC-684 and 604, each having 80 crystals and a crystal oven for 10 switched crystals. At present, one of these transmitters has crystals in the oven for 10 and the other for 11 meters. The two receivers are converted BC 603s. The tuning range of one is left "as is" and the other is bandspread on 10 and 11. On the bulkhead is an interphone amplifier converted to a monitor. Above it, on the shelf, is a power pack and still another 12 v. d-c supply. Copies of *CQ*, a mike for each transmitter and a plug-in coil grid-dip oscillator complete "Studio C."

"Jim" Kirk was an electrical experimenter when a small boy. When he was in the eighth grade he attracted the attention of the physics professor in the Northern Illinois State Normal School. The professor arranged special permission to have the budding ham attend college classes in physics. He first came on the air about 1908 with spark coil and crystal detector, maintaining communication with his pal about a half a block away. They learned the code on the air.

Breezing through high school physics he enrolled in the University of Illinois. Soon after, on the strength of his radio experience, he was transferred to the Signal Corps of the College Military Training program. He was first wireless operator and then first sergeant of the lone Signal Corps company.

After College, Jim Kirk took up his profession of X-ray technician, moving to the West Coast. In Portland, Oregon, 7KA was assigned. Moving to California, he was licensed 6BMA. He taught his XYL the code and, when they were expecting the

(*Continued on page 70*)

Near Grazing Incidence Reflection At 144 Mc

OLIVER P. FERRELL*

A possible explanation of isolated instances of 2-meter DX.

AN EARLIER article [1] was devoted to the interpretation of the Booker Mode theory and the development of propagation curves for 6 and 2 meters. These indicated that under certain meteorological conditions a "leaky duct" might be formed, which would trap some of the radiated v-h-f energy. A further examination of the problem shows that only a moderate proportion of v-h-f DX can be explained satisfactorily by the Booker theory, or as its counterpart is known in the United States, the ray tracing theory. A much more applicable reasoning in certain instances is reflection at near grazing incidence from the lower boundary of an inversion layer.

Certain wave propagation experiments [2] tend to refute the Booker mode, or the ray tracing theory Both of these theories are based upon the concept that when the modified index of atmospheric refraction at some elevation directly above the transmitter has a value equal to, or less than the value at the transmitting antenna elevation, there will be some trapping or ducting.

When a large quantity of meteorological data on the vertical distribution of temperature and humidity was available, the ray theory could be checked by attempting to correlate the radio field strength over a fixed path, and the height of the base of the inversion (duct width). When this was done, it was found that when the inversion height was in excess of 1000 feet there would be a noticeable reduction in signal strength, first at the higher frequencies and over the shorter paths. This effect was quite marked in the one-way transmission experiments over the sea between Los Angeles and San Diego.[2] These tests were made on frequencies of 52, 100 and 547 mc.

The records of the 6-meter tests showed signal variations of some 30 db, although at no time did there appear a condition of sufficiently pronounced super-refraction to propagate this frequency, according to the wave guide theories. However, the peak 6-meter field agreed excellently with the peak 3-meter field, but only slightly with the 55-cm field recordings. This indicated that the means of propagation was distinct from the "duct," although an inversion did form almost daily over this path.[3] Generally, high 6-meter fields correlated with weak fields accompanied by severe fading at 55 cm.

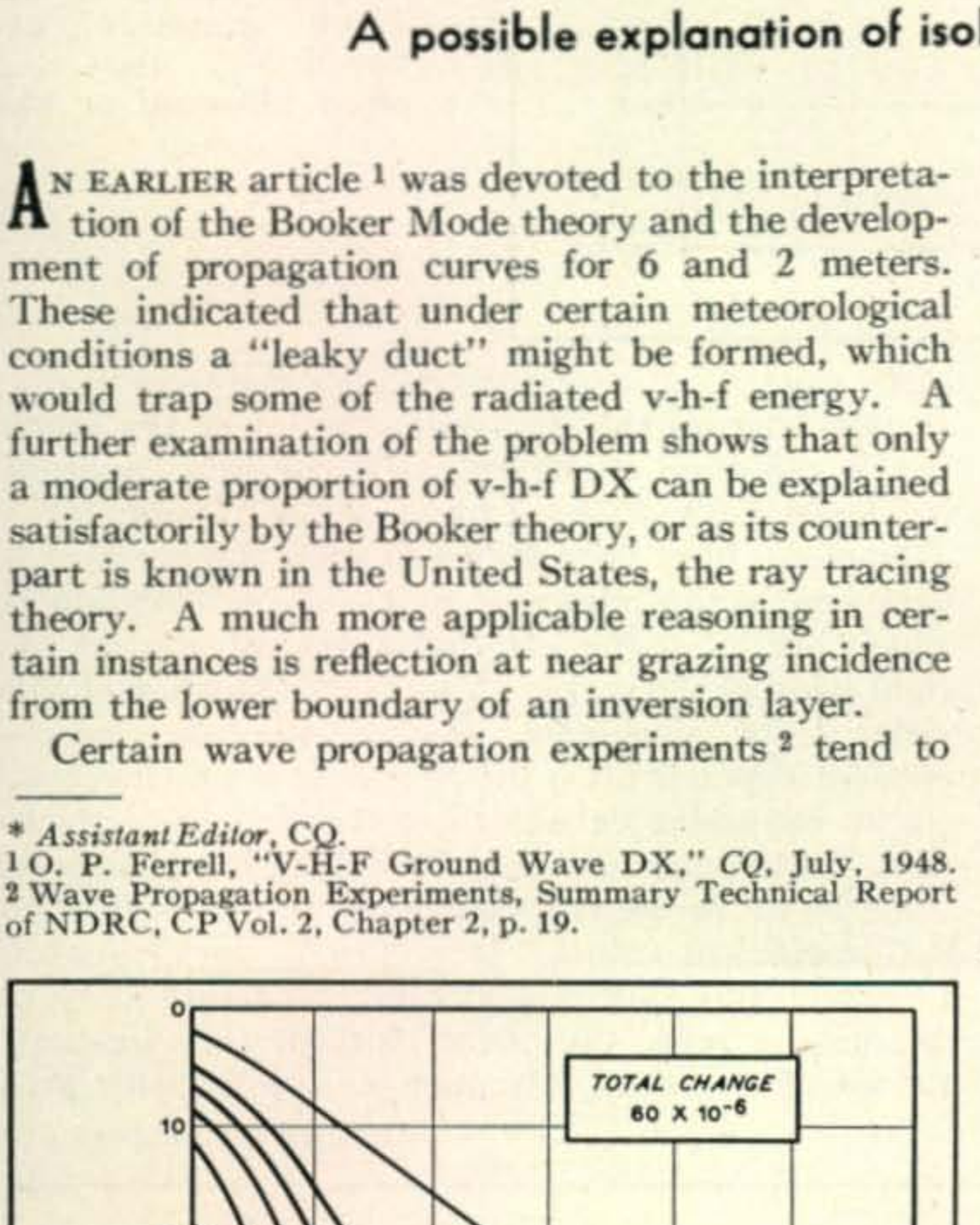


Fig. 1. A theoretical analysis of near grazing incidence reflection shows that the reflection ratio (incident to reflected signal strength) depends upon the inversion layer thickness, wavelength and angle of incidence at the base of the layer. This graph neglects the curvature of the earth.

Grazing Incidence

A theoretical treatment of grazing incidence reflection was made by J. B. Smyth during the war.[4] In this paper it was shown that for a given angle of incidence, the controlling factor was the ratio of the inversion layer thickness to the operating wavelength. But, in any case, the angle of incidence was required to be very large, or the angle of radiation to be extremely small. An example of this is shown in graph *Fig. 1*. In this particular instance the total change in refractive index through the inversion

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* *Assistant Editor*, CQ.

1 O. P. Ferrell, "V-H-F Ground Wave DX," *CQ*, July, 1948.

2 Wave Propagation Experiments, Summary Technical Report of NDRC, CP Vol. 2, Chapter 2, p. 19.

3 In the summer season the San Diego area lies within the belt subtropical anticyclones. Dry superior air subsides over moist maritime polar air and an inversion is generally present from June until October or November. It varies in altitude from the surface of the sea up to 4000 feet.

4 "Transmission of Plane Waves Through a Single Stratum Separating Two Media," J. B. Smyth, BuShips Problem X4-49CD, Report WP-13, NRSL.

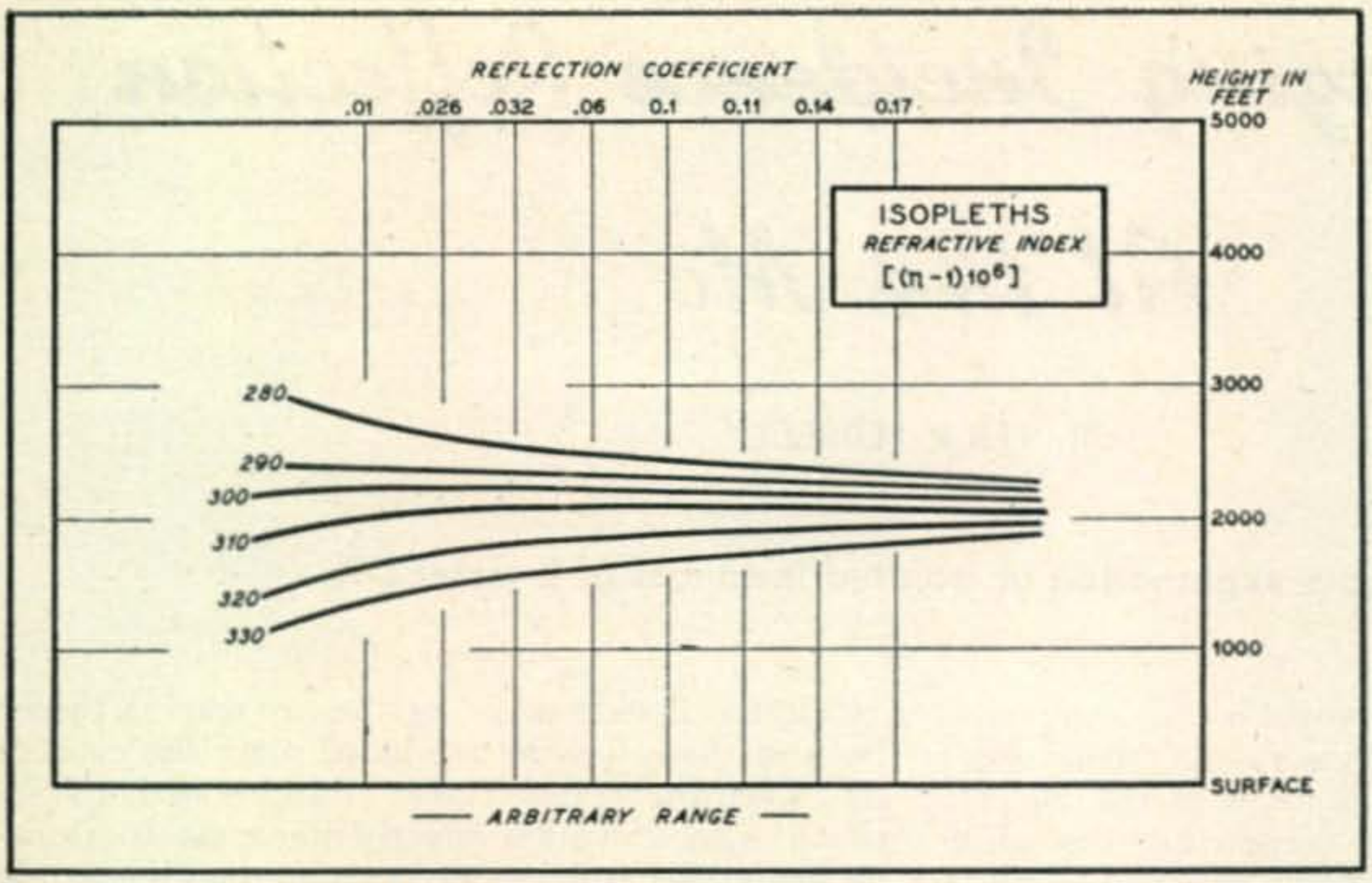


Fig. 2. For near grazing incidence propagation, the inversion layer thickness is of primary importance. Meteorological data shows that the depth varies almost continously in a spatial distribution. The warp or change in the depth probably accounts for the skip effect observed at 144 mc.

layer is taken as 60×10^{-6}. The parameters are the angles of incidence at the base of the inversion. The ordinate is the reflection ratio (incident to reflected signal strength).

At normal incidence the reflection coefficient would be very small, but theory shows that for a given layer thickness and height above ground, the reflection coefficient at angles less than the critical would be greatest for the lower frequency portion of the s-h-f to v-h-f spectrum. The variation may be of the order of 40 to 50 db.

To a much greater degree than the pure trapping theories, the shape or slope of the inversion layer is of considerable importance. It has been found by aircraft soundings that the height and thickness of the layer varies appreciably with distance. For the radio amateur operating at 2 meters this provides the intriguing problem that a "skip effect" might easily exist. The cause may be analyzed from *Fig. 2*. In this diagram the abscissa at the top of the graph is the reflection coefficient at a constant angle of incidence of 89° 20′ for a frequency of 144 mc.

Isopleths have been drawn to show the horizontal variation in the refractive index. The inversion is widely spread at the left, but is concentrated at the right hand of the graph. A warp or distortion of this order is not uncommon. Because the reflection coefficient depends upon the thickness of the layer we see an increasing value with decreasing layer thickness. In this case it means that there is a change of some 26 db in the reflection ratio from the 0.01 to 0.17 coefficient values. It is entirely within reason to expect this variation to take place within 25 to 30 miles, especially over broken or irregular topography. Thus, although active 2-meter sta-

(*Continued on page 72*)

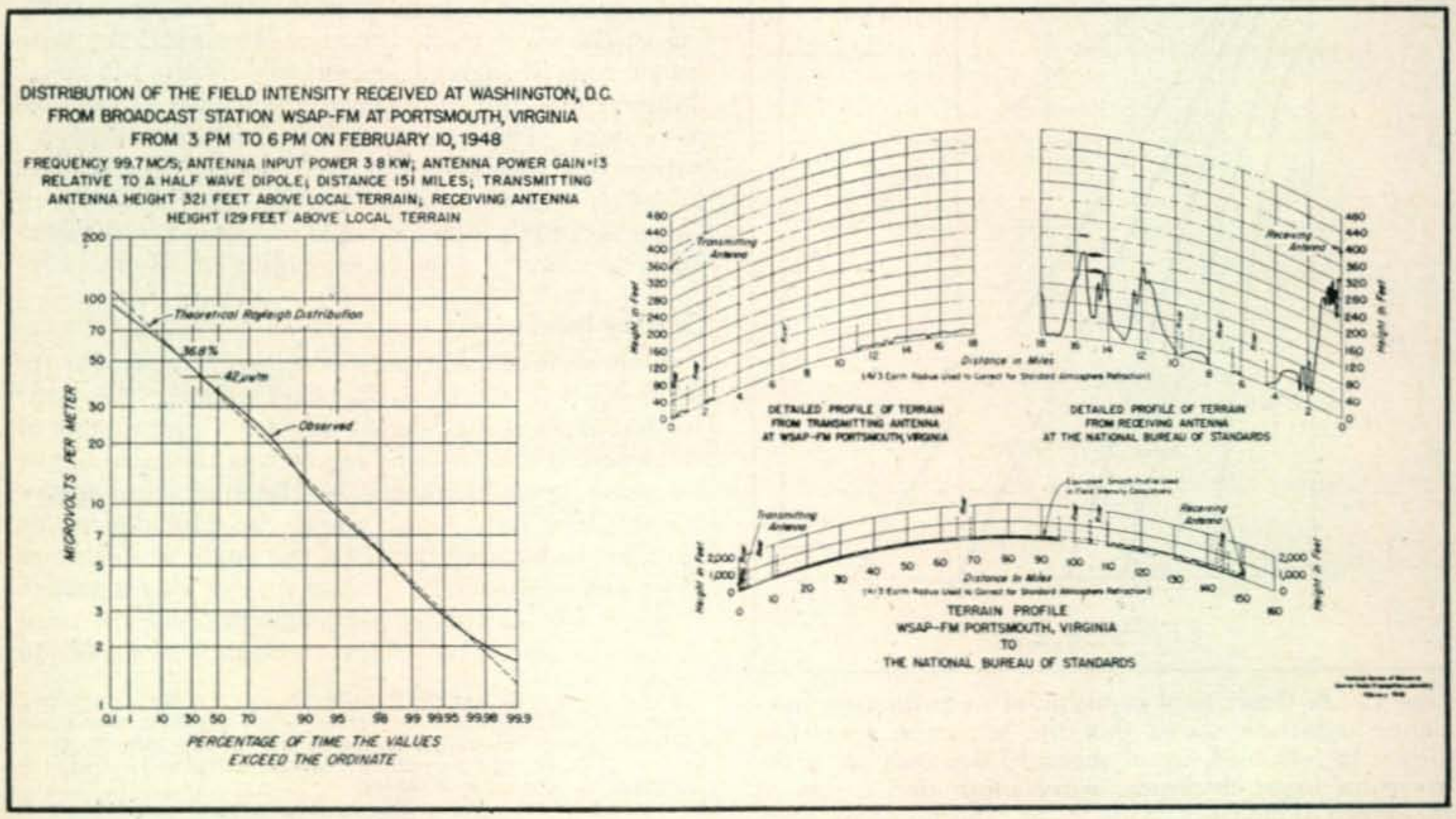
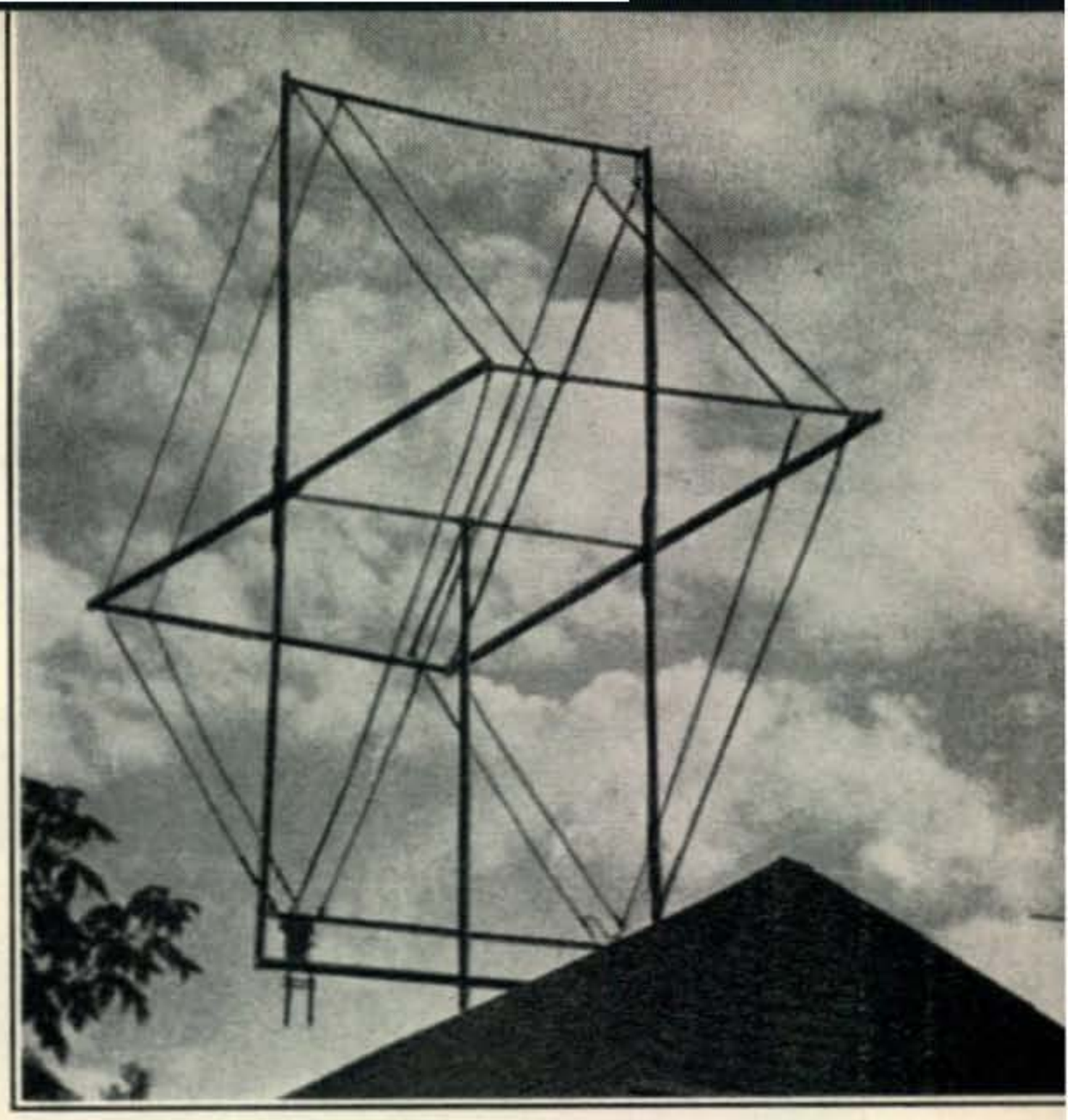


Fig. 3. Rapid recordings of fading tendencies further proves existence of near grazing incidence reflections.



W8RLT's cubical quad viewed close up. The stub is visible, the feed line obscured by the roof peak.

CUBICAL QUAD-

Topic Number One!

THE CQ STAFF

AN INCREASING TENDENCY during this past fall was not to discuss the relative merits of antennas in general, but the merits of one antenna in particular —the "cubical quad." It seems quite possible that never in the history of amateur radio has one development run the gauntlet from sheer derision to wild acclaim in a span of a few months. The whole story of the cubical quad remains to be told in its entirety. Many versions of the story, and the antenna itself, are rampant. Just how much like the original design they are, is still unknown—and will be revealed only when the person who developed this antenna can release all the facts.

In the meantime, from the midst of this confusion, certain points about the quad are in agreement, although many installations often vary in small details. The Editors of *CQ* are naturally in the position that they may compare the many installations and from them extract sufficient data to form a fairly solid background of the mechanical design and construction. This is the extent of this article. In lieu of an "official" release by the developer, we have compiled many notes and from these have selected what appears to us to be the most universally accepted version of the cubical quad antenna.

The Radiator—or Quad

The basic principle of the quad radiating section is to take four half waves and fold them about a vertical square frame that is one-quarter wave on a side, the configuration being fed at the bottom. In doing so, the wire length will go around twice and hence must be spaced with a cross-over made at the bottom so that the feed may be attached to the two free ends. The spacing between wire "wrap around" generally will not exceed 9 inches.

The physical configuration of the quad radiator shows us that the radiated pattern must be one of horizontal polarization. The quad radiator may be

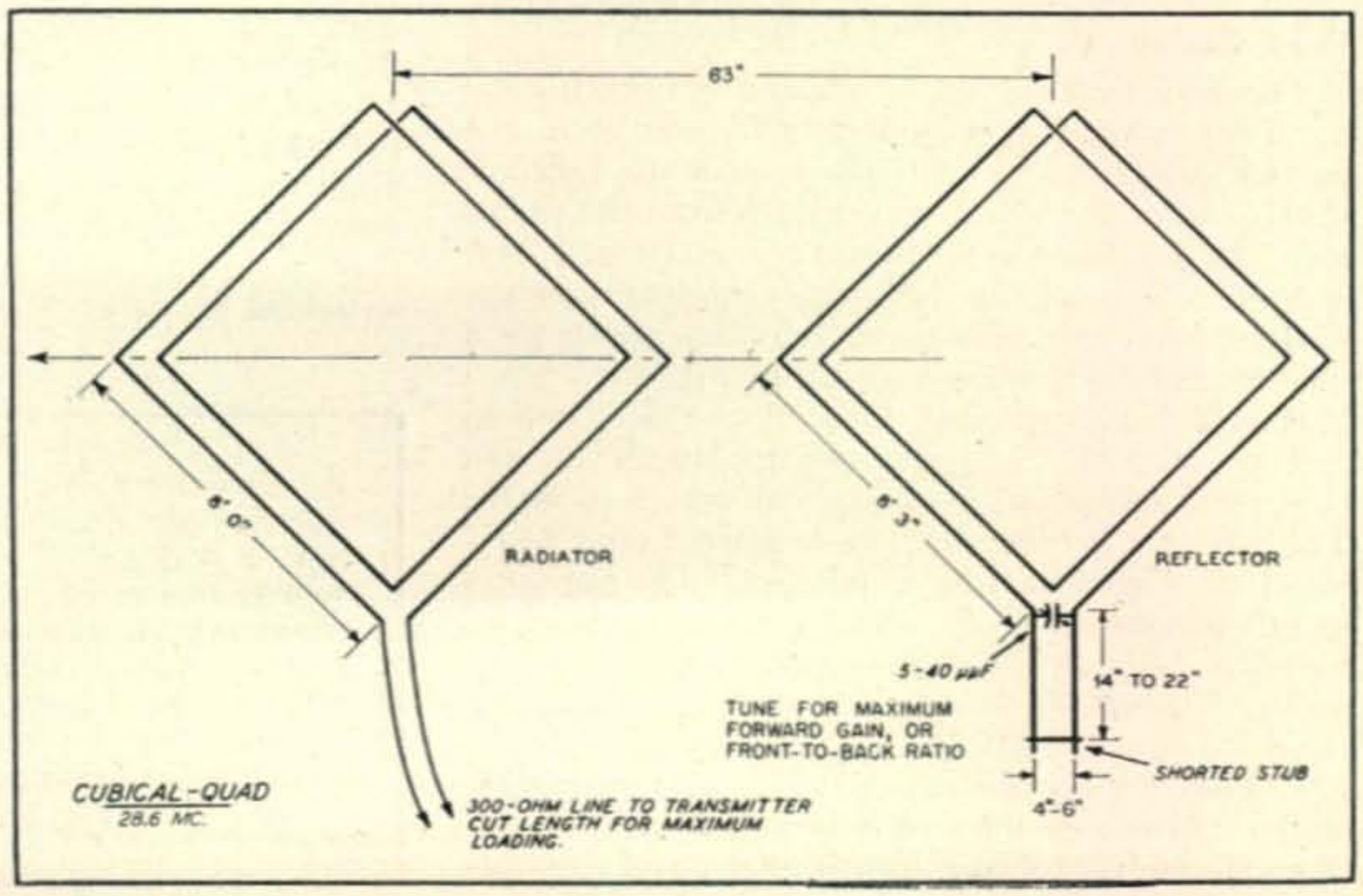


Fig. 1. Recommended dimensions for cubical quad on 28.6 mc. Wire size is not important. Spacing between the parallel wires in the same loop should not exceed 9 inches, and close spacing is preferable.

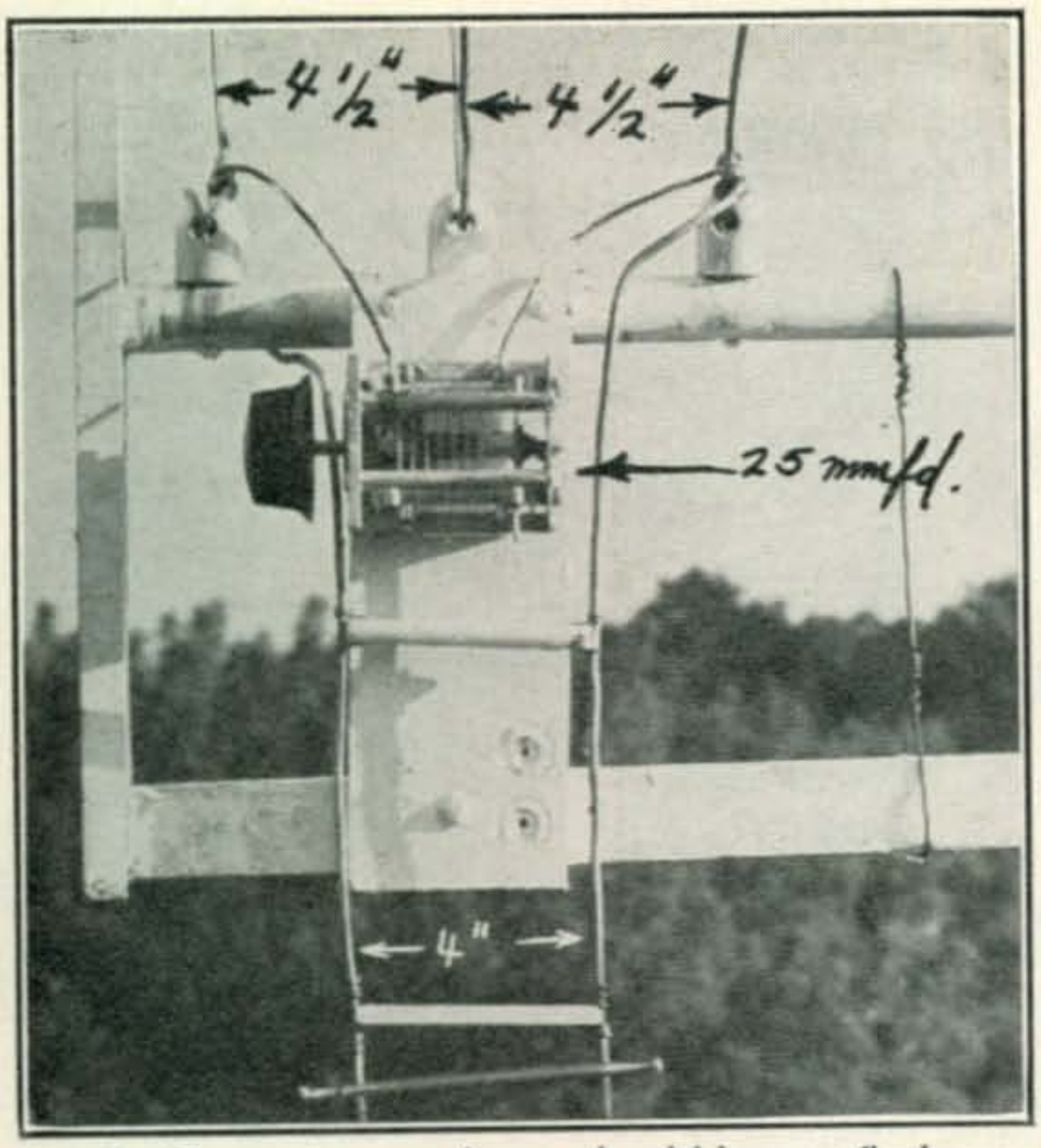


Fig. 2. The tuning condenser should have a flash-over voltage no less than 3000 volts for medium power. It is best to protect it from moisture. This is the stub on the bottom W8RLT's quad.

analyzed as a sort of in-phase stacked array having less than the usual half-wave spacing between elements. As might be expected from stacked arrays there is an increase in the radiated power concentrated at the lower angles of radiation, although the less-than-optimum spacing employed only results in a gain of the order of 1-2 db. The pattern maximizes perpendicular to the plane of the quad.

The spacing of the wrapped-around wire about the frame is a (probably unimportant) matter apparently open to some variation. The greater number of installations inspected by the Editors were spaced according to the wire size and center-to-center spacing of a 600-ohm transmission line when the quad was used with a reflector, the "cubical quad."

The Reflector

The addition of a single reflector transforms the quad into what is now popularly referred to as the *cubical quad*. In general, the optimum reflector spacing appears to 0.15 wavelength from the radiator. It has been experimentally determined that the reflector should be 1.03 times the length of the radiator on a side. The complete dimensions for a 28.6-mc cubical quad are shown in *Fig. 1.*

It will be noted that the reflector is identical (except for the slight increase in length) to the radiator also consisting of four half-waves in series. The reflector is terminated in a shorted stub and a small air-spaced variable condenser. The optimum length for the stub is 22 inches, being tuned by a variable condenser having a maximum capacity of about 40 to 50 $\mu\mu$f. A suggested method of mounting the stub, as used by W8RLT, is shown in *Fig. 2.*

The use of a variable condenser at the termination of the reflector permits an easy as well as an accurate adjustment of the front-to-back ratio or forward gain. Beforehand, however, the loading of the radiator should be properly adjusted. Experiments show that cutting and trimming the feed line to the quad is very important. Rather than thinking of the feed line in terms of SWR, the line is cut until it presents the least reactance (the greatest loading) at the transmitter final tank coil. Actually, the line is trimmed to resonate with the antenna link or pick-up coil. Equal results may generally be obtained by inserting a tuning condenser in series with link and feed line. Of course, the conventional stub and flat feed line arrangement can be used. After this has been established the cubical quad is tuned for maximum forward gain or greater front-to-back ratio. To do the latter, a field strength indicating device is necessary. It is set up about 50 to 75 feet in front of the radiator. While another operator *slowly* tunes the variable condenser on the reflector the meter is carefully watched for a sharp pronounced peak. This adjustment may be quite critical.

The theory of operation of the cubical quad has not been too well determined. On the basis of a stacked array of this small spacing the forward gain with a reflector should not exceed 5.5 db over the conventional dipole. However, the claimed gain of this array is 11 db, or that equivalent to a lazy-H with reflectors. The many users have noted comparable gains and as far as can be determined most reports show gains equal to this, or slightly higher. It is felt that the change in the mutual impedance produced by the reflecting quad is such that the stacking gain optimizes at the shorter vertical spacing. It is also noteworthy that the cubical quad has an excellent front-to-side and front-to-back ratio. The proof of the pudding is the eating—the theory may be cloudy but the antenna really performs exceptionally well.

There can be little doubt that the quad is an extremely interesting antenna development. Mechanically speaking, it is somewhat easier and more stable to erect than parasitic beams. Electrically, it is little affected by moisture as it has no extreme voltage points on the elements and it is easy to tune. The array has been successfully operated in the proximity of large metal objects and can be tuned and adjusted on the ground with little deviation experienced when erected. The quad principle is applicable to other types of arrays (those having more than one parasitic element) and may offer further possibilities in high gain highly directional antennas.

If you want to know more about the cubical quad—right now—than this brief story tells, put up a quad! If you do, the Editors of CQ would like a postcard about the results you obtained. If you're rockbound to wait until the full story is published, watch future issues of CQ. Developer Clarence Moore, W9LZX, is preparing the entire story for us. In the meantime, keep us posted on your quad results —we'll pass them on to the gang.

14 and 21-mc Bandspread For the BC-348

ROBERT W. EHRLICH, W9SMV *

Already a good basic receiver, each improvement to this popular surplus unit enhances its operating utility.

HERE ARE TWO simple modifications for the popular BC-348 receivers that really "pay off" in added utility and convenience. The BC-348 is noted for its sensitivity and stability; however, it has certain limitations in the amount of bandspread available, particularly at 14 mc, with the result that it becomes difficult to tune the receiver under crowded conditions when crystal selectivity and outboard i-f

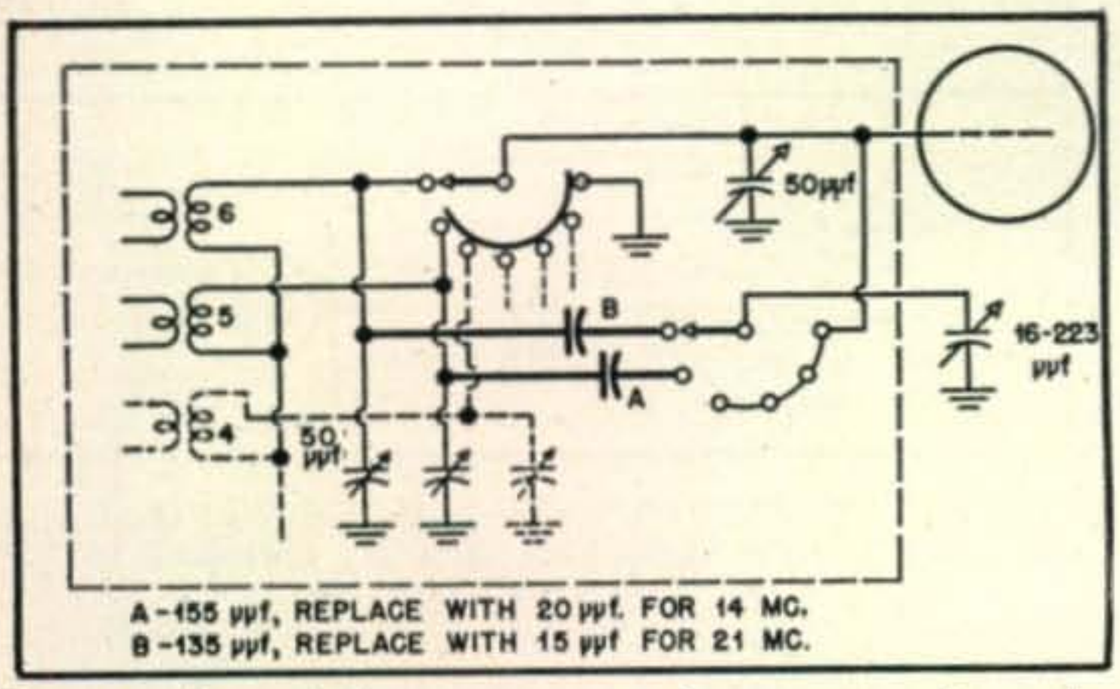


Fig. 1. Essential components of antenna, r-f, or detector assembly for bands 5 and 6, showing modifications for 14 and 21-mc bandspread, respectively. Typical for BC-348 models except J, N and Q.

amplifiers are brought into play. This condition is aggravated, of course, by the slightest amount of backlash. A second major limitation may be foreseen in the fact that the receiver does not cover the proposed 21-21.5 mc band.

Figures 1 through *4* show how the front end tuning assemblies for bands 5 and 6 may be altered to provide 14 and 21-mc bandspread operation. The changes shown for band 5 will convert its range from 9.5-13.5 mc to roughly 13.8-14.7 mc, thus providing excellent bandspread for 20-meter reception (about 50 turns of the dial to cover the band) at the loss of a tuning range that is not required for amateur reception. With the 14-mc coverage of band 6 no longer required, it then becomes practical to carry out a similar procedure for this band to include the 21-21.5 mc range. Having applied one or both of these modifications, the user will probably be pleasantly surprised to find how easy it has become to make those fine adjustments in tuning that are required in the battle against interference.

* *102 N. Williams St., Westmont, Ill.*

One additional wiring change is recommended as shown in *Fig. 5*. With the new small values of padder capacitance, the oscillator frequency is more dependent on trimmer and tube capacitances than before, with the result that the apparent signal frequency is seriously affected by operation of the r-f gain control or the b-f-o switch. These variations may be traced to changes in the mixer screen voltage due to changes in the total screen current. Placing the mixer screen on the regulated supply that normally feeds the oscillator eliminates these variations.

Before going further, it must be mentioned that the circuit changes described here are applicable to all models of the BC-348 series except the BC-348J, N and Q. These models are substantially different from the others, and their arrangement of trimmer and padder capacitances in the front end is such that it is not practicable to apply these procedures.

The circuit changes are perfectly straightforward, involving only the replacement of one or two fixed condensers in each coil assembly by condensers of new values. A few notes on procedure will, however, simplify the job considerably.

Mechanical Procedure

Before starting work, be sure that there are available (1) a soldering iron with a long thin (pencil) tip, and (2) an Allen wrench that fits the set-screws

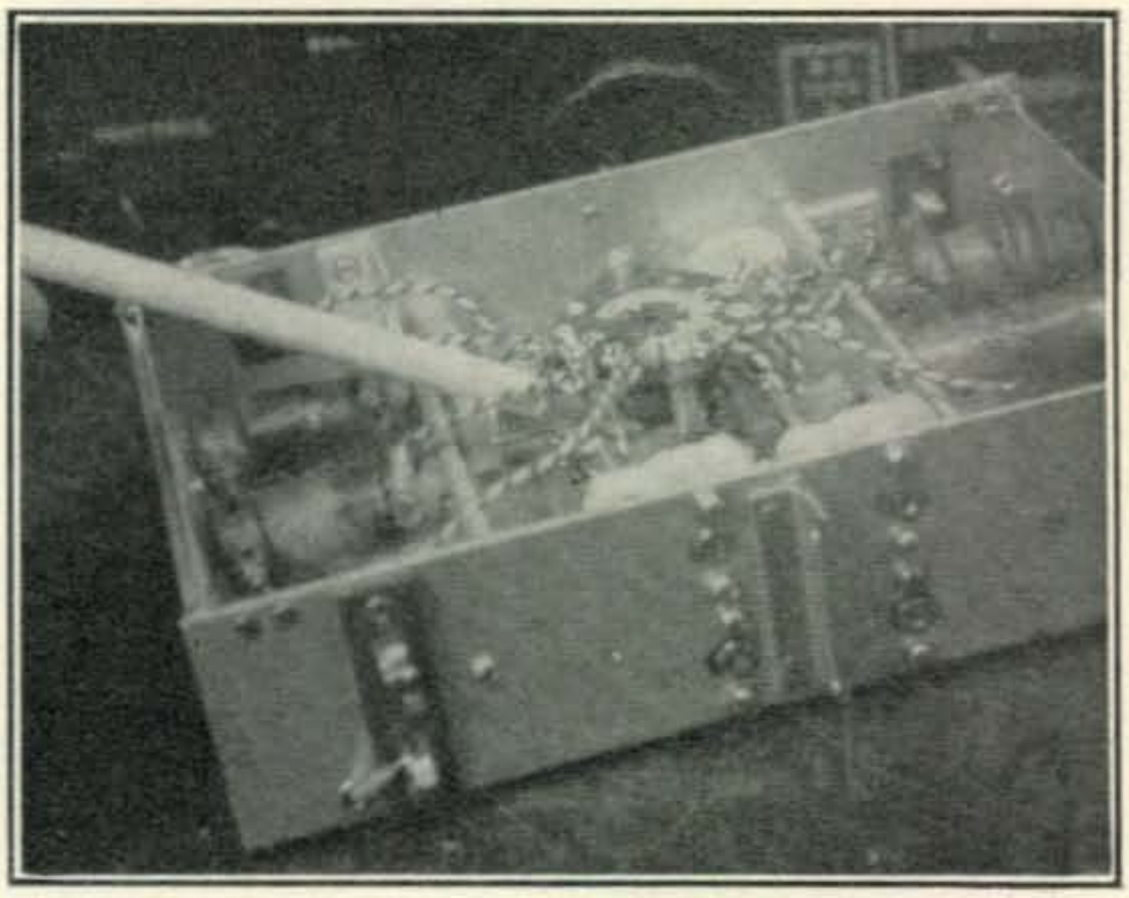


Fig. 2. Photo of antenna tuning assembly. Condensers to be replaced are located between the switch wafers, as indicated.

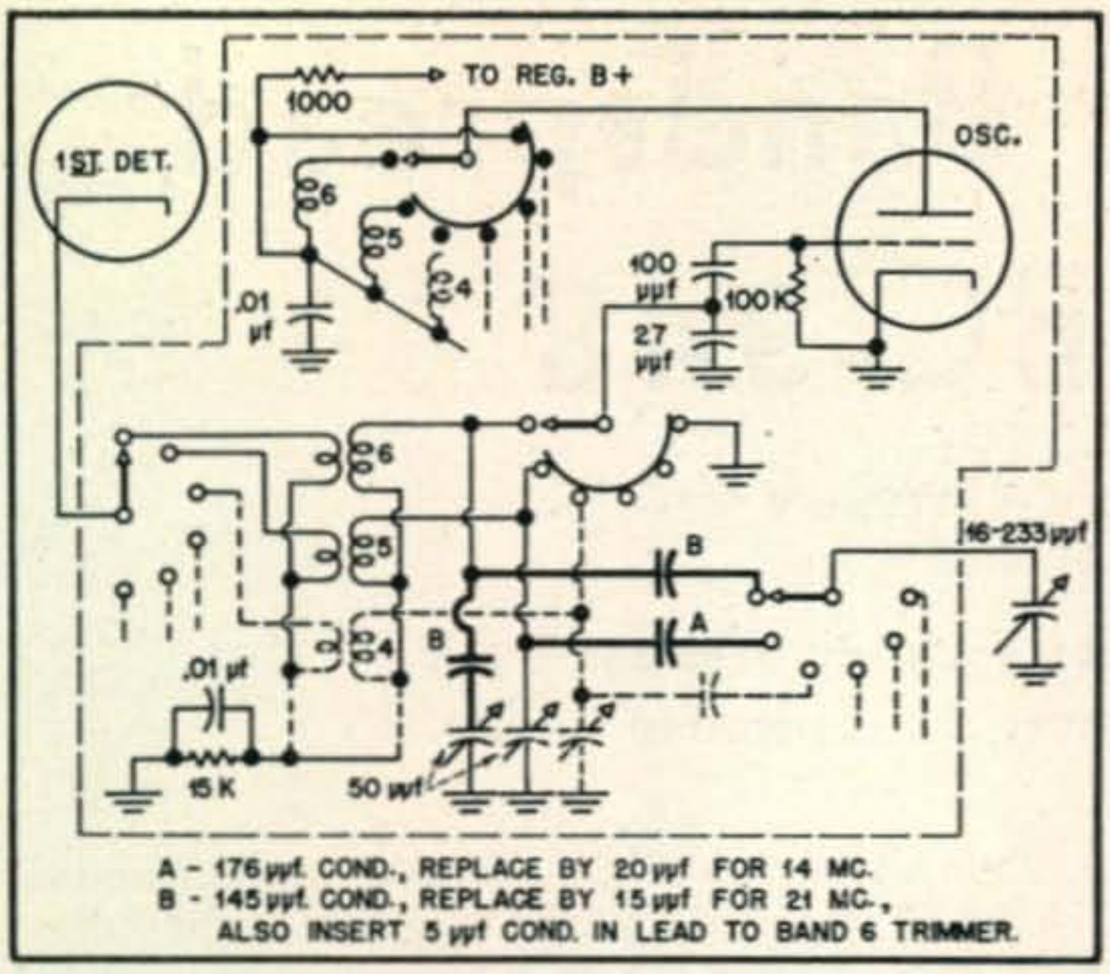


Fig. 3. Essential elements of oscillator assembly for bands 5 and 6, showing modification for 14 and 21-mc bandspread, respectively. Typical for BC-348 models except J, N and Q.

in the panel knobs. The former will greatly facilitate the wiring changes at a minimum of disturbance to other components. The wrench is required to remove the antenna tuning control shaft extension so that the antenna coil assembly can be removed. As for material, it should not be necessary to emphasize that the condensers used as replacements should be of good quality. Zero temperature coefficient ceramics or silvered mica capacitors are recommended.

The first step in removal of the front-end assemblies is to remove the band switch shaft. This shaft is released by removing one set screw (the only one with a standard screwdriver slot) in the right angle drive for band change. Before actually removing the shaft, it is suggested that the band switch be set to band 5 or 6 as an aid in identifying the particular condensers to be replaced. The shaft is removed by simply sliding it out from the far end.

The four cans will slide out easily when all mounting screws and ground straps have been removed, wires disconnected, and the antenna tuning control

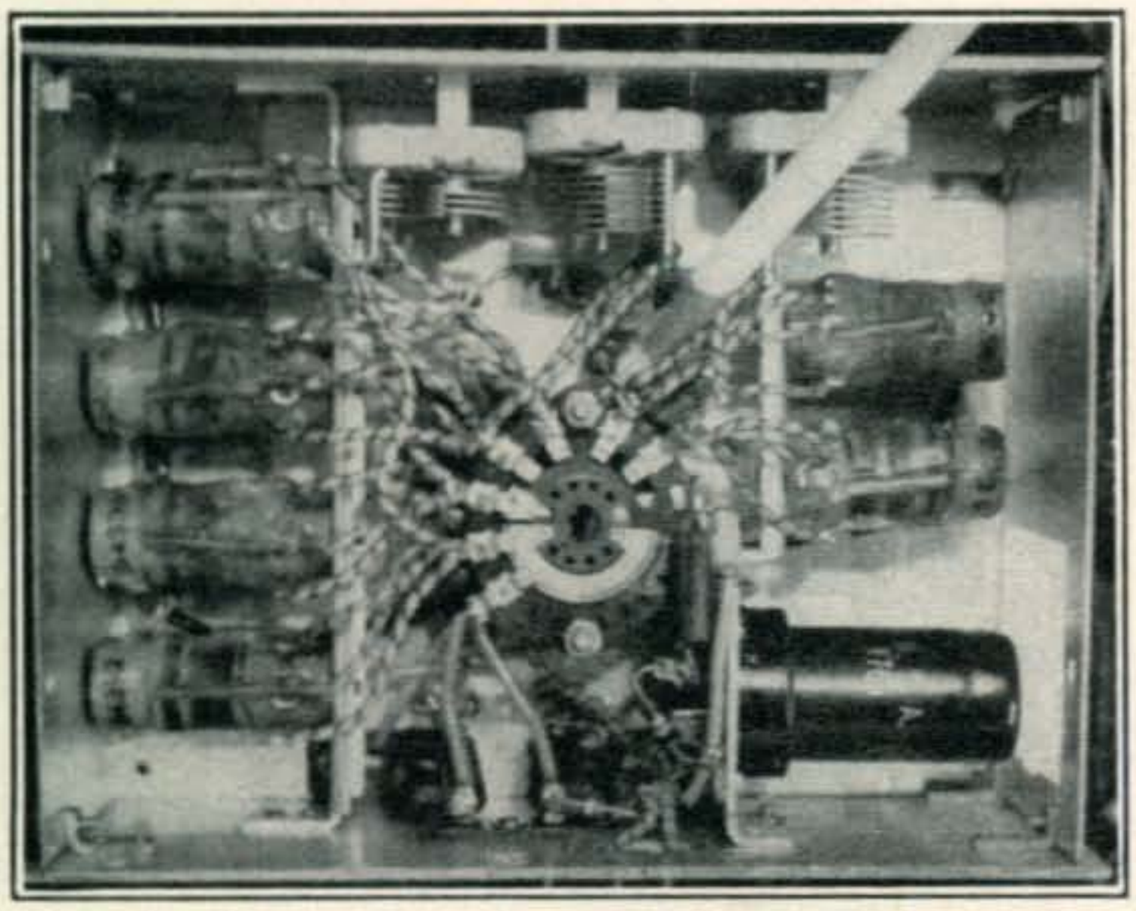


Fig. 4. Photo of oscillator tuning assembly. Condensers to be replaced are mounted at the point shown between the first and last switch levels.

extension removed. Incidentally, removal of the shield plate on the main tuning condenser will simplify the matter of disconnecting the wires leading thereto.

When working on the tuning assemblies, existing apparatus and wiring should be disturbed as little as possible. In this connection, it is better to cut the pig-tails on condensers being replaced rather than to attempt to unsolder them. It is also important not to turn the switch wafers, otherwise it will be difficult to replace the band switch shaft.

The modification in the mixer screen circuit is very easy to make. Removal of the panel plate in front of the r-f tube shelf will reveal a 10,000-ohm resistor connected to *pin 4* of the 6J7 (mixer) socket. The *other* end of this resistor should be clipped free and wired over to the left-hand (positive) lug on the neon tube regulator.

Re-alignment

After the receiver has been reassembled, alignment is simple and straightforward. On band 5, even without readjustment, the front end should be well enough in line to receive strong signals. The lower portion of the familiar 20-meter spectrum will probably appear near the top of the dial, and this

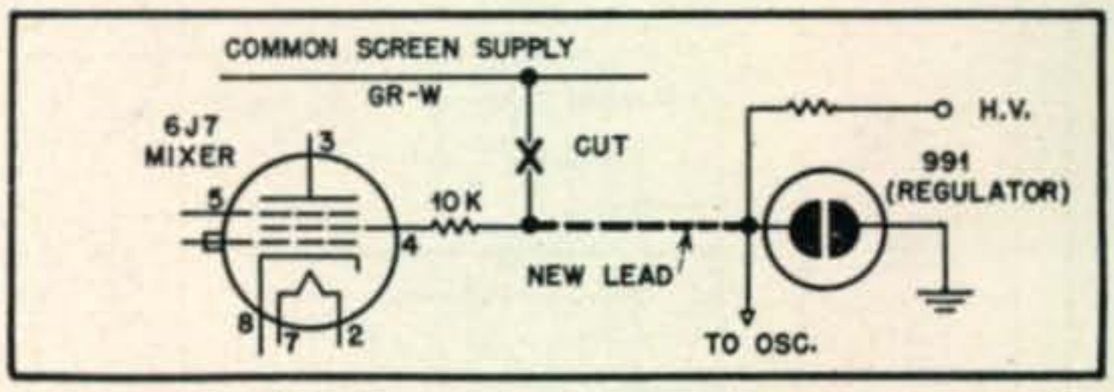


Fig. 5. Modification of mixer screen supply to eliminate frequency variations due to changes in total screen current.

can be confirmed by setting the transmitter oscillator or some other local signal source at 14.0 mc. Then, by means of alternate adjustments of the band 5 oscillator trimmer and the main tuning control, the appearance of the 14.0-mc signal may be worked down to the lower part of the dial, say the 10.0 mark. The oscillator trimmer adjustments must be made carefully in small steps, because this condenser now has a large effect upon frequency. Alignment of the front-end stages is completed by tuning to a point where there is no signal and adjusting the remaining band 5 trimmers for peak noise.

Band 6 is a little harder to align because of image difficulties, but the 21-mc region may be found near the top of the dial again through the use of a transmitter oscillator harmonic. To determine whether or not some received signal is an image, turn on the crystal and b.f.o. and observe at which side of zero beat the maximum signal occurs. Then switch to band 4 and observe that maximum signal occurs on the opposite side of zero beat; if this is not the case, the signal received at 21 mc is an image. Once a bona-fide 21-mc signal has been located, it may be spotted on the dial by means of the oscillator trimmer as indicated above. It is best to align the remaining front end stages on this signal rather than

(*Continued on page 72*)

Conducted by HERB BECKER, W6QD*

This month's column is by Andy Elsner, W6ENV, once again pinch-hitting for Herb, who of necessity had to hit the road for a couple of weeks. You've heard about the traveling salesman, no doubt.

WELL, HERE WE GO AGAIN. Honestly, gang, I couldn't help it. Herb is out and I'm in . . . that is, Herb is out of town, and I'm in up to my neck. It was kind of slick the way he arranged it this time. He waits until I'm in an apprehensive mood (whatever that is), at the DX Breakfast of the recent Southwestern Division Convention. In the middle of confidential DX chatter, he leans over the table slyly and says, "By the way, will you be around during the evenings next week?" Think I to myself, good ole Herb, he finally has lined up a sked with a rare country and is letting me in on the ground floor. So, natch, I say, "Am I going to be around? I should say so. What's cooking?" "Just the column," says Herbert The Fox Becker, with an evil gleam in his eye. Well, you can guess the rest. He has to go up North for a couple of weeks. Hasn't been there for quite awhile. Business is business, and all that sort of thing. What you may not know, though, and what I did not find out until after he had left, was that he had been all over trying to talk someone into writing the blamed thing, but even the janitor would have none of it. I feel so goaty, I've been butting my head into the antenna pole to keep in trim.

Now that that is out of the way, perhaps we can settle down to business, if any. This is not as easy as it sounds, because every time you pick up a letter, you start thinking how good the band must be, and about all the new countries you are missing. Hold on . . . time out. Hurrah, the band is flat. Here we go again.

Taking first things first, let's congratulate these boys for making up this month's quota of W.A.Z.ers.

72	ZL1HY	Dave Brown	40	182
73	OK1FF	Vladimir Kott	40	150
74	W3EVW	Roger Causse	40	185
75	W6RW	Roger D. Mace	40	158
76	VE4RO	George Behrends	40	157
77	W6SRU	Lloyd I. Burns	40	153
78	W9VW	Harold L. Brooks	40	163
79	G3AAM	Jack Mann	40	156
80	W3GHD	Robert G. Wilson	40	197
81	W6BIL	George S. Maxey	40	85

All of these DXers worked the necessary 40 Zones long ago, but have been held up in applying for the certificate by the lack of a single card, in most cases Zone 19. Now that the ice seems to have broken in Siberia, there should be a flood of cards in here before long. Both ZL1HY and OK1FF are the first to W.A.Z. in their respective countries, while W3EVW is the first W3 and VE4RO the first in his district. W6BIL has the distinction of having made W.A.Z. with a total of only 85 countries! How did you do it, George? W.A.Z. certificates, on an all-time basis (prewar and postwar), were also awarded this month to WØCWW and I1IR.

After the past year's apparent dearth of VP8s, all of a sudden there are more of them on than you can shake a 3-element beam at. What is going on down there, no one seems to know, but nearly everyone in the expeditions must be a ham. While we can't guarantee it, the following locations appear to be correct insofar as we can tell at this point: *VP8AA* and *VP8AI*, Falklands; *VP8AD*, So. Georgia; *VP8AJ*, *VP8AL* and *VP8AM*, all in Antarctica; *VP8AK* and *VP8AO*, So. Shetland Is.; *VP8AP*, So. Orkney Is. Of course, *LU1ZA* is back on, and again we state that regardless of the position the A.R.R.L. has taken on LU1ZA, we have not yet found sufficient reason to scratch him from your lists. The mailing QTHs for the above will be found in the usual place.

MD4BPC is not in Italian Somaliland as his call would indicate, but rather in Hargeisa, British Somaliland, according to W4GG and others. We hear rumors that there is also an FL8 on in French Somaliland, but as yet, no one has reported working him, nor is there any proof that he is actually there. However, we do have evidence from *PJ5KO* in the form of a letter, with a list of stations worked from the Netherland West Indies. No licenses are being issued to hams there, so of course the few in operation are under cover. PJ5KO has been on 14-mc phone since August, 1948, with 100 watts, battery operated.

An old-timer, David Mitchell, GW6AA from 1936–1948 and ex-G2II from 1930–1936, has moved to New Zealand, and is now signing *ZL1MP*. He is anxious to contact old friends on 14 and 28-mc. c.w., and can be reached c/o Bank of New Zealand, Auckland, New Zealand. David was equipped for some high-powered listening while on his way to

W7KMV/lwo relaxes before panicing the band.

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

W. A. Z. HONOR ROLL

C. W.-PHONE			C. W.-PHONE			C. W.-PHONE			C. W.-PHONE			PHONE ONLY		
W6VFR	**40**	**214**	W3JNN	39	189	W3JNN	38	191	WØRBA	36	89	G6LX	37	124
W2BXA	**40**	**207**	W9IU	39	189	VE3QD	38	172	GM2AAT	36	75	G2AJ	37	121
W6ENV	**40**	**204**	W8RDZ	39	188	W1JYH	38	170				C1CH	37	75
W6PFD	**40**	**203**	W3KT	39	186	W3EPV	38	163						
W8HGW	**40**	**202**	W2NSZ	39	186	W3IVE	38	161	CM2SW	35	143			
W6ITA	**40**	**201**	W9ANT	39	185	W8FJN	38	153	W4LVV	35	125			
W6EBG	**40**	**200**	W5ASG	39	180	KP4KD	38	151	W3WU	35	121	W1JCX	36	155
W6SAI	**40**	**199**	G6ZO	39	180	W3DKT	38	151	VE3AAZ	35	118	W8REU	36	139
G2PL	**40**	**199**	W2HZY	39	180	W1ZL	38	150	W8ZMC	35	117	W1MCW	36	136
W3GHD	**40**	**197**	W3JTC	39	180	W4OM	38	149	W2GVZ	35	115	W2DYR	36	135
W6ADP	**40**	**196**	F8BS	39	179	W1ENE	38	147	W9WCE	35	115	W6PXH	36	129
W4BPD	**40**	**193**	WØNUC	39	178	W9LNM	38	144	W8AVB	35	113	W1FJN	36	128
W4CYU	**40**	**191**	W8NBK	39	174	W8CVU	38	142	VE3ACS	35	111	G2PL	36	128
W6SA	**40**	**186**	W6KRI	39	173	W3KDP	38	141	W9CKP	35	109	G6BW	36	127
W6MJB	**40**	**186**	W6ZCY	39	173	W2PUD	38	141	W6ZZ	35	104	G6BW	36	127
W2CZO	**40**	**185**	PY1DH	39	172	W1KFV	38	134	G8VR	35	100	W3JNN	36	126
W3EVW	**40**	**185**	W2CWE	39	171	W4FPK	38	132	W2WC	35	99	W6WNH	36	120
W6MEK	**40**	**185**	W6MX	39	171	W4VE	38	132	W2HAZ	35	91	W4INL	36	113
ZL1HY	**40**	**182**	W2CYS	39	170	G8IL	38	131	G2AVP	35	89	F8VC	36	111
W6DI	**40**	**181**	W1ENE	39	169	W3ZN	38	130	W8JM	35	86	G5YV	36	106
W6NNV	**40**	**180**	W8LEC	39	168	G5CI	38	130	D4ANM	35	80	G6WX	36	105
W7AMX	**40**	**179**	W9RBI	39	168	W2PQJ	38	130	G8RC	35	78	W3DHM	36	96
W6KRI	**40**	**178**	W3DRD	39	167	TF3EA	38	128	G3BDQ	35	74	W6SA	36	92
WØYXO	**40**	**176**	W6RBQ	39	166	G6LX	38	126	W7FNK	35	72	F8DC	36	87
W6PCS	**40**	**175**	W6GDJ	39	164	W9MZP	38	126						
ZS2X	**40**	**175**	W1NMP	39	164	W9TB	38	124						
W2IOP	**40**	**175**	W6MVQ	39	164	GW3AX	38	123						
VE7ZM	**40**	**175**	W4BRB	39	162	WØSQO	38	123	W4DHZ	34	132	XE1AC	35	139
W6TT	**40**	**174**	W4DKA	39	162	W9FKH	38	122	W4HA	34	119	W1NWO	35	133
W6FSJ	**40**	**172**	G5DQ	39	160	W8VLK	38	121	W9FNR	34	103	W9RBI	35	129
W6AM	**40**	**171**	CE3AG	39	160	WØEYR	38	120	G8QX	34	99	W8BF	35	120
W9KOK	**40**	**170**	W4INL	39	159	GW4CX	38	120	G8KU	34	96	G3FU	35	115
W6WKU	**40**	**170**	WØGKS	39	159	W8WWU	38	119	VK4RC	34	91	W6CHV	35	111
VK2DI	**40**	**168**	W6RM	39	159	W8KPL	38	117	W8JM	34	89	W6PCK	35	109
W6RM	**40**	**168**	W1BIH	39	157	W9YNB	38	117	G6XX	34	89	GM2UU	35	107
W6OMC	**40**	**166**	G8KP	39	156	W5CPI	38	113	W7PK	34	87	W4OM	35	106
W7FZA	**40**	**166**	VE7HC	39	156	OK1CX	38	110	WØFWW	34	86	W4ESP	35	105
W6DUC	**40**	**166**	VK2ACX	39	156	G3ZI	38	107	W2JA	34	84	G8QX	35	100
W6AMA	**40**	**165**	W2RDK	39	154	G8IP	38	105	W9LI	34	81	W9CKP	35	100
W6PKO	**40**	**164**	W9LM	39	154	W9FKC	38	104	W8PCS	34	80	W9HB	35	89
W5AFX	**40**	**163**	W4GG	39	152	W6DLY	38	102	W5CD	34	74			
W9VW	**40**	**163**	W9LNM	39	152	W6ID	38	101	W6WUD	34	68			
W7DL	**40**	**162**	G6QB	39	152	W6MUF	38	96	J4AAK	34	66			
WØNTA	**40**	**161**	G5YV	39	151	KH6PY	38	91				W2RGV	34	111
W7GUI	**40**	**161**	G2AJ	39	151	C1CH	38	76				W8BIQ	34	103
W6PB	**40**	**160**	W2COK	39	150	G3BI	38	75	W4LVV	33	111			
W7BD	**40**	**160**	G2WW	39	147				W4QN	33	104			
VE4RO	**40**	**157**	D2KW	39	147				WØGBJ	33	79			
G3AAM	**40**	**156**	W2MEL	39	145				G2LC	33	85	W5ASG	33	118
VE7HC	**40**	**156**	W6RW	39	145				W8QUS	33	85	W2ZW	33	115
W6BPD	**40**	**154**	W8SDR	39	144	W2TJF	37	144	G8VG	33	78	W4HA	33	109
W6SRU	**40**	**153**	W6PQT	39	144	W3JKO	37	143	G3BFC	33	77	W9BZB	33	102
W7BE	**40**	**152**	W6OEG	39	143	W4ML	37	131	W2NXZ	33	61	W5LWV	33	100
W6FHE	**40**	**152**	W6JZP	39	142	W2CNT	37	126				W2PQJ	33	100
W6KUT	**40**	**151**	W9DUY	39	141	G4CP	37	117				W8ZMC	33	99
G3DO	**40**	**151**	G6BQ	39	140	W2EMW	37	117	VE3AGC	32	108	WØHX	33	89
W6SC	**40**	**150**	G3FJ	39	139	VE1EA	37	116	W1BFB	32	94	W8QBF	33	87
KH6IJ	**40**	**150**	W6EPZ	39	138	WØAZT	37	112	W2OEC	32	92	VE3ZM	33	81
OK1FF	**40**	**150**	W9VND	39	136	W2BJ	37	111	HA1KK	32	78	VE3BNQ	33	79
W6LEE	**40**	**150**	G5RV	39	132	W6CTL	37	111	WØFET	32	71	W2DRH	33	60
W1AB	**40**	**149**	G2VD	39	132	W2GUR	37	109						
ON4TA	**40**	**148**	W6UCX	39	131	G4AR	37	108						
W6ANN	**40**	**148**	W6EAK	39	130	W8HSW	37	104	W2AYJ	31	103			
W6BAM	**40**	**147**	G2FSR	39	130	G5MR	37	100						
W7DXZ	**40**	**146**	W6LRU	39	130	W2BLS	37	100				W9RNX	32	105
W9NRB	**40**	**146**	W6UZX	39	130	G3AAE	37	99	G6QX	30	89	W2HY	32	85
W6LER	**40**	**145**	VR5PL	39	124	W2SGK	37	95	VE5JV	30	77	W9GZK	32	72
W6QD	**40**	**141**	G5VU	39	124	W7BTH	37	95						
W6TI	**40**	**141**	G3AAK	39	122									
W6AOA	**40**	**139**	OK1AW	39	122									
ON4JW	**40**	**136**	W2GUR	39	120							W9WCE	31	91
W6PZ	**40**	**135**	G5WM	39	120							W6UZX	31	85
W6RDR	**40**	**134**	G8RL	39	120	W3OCU	36	140				W6AM	31	80
G3AZ	**40**	**134**	WØOUH	39	119	W2RGV	36	137	**PHONE ONLY**			W4LZM	31	79
W7GBW	**40**	**129**	G6BS	39	117	W3LVJ	36	131						
W6YZU	**40**	**129**	W6NRZ	39	117	WØDU	36	129						
W6MLY	**40**	**129**	W7ETK	39	116	OA4AK	36	124						
G5BJ	**40**	**126**	G3QD	39	116	SV1RX	36	119	W6VFR	39	144	W9MIR	30	82
W6NRQ	**40**	**123**	G3TK	39	114	MD5AK	36	118				OA4AK	30	81
W6BIL	**40**	**85**	W6RLQ	39	110	G2CNN	36	114				W2SVK	30	74
			W6LN	39	107	G2AKQ	36	112	W6DI	38	163			
			W7GXA	39	106	W3AYS	36	109	W8BKP	38	145			
W3BES	39	206	KG6AL	39	104	W2BF	36	108	W7HTB	38	132			
W2GWE	39	200	W6LEV	39	103	W4DIA	36	107						
W2PEO	39	198	W6MI	39	102	VE1PQ	36	105				W8SXU	28	59
W6SN	39	195	W7ENW	39	101	W4BK	36	101	W4CYU	37	159			
W2HHF	39	193	W6WJX	39	101	G2AO	36	100	W2BXA	37	143			
W3DPA	39	191	W6AX	39	93	G6WX	36	95	W1HKK	37	136			
W8BKP	39	190	G6PJ	39	76	W7EYS	36	90	G3DO	37	125	W2BF	27	52

ZL-land and even had heard cards printed as GW6AA/MM. A mouth-watering heard card from him was received here recently while near the Kerguelen Islands in the South Indian Ocean.

W1ENE sends in some additions to his list and complains that they are not enough, and that they're getting harder and harder to make. It seems as though he would like to see Lebanon removed from the country list. Even with a sked, he says he can't work AR8AB. This is tough, but wait . . . something new has been added . . . a Jr. Op. on September 24th. Just be patient, Jon, in about 15 or 20 years you can retire from this madness. Congrats, anyway.

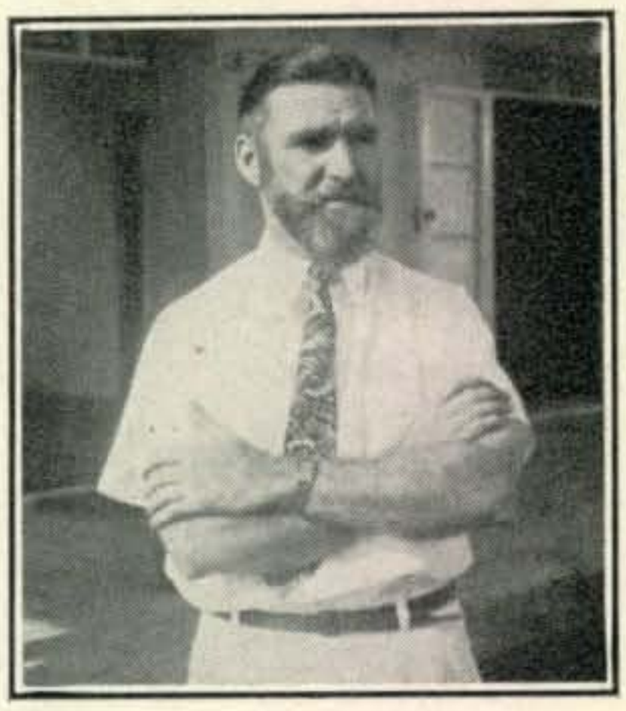
Good news from Tibet. Reg Fox, *AC4YN*, has finally received his new cards and is sending them out now. W6FHE and W7HTB are among the lucky ones to receive verification for QSOs this year. And now a bit of not so good news is that *UM8KAA* has QRT. This comes through our pipe-line to the USSR, W6VFR, who gets it from UA3AM. No, Marv has not worked the UM8 either. Why, I wouldn't know. He must have overslept just one morning.

W4IYT has logs from *EP1J* and will handle QSLs for him, so if you need a card from Zone 21, perhaps this is the way to get it. Probably it would help to work him first, but this isn't hard, even from here. W9LNM reports that *SP8XA* said his QTH was "incognito and taboo," and that there would be no QSL but that he was really in Poland. He understands English with no apparent difficulty. Art was the surprised recipient of an extra zone from the DX Committee or the printer, we don't quite know which, but in any event, it spurred him on to work another one, thus making it legitimate. Herb blames these little happenings on me, and he could be right, because I'm the guy that handies the lists. What I don't understand though, is my apparent generosity. Why don't I take a few off sometime, instead of always adding them?

W9BZB has worked some nice ones on 10 phone, including *G6AJ/AP2* in Pakistan, who runs about 400 watts to a 20-meter Windom. He operates around 28,480 kc, and is heard at about 8:00 a.m. in W9-land. AP2F was also heard at about the same time and frequency.

G6QX has finally come to the conclusion that a single wire fed 139-footer is not the answer to 40 zones. Consequently, a 2-element 28-mc and a 2-element 14-mc rotary beam is about to be hoisted skyward. We hope that this does the trick, but . . . time marches on. Says Bob, "An enterprising TV salesman has done me a bad turn, and TV antennas grace every chimney other than mine. So it's silent hours, or out of bed with the dawn to keep the station on the air."

We hear from several sources that *ZC4AR* is likely a pirate. Fortunately, no one has claimed him as yet. Speaking of pirates brings *AC3GG* to mind. Most everyone seems agreed that he comes over the European path, and here on the West Coast he peaks over the Azores, much the same as *ZD7AA*. Who knows, perhaps he too will slip, and become the snicker of the month for January. OK1AW wants to know if he must have all 40 cards and send them to *CQ* before he will be listed with 40 zones in the Honor Roll. The answer, of course, is yes. Everyone shown with 40 zones has sent his 40 cards in and had them passed on by the DX Committee, after which a W.A.Z. certificate has been issued. This might be a good place to mention to the hams outside the U.S.A., that when applying for W.A.Z., it is necessary to send a list of countries worked along with the 40 cards. This list must show the countries listed alphabetically, the station worked in each, together with the time and date of each QSO. A standard form is available at *CQ* Hq. in N. Y. A number of W.A.Z. applications we receive, especially from foreign hams, do not include a country list, and of course considerable time is lost in requesting and receiving these lists. This also makes the number on the certificate larger!



Bill Scarboro,
ZK2AA,
Niue Island.

A short note from HP1BR, for the benefit primarily of KG6AI, states that *HK1CK* has moved from Baranquilla to Bogota, and is now *HK3CK*. This no doubt explains why KG6AI's mail has not been answered. Full QTH in QTH section. In turn, Bob would like information on how to get cards from *VP3JM*, *VP4TAU* and *EP2XZ*. Don't know about the last two, but VP3JM does QSL.

If you are looking for Iwo Jima and should happen to hear *W7KMV/Iwo*, don't just barge in on top of his QSO. This will only get you a top spot in his little black book, which incidently, is almost full of calls that will never have a QSO with him. He is trying to work as many stations as possible, but he does have traffic, and skeds for this traffic are being broken up by great hordes of overly eager hams. A little courtesy in this respect will be greatly appreciated. His QSL situation is particularly grim, having sent out over 2000 cards in the four months of operation in Iwo Jima. *OE7FR* wants his cards handled through the R.S.G.B. W1RWP says that he was specifically requested not to QSL via the O.V.S.V. We wonder if that applies to all other OE7 stations? What this column would do without *PY1DH* is difficult to imagine. Every continent seems to have one ham with an outstanding sense of humor, and Ed gets the vote for South America, hands down. When the world looks dim, and the band sounds grim, along comes a letter with a Brazilian air-mail stamp, and, brother, you've had a lift. Just for fun, we'll let you take a peek at an excerpt from Ed's latest. "You know that G6ZO got married? Yep, he is right now in the honeymoon, according to G5LI, and nobody knows when he will be back to DX game. Maybe never! The XYL attitude for Kirk's hobby is incognito yet. For example, I will tell you that last night I was working I1PL/M1, then I call PY1AHL by telephone and

(*Continued on page 58*)

Guy Dennis, W6DI, chief statistician of the DX Marathon, is laid up after being severely lacerated in an accident at home. Due to the mishap DX Marathoners will have to hold their breath until final tabulations can be made next month. Get well soon Guy—DX's a'wasting!

Conducted by VINCE DAWSON, JR., WØZJB*

WRITING THIS COLUMN at this time is like trying to guess the flip of a coin while it is still in mid-air. Will we have 50-mc F2-layer DX this season, or not? Across the continent opinions seem to differ as observations of the MUF trend are interpreted. The MUF was as high as 46 mc during the late October peak. In the south, W5ML reports those bursting variety signals that seem to move along just slightly above the real MUF. In the west, W7QLZ and W6QG have heard signals above 40 mc, especially from the Hawaiian Inter-island Telephone Company. But, still the question remains—will 50-mc get across? (P.S. Don't say we didn't tell you as we are betting on 6 meters opening November 12 to 14).

Activity is still in a slump on 50 mc, though in the foreseeable future a new type of 6-meter "citizen" may emerge. Practically everywhere but in the vertically polarized territory of eastern W2 and W3, activity on 144 mc is somewhat off pace. While DX of the order of 100-150 miles is now being consistently worked by the fellows with the bigger beams and arrays, we must pause and wonder where actually are we going?

In the past several months readers may have noted a liberalization in our views on 144-mc antenna polarization. This has been brought about for a number of good reasons. During the past year or so we have been lead to believe that DX was the most important factor about the v.h.f.—but, is it? While DX does have its place on any amateur band, it is currently upsetting an increasingly large segment of the v-h-f world. The root of the trouble, as I have delicately attempted to point out in past columns is antenna polarization. We were particularly glad to see that others are awakening to the harm in the polarization question. Next month, we hope to say more about this grave problem, and offer possible solutions.

An interesting note concerning solar static was recently published in *Science* (Oct. 1, 1948; page 454) revealing some measurements made by Dr. H. T. Stetson on about 45.0 mc. These were indicative of the intensity of the "hiss" which 6-meter amateurs might expect during daylight sunspot disturbances.

Using an S-36A receiver and a slanted dipole the intensity was measured in microvolts input. During major ionosphere storms characterized by the passage of very large sunspots across the face of the sun (March and April, 1947) the "hiss" was received in bursts often exceeding 2.5 microvolts. While field strength levels of this order would naturally limit daytime ground wave DX at 50 mc, many amateurs are not aware that the "hiss" may also be used to forewarn possible auroral type band openings. It has been suggested that there is quite likely an extremely close correlation between bursts of intense solar static and aurora type 6-meter propagation the following evening.

6-meter operators who normally tune periodically throughout the day should watch for short periods when the background noise suddenly increases and has a definite frying-pan sound. British amateurs have noted this effect for over a decade and were especially warned of their big auroral opening on August 8, 1948, by the intensity and duration of the solar static observed hours earlier.

Foreign Notes

To the amazement of everyone, but B. J. and his Argentine counterparts, the XE-LU 6-meter path opened at least twenty-five times prior to this writing. The mystery of "why" is still unsolved. Each evening B. J. lights up the pipe, pulls up the easy chair and by turning on the rig promptly at 1929 CST can expect to work this 4600-mile path within the next couple minutes. Gee, just like in the movies —Estudios Azteca, that is!!

Can you imagine this? Six meters open almost nightly for OA4BG, John Dittemore, in Lima, Peru, but it seems as if a minor thing called a revolution has John off the air, what a revolting development.

Recently, as most of us know, the Olympic games

(Continued on page 48)

**Send all contributions to Vince Dawson, Box 827, Gashland, Mo.*

Picnic roundup of the 6-meter gang at the home of W2MEU. Attending were (seated): W2SYR-XYL; W2QVH - XYL, W2KZG - XYL, W2QVH, W2MEU-XYL, W2KZG, W2FHJ, W2MEU, W2COT, W2LAL-XYL, W3CGV, W2IDZ-XYL, W3HC, W2AMJ - XYL; W2TWC - XYL; W2LAL. Standing: W2AMJ, W2FHJ, W2TZU - XYL, W2TZU, W2IDZ, W2SYR, W3MQU, W3GGR, W2TWC. In the forearound are jr. ops. of W2IDZ, W2SYR and W2MEU. Others who attended but are not shown were W2IQQ, W2IKO and W3MAC.

(Number fourteen of a series)

We are very fond of fresh-opened Cape Cod oysters served raw on the half shell together with a small cup of tomato sauce seasoned with horse-radish and tabasco. If you are an oyster lover, you will know what we mean. If you have never tasted oysters, you should visit the best seafood restaurant in town without delay and try an order. Don't try just one and mouth it gingerly and decide that that's enough. Eat the whole order. When you have finished, you will either call for another plateful or declare that you never want to taste the awful things again as long as you live.

Perhaps radio receivers and oysters do not have much in common, but the point we are trying to make is that if you are a ham or an SWL and have never had a National receiver in your shack, you may be missing just the type of receiver performance that you have always wished for. Thousands of satisfied owners swear by their National receivers. Of course, a few swear at them, too, when failure of some component puts a crimp in the excellent performance they have come to expect.

All this tub-thumping is, we realize, quite out of line with the non-commercial type of article we usually present on this page, but we have always tried to give you helpful information here and our confidence in our product is such that we believe urging you to try a National receiver is asking you to do yourself a favor. Of course, if you do, it will not do us any harm either!

Changing the subject, we wonder if you fellows who bought NC-173 receivers when they first appeared on the market have noticed that this model as currently produced has ventilation openings in the rear of the cabinet. This ventilation is not the only change; a bi-metallic temperature compensating element is used in the H. F. Oscillator section of the tuning condenser with marked improvement in temperature/frequency characteristics. This arrangement was worked out during development of the more recent NC-183 and we felt it well worth incorporating in the NC-173.

When making this change, we realized that many owners of the earlier NC-173 would like to avail themselves of its advantages. We have, therefore, made available a modification kit carrying the designation VMK-173. The price is $6.75 and your National distributor can order it for you if he does not have it in stock.

—Seth Card, W1DRO

National

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Conducted by LOUISA DRESSER, W2OOH*

TO START OFF a high-light month, congratulations to our youngest present-day YL amateur! She is Jane Bieberman of Bala-Cynwyd, Pa. Jane, who was ten years old on last July 27th, received her ham ticket on September 23rd, and the call W3OVV. The daughter of W3KT, Jesse Bieberman, third district QSL manager, Jane first learned the code when she was seven years old and at that time could copy about five words a minute. Because of her age no effort was made to encourage her to take the license examination, but about six months ago Jane announced that she wanted to become a ham and started to practice code again. Copying 5 - letter code groups as sent by a TG-10 keyer constituted most of her practice, and later her Dad sent straight English text. During her summer vacation Jane intensified her code practice, and had daily lessons in theory and radio regulations. The fateful day was August 20th, and she passed with flying colors. Jane has a rig all her own on 40 meters. It is e.c.o. with an 807 final running about 30 watts, feeding a 7-mc folded dipole. The story of her accomplishment was sent to us by Anabel, W3NNS, who tells us that radio is only one of Jane's interests. Her other hobbies include sports, reading and music.

Jane Bieberman, W3OVV, youngest licensed YL.

Convention News

Conventions galore—one would have to be triplets to cover them all! Jackie, W9AYX, reports on the National Convention at Milwaukee, and says sadly that, "of 355 ladies registered there were only four licensed YLs: W8BFQ, Margaret Roberts; W3KJT, Ellen Owen; W9JTX, Louise Baker, and a WØ." Jackie says their program was necessarily planned mostly for the girls who had no interest in ham radio, but describes one activity that any group could use to good advantage: "I guess the most fun of all was with our contest sheets. Each girl was given a large sheet of paper and had to write down the names of as many YLs and XYLs attending the convention as she could before our official program started, and for which we gave prizes. This made the gals really get around and get acquainted with all the others."

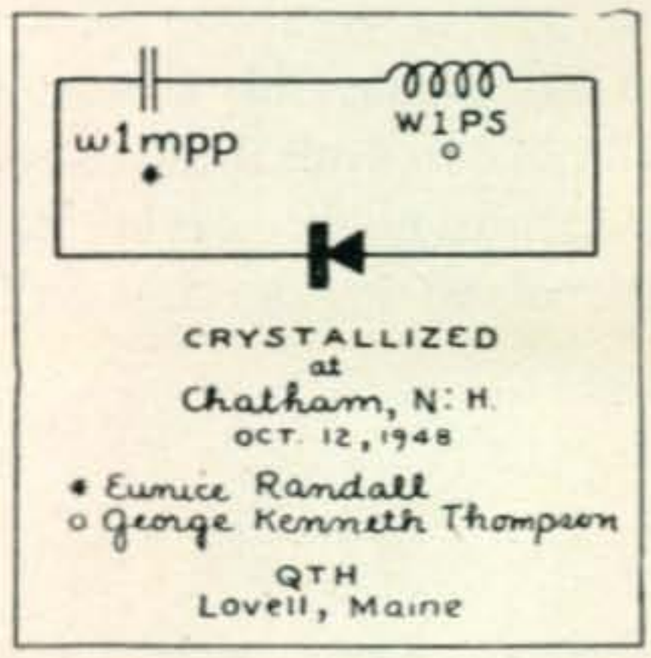
Jackie, who was in charge of the YL program, by the way, leads a most active life. She has two jr. YLs, one 14 and one 9, to care for, does her own canning, is always on the lookout for DX (best to date, VU2JP in Travancore, South India), and keeps open house all the time for skeds between friends or relatives. "Sure keeps me busy," she says, "but it's fun and we love it."

Getting back to ham gatherings, we hear that the Boston Hamfest on October 9th, though very well attended, drew only a small group of YLs. But there to enjoy the fun were: W1QON, Eleanor Wilson; W1KTG, Beatrice Wertheimer; W1MPP, Eunice Randall; W1QJX, Charlotte Spaulding; W2RTZ, Hope Plummer, and W3NHI, "Tillie" Kurtzner.

The Southwestern Division Convention in Los Angeles the first weekend in October was a gala affair for the YLs in general—and for your column editor, especially! The W6 girls really rolled out the welcome mat, and we had a wonderful time renewing old acquaintances, meeting in person for the first time many other YL friends, working their stations, and chewing the rag until we were hoarse. There was a record turnout of *thirty* licensed YLs attending—practically a YLRL convention in itself! Since we can't do justice to describing the occasion in this limited space, editor W2IOP has promised us a couple of extra pages in the next issue of *CQ* to tell you about it, with pictures of all the YLs as well.

Personal Mention

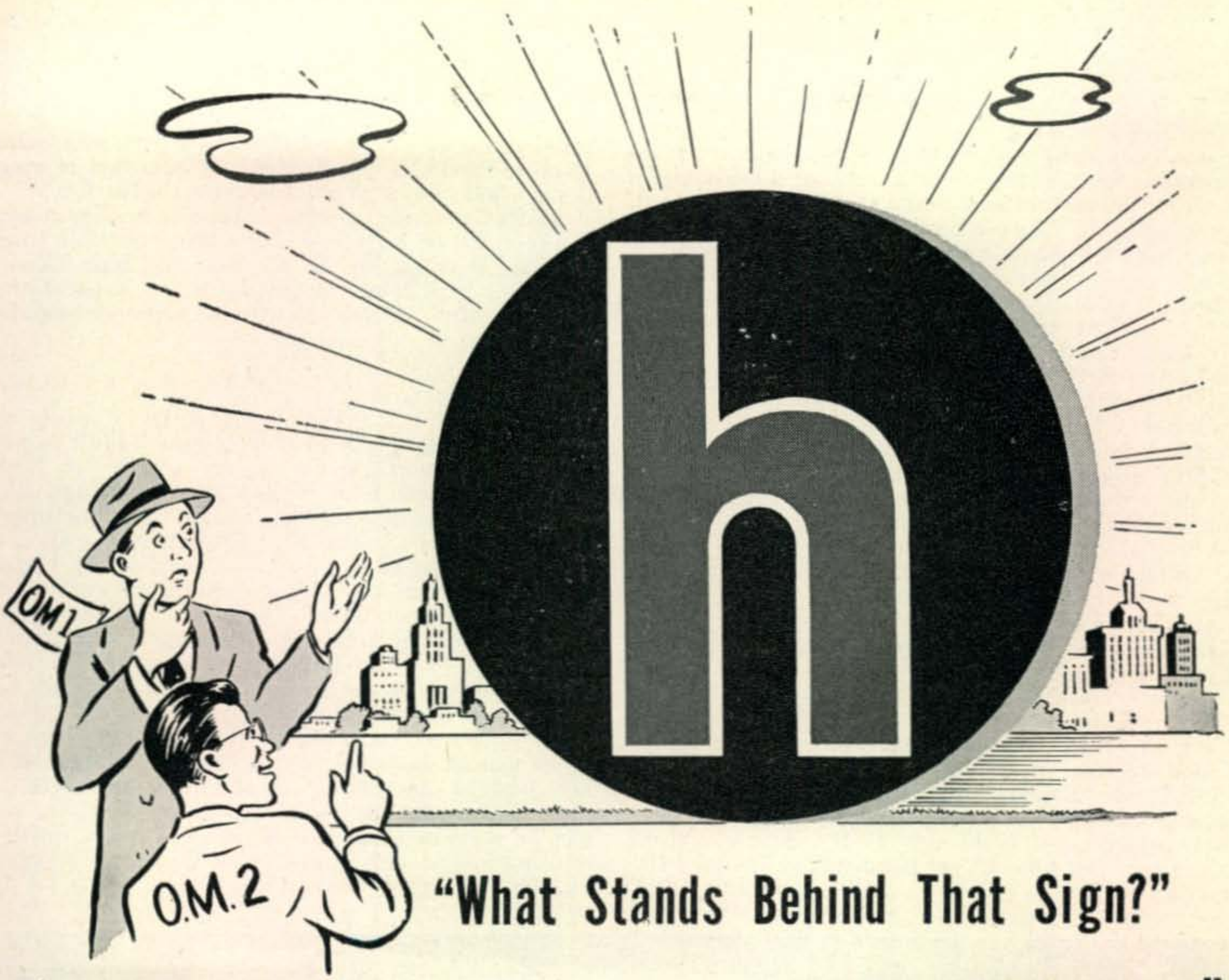
It's for sure you've never seen a wedding announcement such as this one we recently received in the mail. Clever—and cute—don't you think?



Eunice and George decided to join forces and really enjoy their common hobby. They've given up their work in Boston and have bought a place in Maine where they say there is plenty of space

(*Continued on page 68*)

**Assistant Editor, CQ. Send all contributions c/o CQ, 342 Madison Ave., New York 17, N. Y.*



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S-47C Broadcast Chassis	209.50
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S-59 Broadcast Chassis..	49.50

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(*from page 44*)

were held in London, England. Well, what those in the Olympics don't know is that the Gs were given permission to operate on the 144-146 mc band, commencing Sept. 1, 1948, which developed into quite a race for the first 145-mc contact as well as the record. According to *Short Wave Magazine*, G2XC had a QSO with G6LK on 145 mc at 0001 hours Sept. 1, at 32 miles. The race was then on for the establishment of a 2-meter record, which goes something like this: On Sept. 1, G2BMZ/G6LK had it; On Sept. 5, it went to G5MQ/G2AJP; then G2BMZ/G8GX seized it on Sept. 9, and on Sept. 14 it passed to G5BY/G5MQ. But within 45 minutes G3APY had worked G5BY to increase the distance by a few more miles, and since then G2IQ and G6OS have worked G5BY at still greater distances. Well the final outcome is the present co-holders of the G-DX record on 145 mc are G5BY and G6OS at 287 miles. Whew, glad that's over!

G6DH worked PAØPN at 120 miles on Sept. 14 for the first G/PAØ QSO on 145 mc. ON4FG is on 144.1 mc, while I1AS hugs 144 mc flat, some nice DX tries for the 2-meter gang here in the U.S. Any takers??

A last minute note from G5BY says that the 50-54 mc band was re-opened for the Gs until Dec. 31, 1948, so watch that MUF more eagerly. Upon receipt of his permit for 50 mc, Hilton, G5BY, tried a new converter covering 40-52 mc and was rewarded with S-9 signals from the U.S. Police networks around 42-43 mc. G5BY is now xtal on 432.5 mc, the 420-460 mc band being allocated the Gs on Oct. 1.

On June 13, 56 PAØ amateurs took part in the first Netherlands v-h-f conference, held in the Hague, according to the Chairman, PAØANI. Discussions were held on various phases, such as polarization, xtal control, more use of superhets and converters, extended use of c.w. It is certainly gratifying to us here to see the boys on the DX side interested enough to have a discussion of this sort. Our thanks, PAØANI, for keeping us informed of your doings, and please keep us posted in the future.

VE5NC, Moose Jaw, Sask., reports hearing many commercials as high as 43 mc during October from Florida, Washington, D. C., and the East Coast. Basil has high hopes of getting in on some of the F-2 DX, after his success with 10 watts during the past Es season.

50-mc Notes

Recently W1CLS, W1RO and W1ATP wrote us that the listing of DX in this column, hadn't as yet helped local work on 50 mc, for activity in New England and the East is very low. Although stations do seem to get on for the various nets that operate once a week in the East, in between, QSOs are few. No doubt all of you have heard of the Horse Traders, perhaps the oldest existing network of 5 and 6-meter operators. The Horse Traders meet once weekly on 6 meters to discuss various and sundry things. In the Philadelphia area the Middle Atlantic Net does the same. While this may not be the answer to promote activity during the dead spells on 50 mc, it could be used to advantage in other remote spots. If any of you are members of a net, how about sending us the time and date of meeting on the air, and frequency used, so we can list them in a special block in these pages, for the information of new converts to the band in your vicinity. Anything we can do to help, please let us

know. Some good articles on 6-meter antennas, rigs and converters would be another good bet. We can almost promise you immediate publication of any good articles on the above-mentioned subjects. Together, all of us can surely promote interest on a resemblance of the old 160-meter band, for any good v-h-f operator can tell you that we have never lost 160, for 50 mc can do all it could and certainly with smaller equipment and more thrills. We can't hope to do it alone but with the help of each of you writing articles and talking it up on 10 or 11 meters, activity can be increased on a very interesting band. How about it?

Charley Rice, W8MVG, in Clio, Mich., says that his weak heart is really kept weak, for 50 mc surely provides the thrills. On Sept. 26, just before his breakfast around 0830 EST, Charley turned his 6-meter receiver on and found about 7 LUs rolling in S-8. A quick check of the MUF showed signals coming in up to 50.7 mc, with a very loud bc station on 49 mc peaking from the south, evidently HCJB in Ecuador. Although W8MVG wore an eighth of an inch off his key contacts, none of the LUs were raised. They were heard until 0912 EST. W8APG in Detroit also heard the stations, one of them being an LU1. Now both W8MVG and W8APG can be found nightly, pouring over a beginners' Spanish book—es bueno amigos, no es verdad?

Perry Ferrell recently made a trip to Washington, not to politic, but to find out about the 6-meter gang. Things have really been happening in Washington, as they usually do, and the facts are, well just facts.

Rick Emerson, W3OJU, was met. Rick is not quite over his circular polarization, and recent aurora contacts, but still in there pitching at NRL. Bill Carley, W4WMI, whom most of us thought was still in Raleigh, is now in charge of the communication lab at George Washington Univ. W4HVV is also in town, doing work with Ring and Co., on the stratovision venture. While we thought W4HVV had v.h.f. at heart it was found that Charley bought a new house, only to find out later that it was 50 feet below sea level. *Submerged* W4HVV will still try 6 meters, no doubt with a slight twang of salt water on his signal! Mel Wilson, W1DEI, who used to roam the 5-meter band with us fellows, is now married and a father (now we know it isn't true about v.h.f.), but unfortunately lives in a QTH where any form of an antenna is verboten. Mel, W1DEI, is now a section head at NRL, among the learned class that is.

W7III in Big Piney, Wyo., is working on an ARR-5 to check the MUF. Monte says the band has been dead, giving him a chance to rebuild for a bigger season come next spring and summer.

In Akron, Ohio, Bud Ports, W8LBH, is busy taming an 813 on 6 meters. Might contact W1DX, Bud, he is an expert on these 813s we hear.

Jack Woodruff, W9PK, still needs Ky., Mont., and Nevada for his W.A.S. Jack mentions that in the Chicago area W9QKM, FDD, FCM, OBW, ZWF, PFA and he are the only ones still active on 50 mc.

W7JPA, one of the Sad Sack Net members, says that his noise level is too high to do much, and to prove his point he sends us a recording of same. Now if we can get the harmonic to sit on the platter and slow the turntable down to 33 r.p.m., we can listen to some awful rackets, no doubt, from the recording, that is!!

W9OVS, Matton, Ill., is a newcomer to 50 mc and although each evening between 1930 and 2025 CST listens 5 minutes in each and every direction, he has yet to make a contact. He was told that Mr. Zear-

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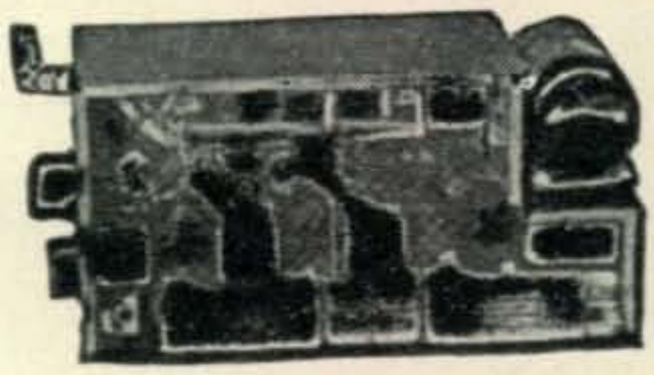

Freq. 108-110 Mc. Tube complement 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—12AH7GT, 2—12SG7, 3—717A. NEAR NEW CONDITION. Companion to the glide path receiver. Also contains 90 and 150 cycle band-pass filters. Has the best AVC system yet developed can use parts or use as a model for construction. 10 tubes, crystals, relays, etc. Schematic included. Don't pass this up. With dynamotor. BF type at only **$3.95**—2 for..... **$6.50**

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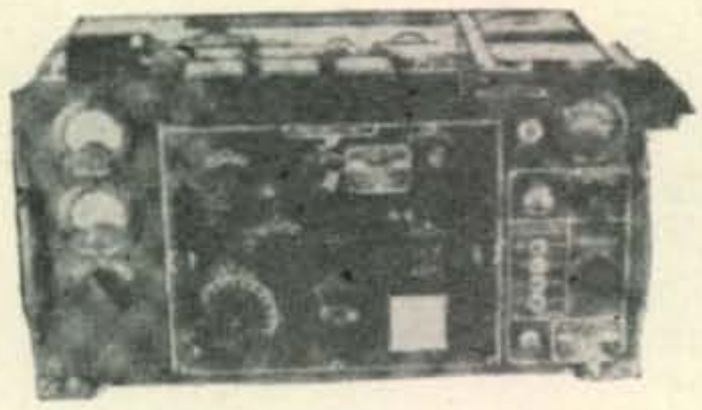
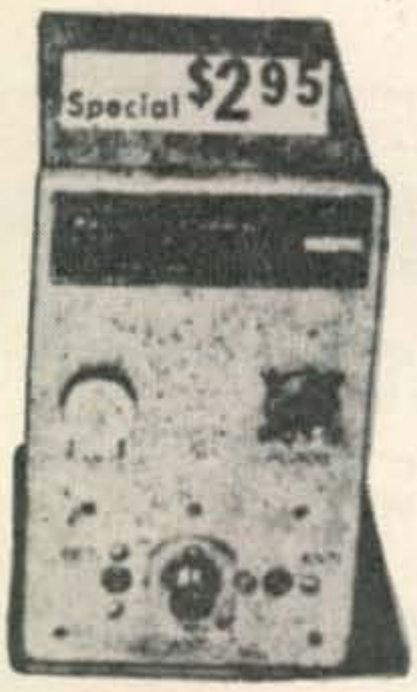


USED



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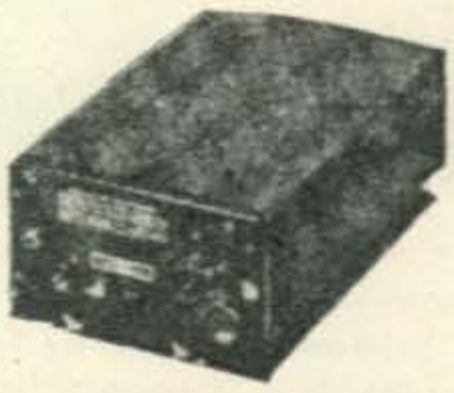

Very late model ADF receiver. Includes broadcast band. Frequency 100 to 1750 kc. in 4 bands. 5-gang tuning capacitor. With 15 tubes: 4—6K7, 1—6L7, 1—6J5, 2—6B8, 2—6F6, 1—6N7, 1—6SC7, 2—2051, 1—5Z4. **Schematic Furnished.** Like new. SPECIAL..... **$19.95** 2 for..... **$35.00**

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ing heard signals from his way. Stick with it Ralph; it's not so rough that you have to write Herb Becker, W6QD, about it—or should you?

While most of us realize we need a shot in the arm for 6 meters during the lull in Es and F-2 DX, we have a suggestion from W8NBM, of Cambridge, Ohio. With the present conditions on the other bands—QRM, high-power, more kilocycles demanded, and umpteen others—these guys should wake up and try 6 meters, for it has all the advantages of being an all-around band. Now how are we going to make everyone on the lower frequencies realize the advantages of trying 50-54 mc? Well W8NBM says, and we quote: "Look at the present increase in broadcast listeners simply by the so-called something for nothing line. Who wouldn't like a 1949 whozit sedan, a 79 tube (with FM and TV), a package of allfix, which will fix the bugs in the rig. So—

50 MC HONOR ROLL

CALL	S.	C.	CALL	S.	C.	CALL	S.	C.	CALL	S.	C.	CALL	S.	C.
W9ZHB	**48**	**6**	W7HEA	42	3	W2RLV	37	6	W1HDQ	33	6	W5LBG	26	3
WØZJB	**48**	**4**	WØKPQ	42	2	W5FSC	37	6	W6PUZ	33	4	WØDNW	26	2
						W5JTI	37	5	W4WMI/4	33	3	WØYKX	26	2
WØNFM	47	5	W8QYD	41	4	W4EQR	37	4	W4DRZ	33	3	W7BOC	26	2
W9QUV	47	4	W3CIR/1	41	3	W5VV	37	4	W7KAD	33	3	WØUEL	26	2
W6UXN	47	3	W5ML	41	3	W6IWS	37	3	W3MKL	33	2	W6NAW	26	2
WØUSI	47	3				W6OVK	37	3						
W6WNN	47	3	W8ZVY	40	7	W9NJT	37	3	W1CLH	32	3	W7QLZ	25	3
			W5AJG	40	7	W7DYD	37	2	W5WX	32	3			
W4GJO	46	4	W9ALU	40	5	W9UNS	37	2				VE1QZ	24	6
W9DWU	46	3	W4QN	40	4				W6FPV	31	3	W5LIU	24	3
WØDZM	46	3	W1LLL	40	4	W7FDJ	36	3						
			W4FBH	40	3				W4HVV	30	2	G5BY	23	14
W9ZHL	45	6	WØSV	40	2	W3OR	35	6	WØDER	30	2	XE1KE	23	6
W1CLS	45	5	W4GIY	40	2	W1GJZ	35	5				W9AB	23	4
W7BQX	45	4				W6BPT	35	4	W4FNR	29	3			
W9PK	45	3	W5JLY	39	10	W1JLK	35	4	W8MVG	29	3	W8YLS	22	3
W8NSS	45	3	W1CGY	39	6	W9VZP	35	4	W5ELL	29	2	W7CTY	22	2
			W6ANN	39	3	W9UIA	35	3				W8LBH	21	2
W7ERA	44	4	WØDKS	39	3	W5HF	35	3	VE1QY	28	4			
W7FFE	44	4	WØYSJ	39	2	W5HTZ	35	3	W9FKI	28	4	W5HVP	20	3
WØQIN	44	4	W4GMP	39	2	W5HLD	35	3	W4FQL	28	3			
									W1ATP	28	3	VE7NM	17	2
W5VY	43	11	W2AMJ	38	6	W2BYM	34	4	W5ESZ	28	2			
W4EQM	43	3	W5FRD	38	6	W3RUE	34	3	W9MBL	28	2	VE7CN	15	2
			W2IDZ	38	5	WØJHS	34	3				W8EP	14	2
WØBJV	42	3	W3OJU	38	5	W6AMD	34	3	W1AF	27	5			
WØINI	42	3	W4EID	38	4	W7JPA	34	2	W7ACD	27	2	KH6PP	5	7

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why not a few bottles of the same medicine for the 6-meter band in 1949?"

In line with the above suggestion by W8NBM, there is nothing more we at *CQ* would like to sponsor than a v-h-f contest. But in order to do it up brown how about comments from you the readers of the column as to what kind of a contest you want. Shall we use a power multiplier? What kind of a distance multiplier, how many prizes for each band? In other words, let's have your comments and we shall try to please all, perhaps for the first time in history.

VE7NM, in Vancouver, B. C., runs nightly code practice on 50 mc, and so far he has two listeners. This is one way of keeping the 6-meter band alive. VE7CN was a recent visitor in Vancouver, and is keeping schedules from his location about 200 miles north. VE7NM says that the band is sounding peculiar again, with carriers drifting up and down the band and intermittent carriers breaking in and out. Our Budweiser down here doesn't do that!

In Oil City, La., W5ML, says that only he and W5AJG are left on the band, so they are trying skeds on 144 mc. Art, W5ML, finds the spectrum between 30-50 mc very interesting; all kinds of signals come through.

Propagation Log

Under this heading will be found the activity reports on the very-highs; in other words the dates when DX has been worked.

Sept. 17: OA4BG worked LU and CX between 2010-2217 EST.

Sept. 18: LU and CX worked by OA4BG, from 2010-2211 EST.

Sept. 25: Aurora opening, W3OJU worked W1-2-8-VE3 from 2046-2100 EST.

Sept. 26: W5FSC worked WØUOG, on Es, at 2015 CST. W8MVG and W8APG heard LUs between 0830-0912 EST.

Oct. 14: W8NQD worked on aurora, from 2235-47, W2AMJ and W9VZP. WØINI in Missouri heard several aurora carriers around 2225 CST. W3OJU heard and worked 10 stations in W2-VE3 on aurora between 2225 and 2333 EST. W9AB worked stations in W2-3-8-9 with good aurora signals, from 2145-2335 CST. W3OJU rolled up a pile of 33 stations heard and worked in W1-2-3-4-8-9-Ø. The W4 was W4FWH in Birmingham, Ala., perhaps the furthest south aurora(?) reflections have been reported.

Oct. 18, W3OJU, now used to fuzzy carriers and rough notes, got on to work via aurora, between 1835-2036 EST, 10 stations in W1-2-3-8-9.

144-Mc Honor Roll

	States	Dist		States	Dist
W8UKS	15	6	W9IPO	8	5
W8WJC	14	6	W3GV	8	5
W8WXV	13	5	W4FBJ	7	5
WØNFM	12	6	W8PYY	7	4
W1JFF	12	4	W9PK	7	4
W1IZY	12	4	WØBZE	6	3
W1PIV	12	4	WØGOK	6	3
W3KUX	12	5	W8DRZ	5	4
W3RUE	11	5	WØWGZ	5	4
W9BBU	11	5	WØRNC	4	2
W3GKP	10	5	WØKPQ	3	2
WØIFB	9	6	WØDDX	3	2
W9AB	9	5	WØMZH	3	2
W9ZHB	9	4	WØZJB	1	2
W9LWE	8	5			

144-mc Notes

Although W9ZHB had the third tower settle from weight, he now has a 16-element beam riding 75′ up in the blue.

The Yakima, Wash., gang sponsored a "Gone-

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"WORLD'S LARGEST DISTRIBUTORS OF SHORT WAVE RECEIVERS"

Goofy" 2-meter expedition by scaling Darlan Mt. some 7000′ up. 90 watts to a vertical 6-element beam was used for the best contact with W7SO near Portland, some 200 miles.

W8WRN mentions that good nights were Sept. 11-14-15-17-18-19-22-24-27-28-30, Oct. 5 and 6. No records were broken but nice contacts were made to the east and west. Activity is picking up in the a.m. on Sundays, even though Ken has to call the gang out of bed. W8WRN tells us about W8BKI, in Charleston, W. Va., who is on 144.2 mc, with 100 watts and a square corner reflector. The QTH is on a mountain, where the bc station resides. Oct. 7 was the first time they could hear W8WRN, although Ken had been hearing them before.

W9UDD of Ft. Wayne, Ind., decided to try this here expedition stuff, too, so he, W9IDZ, W9EOG, and Roger Williams loaded the gear into a trailer and tore off to Hells Point, the highest spot in N. W. Indiana. The rig was 100 watts into a 16-element beam. A total of 23 stations in 4 states were contacted with the best distance to Miamisburg, O., and Waukeegan, Ill.

Our thanks to Perry Ferrell for taking the task of compiling this column the past two months. It seems we now have a roving sacroilliac. Ours might well be termed a raving one, but on the mend. We're still thinking about a many-element beam on 144 mc. Thanks for your co-operation, and how about comments on the v-h-f contest for 1949?

DX PREDICTIONS

(*from page 25*)

until 1015 EST. *10 meters:* Comparatively weak opening 1745 until 1915 EST. Phone signals probably unreadable due to very high seasonal absorption tendency. C-W best 1830 to 1915 EST.

Middle West to Mediterranean Areas

40 meters: Auroral absorption limits signals over direct path. A few signals may be heard after 2000 until 0300 hours CST. Atmospheric noise may also be troublesome at far end of path, especially before 2300 hours CST. *20 meters:* Weak opening improving to fair from 0700 until 1330 CST. Best signal strengths about 1200 until band closing. Strictly a c-w opening, however. *10 meters:* Good phone signals when ionospheric conditions are quiet from 0745 to 1030 CST. Best signal strengths 0930 to 1030 CST.

Middle West to Western Australia

40 meters: High atmospheric noise level at far end during period of LUHF opening. Signals possibly heard *from* Australia 0430 until 0715 hours CST. However, only the most powerful mid-west stations should expect to get through this noise level which may exceed 10-db above kilowatt incident field. *20 meters:* Erratic day-to-day variations during an opening extending 0330 to 0545 CST. Strictly c.w. Second opening 0830 to 1015 hours CST. Possible readable phone signals during this opening. *10 meters:* Weak opening from 1545 to 1915 hours CST over direct route. No predicted peak time, though conditions may improve slightly between 1800 and 1915 CST. Very high absorption ratio at southern end of path.

Middle West to Western India

40 meters: Predicted opening 1730 to 2015 hours CST. Path subject to almost hour-to-hour variation. Atmospheric noise may be troublesome at far end of path with level decreasing during latter part of opening. Peak time 1900 to 2015 hours CST. *20 meters:* Possible opening extending from 0645 to 1015 hours CST when ionospheric conditions are quiet. Atmospheric noise level high at far end of path. Peak time 0830 to 0945 hours CST. Almost strictly a c-w opening. *10 meters:* No openings predicted for this month. MUF should not exceed 23 mc at any time.

(*QSY to page 58*)

Ionosphere Storms

At this writing ionosphere conditions are very unsettled. It would appear that several new storm cycles have been started in the latter part of October. Present indications are that the periods most likely to be disturbed will be December 7 and 8, December 10 to 13, December 15 and 16, and December 20 to 23. Irregular short periods of intense short-skip may be expected on 10 and 20 meters from December 20 to December 27.

DX

(*from page 43*)

tell him I am gg give him a chance. The answe. was: 'Well . . . sorry Ed . . . if only I could. But, you know . . . I'm gg bed right now and don't think people here will like see me on radio again! So . . . maybe I have chance next nite!' ('People' mean XYL! hi). You see that? He was talking with a very faded voice and I feel all the tragedy of that beginning ham who was losing a very rare DX due to 'people.' That shows what can happen to poor old Kirk! It's possible he too will have to turn switch definitely. How happy guy we are, Herb!" This is an unexpurgated excerpt, whew! Ed thinks that VP4TAN and W6DTN were on ships, because they were both heard in Rio de Janeiro like locals, or better he says, at a time when they could not be so strong. Then, a few days later, they QSB like a ship going farther and farther away. He says that I8PAP and HB1HL are both ships, and that PY1AHL got a QSL from a certain CR5, confessing that he was on a lovely trip on sea waves! He also promises not to dream up any more new countries, and in the future will just stick to the official Country List. Thank you, Ed. How about K2UN? No, better not start that again.

Hal Leighton, W9LM, is curious about *W8OZG/C6*, who claims to be in Zone 23, doesn't know the province, but says he is in Inner Mongolia. Hal has the Z23 jitters. Can anyone unjitter him? We can't, so far. Hot off the press comes the word that Israel has a new prefix, 4X4, and that ZC6XY now signs *4X4AA*. No, Israel is not a new country, insofar as we are concerned.

Court (W6EAK) Matthews, for the 138th time has quit, dismantled, and completely forsaken ham radio, only to return again, and this time with a 3-element beam. You know, Court has always been a staunch advocate of the no-direction, no-gain vertical antenna. In fact, his is probably one of the original proponents of this Frankenstein monster, and hence it is a great concession for him to degrade himself with a lowly rotary beam. And don't think that it came about easily, either. Court has tried every known method of getting the results without using a modern antenna. He has had them stacked, phased, de-phased, unstacked, and even a few original arrangements provided frequently by the local winds, but it finally had to come to pass. Our congratulations to Courtney for this great, forward step. We await, breathlessly, for an announcement from him as to whether or not the 3-element rotary beam is here to stay.

Well, gang, the DX contest is over, and everyone can relax now, or put in one last spurt of effort for the Marathon. This is your last month, you know. Now for the scores in the contest . . . whoa, wait a minute. We're getting ahead of ourselves. Although the date on this magazine is December, the darned thing hasn't yet taken place. Even in this so-called modern age, it still takes about 6 weeks to get the mag into your hands. Apparently everyone

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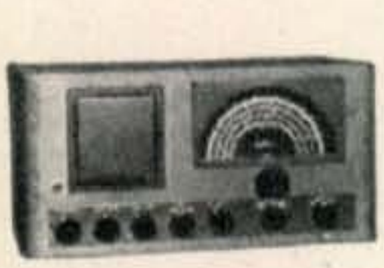

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is not aware of this, because we still receive complaints that someone's country total is not up to date in the October issue, when they sent the info in September 12th. Sorry we appear to be so slow, can't help it.

ZD3A informs us that Ron, *ZD3B*, left for England some months ago, and will no doubt be opening up in some other country in due course. ZD3A appears to be a very busy Gambian. He is an electrical engineer in charge of all electric light and power services, power station engines and equipment, wireless and telegraph communications, etc., and with only two assistants. You are most apt to hear him on 14-mc phone when he finds time for hamming. *ZD3B* was recently heard on 28-mc c.w. Wonder who it could have been.

The most familiar question we hear these days is; "What has happened to the QSLs from U.S.S.R.?" All we know is that they are coming through again, and largely through the American QSL Bureau in Newark, N. J. What happened to the cards during the past year is quite a mystery. The ones that are now being received are for rather recent QSOs, so it looks like there was a period when the USSR hams were sending cards to their bureau, but we were not receiving them here. From all indications, it seems that the average USSR ham was not at fault. Of course, by implication, this points the finger at their bureau, but when quizzed about this, they always say, "Our bureau is very FB." You figure it out.

A number of you have written in asking if we keep a record, on your new country lists, of the confirmations you have received. We don't, but we still are interested in knowing which stations QSL, and which do not, so any information you care to send along concerning QSLs received, especially from the rare countries, is appreciated. A never-ending stream of requests come in for this kind of information, which we are glad to pass along when we can. However, don't be disappointed when you don't receive an answer by return mail. This is only a hobby and a side-line with us too.

W9LM tells us to spread the word that *HZ3AA* is actually in Saudi Arabia, in spite of the large signal he wends this way. The big sig comes from a commercial rig on a rhombic. Seems as though we've heard this someplace before, but Hal swears that he has an air-mail letter from Arabia to confirm it. The HZ says that his mail is censored and he does not want any QSL cards sent at this time, but that he will QSL when he gets some cards. W9FKC sends in a whopping list of additions, and says that evidently his new 3-element beam has had something to do with it. It's really amazing what a good beam will do for the country total. Of course, the 3-element beam poohs out after a few months, but don't let this discourage you. Just take it down regularly, simonize it, and replace. The psychological improvement will lift you out of the rut, and you will be on top again, for a week or so.

If you have not yet been able to break into the charmed circle that revolves around *ZK2AA*, don't become discouraged, and don't think unprintable thoughts either, because Bill is a very friendly, salt-of-the-earth ham. Needless to say, he is the only ham on Niue, and is perhaps busier than all of us put together. His many occupations include those of Radio Superintendent & Postmaster, and his time on 14 mc is highly restricted. The transmitter used is a 6V6 xtal oscillator driving an 807 with about 25 to 30 watts input from a 12/500 volt genemotor. The receiver is a 5-tube job which he says seems to be very kindly disposed towards us, as

LEO I. MEYERSON
WØGFQ

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that is all he has been able to hear on it. He hopes to receive an HRO anyday now, which should help a lot. W1FH is responsible for the HRO, so perhaps this will explain the weekly skeds you have been hearing. Bill says that Niue is really isolated, and the period between shipping calls is often as long as 12 weeks. This sometimes means doing without fresh butter, meat, and even tobacco! There is no air service; all mail coming via New Zealand. There are no picture shows, no dances, and no beaches worthy of the name, and almost no nothing; consequently, Bill's limited operating time is really enjoyed. He will be there another 20 months, so be patient, gang, and give him a break. He would like to work a little DX too.

W3KDP tells us that *VP2GJ* in Grenada, Windward Is., is on phone around 28,100 almost every morning, and is working as many stations as possible. He is also on 14-mc c.w., but seems to be a bit more elusive there, and does not appear to answer stations calling anywhere near his frequency. This is certainly a step in the right direction that others could well follow.

A newcomer to the Honor Roll is *VE3BNQ*. Al works only 10 phone and now has 33 zones and 79 countries collected in the past year with only 65 watts. He says his only claim to fame will probably be that he is the only listing on the page that has never at any time worked a ZL. He can't hear them; too much mountain in the back yard in that direction.

Fred Gallien, W6PZ, fell downstairs recently, and broke three ribs, thus allowing him to stay home and catch up on his DX. Says he, "Believe me, it wasn't worth it." Condx must have been poor. W2NSZ enters the Honor Roll with 39 zones and 185 countries, and sums up the modern DX chase as, "a fascinating game, although of hardly any constructive value." Having practically retired from the race, he can't hurt my feelings. Ed Nettleship, W6SHW, an ole phone man with an abbreviated beam (10 meters) thinks that Herb has not done right by 10-meter DX, so he sends in his log for one day, which shows 12 European contacts, *VS1AY*, *VS6AM*, a J2, a C6, plus *ZC6XY* and *TA3FAS*, making 15 countries in all. Is this a daily occurrence, Ed., or do you save your strength for one shot?

W6YEF took the time to write to our old prewar friend F. Paul Bour, *FB8AB*, regarding his needs in the way of radio parts. From the answer he received, Paul needs enough spare parts to build a complete transmitter, phone and c.w. It appears that he is a little out of touch with present-day ham equipment, not receiving any ham magazines, and doesn't know just what to build. He mentions that *FB8AH* is constructing three sets, but is unable to get some parts, such as condensers. He is prepared to send stamps for the value of the material ordered as no money can be transferred or drafted from Madagascar.

If you will look in the American phone band, you may be surprised to find either *YJ1AA* at 14,208, *ZS9D* at 14,250, or *EA8CO* at 14,252. This should be pleasant news for some of you, and perhaps will lessen the pile up on the heretofore lone Canary Islander, *EA8AN*. You have to be a mike-gripper, of course. One word of caution, however. If you need the EA8, better take off a few months first and brush up on your Spanish. He doesn't speak a word of English. Or, if you really want fun, try working him with my sub-meager knowledge of espanol. Ask W8HGW. *HS1MR* has returned and is again W6SXY. All requests for QSLs will be answered promptly. *C1CH* enters the

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2X2/879	.69	12SF7	.49	801-A	1.10	QK 61	65.00
3A4	.65	12SR7	.72	804	9.95	QK 62	65.00
3BP1	2.25	15R	1.40	811	1.95	*RCA 932	.65
3C24	.60	28D7	.75	814	4.95	VR 91	1.00
3C30	.70	30 (Spec.)	.70	815	2.50	VR 130	1.25
3D6	.79	45 (Spec.)	.59	836	1.15	VR 135	1.25
3CP1/S1	3.50	39/44	.49	837	1.95	VR 137	1.25
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SCREEN CURRENT	10.5 ma	6.5/11.5 ma
GRID VOLTAGE	-55	-16.5
GRID CURRENT	5 ma	.....
GRID DRIVE	.36 W	.4 W
POWER OUTPUT	19.5 W	36 W

While they last..... $.21 ea or 5 for $1.00

DYNAMOTORS

Type	Input Volts	Input Amps	Output Volts	Output Amps	Radio Set	Price
BD 77KM	14	40	1000	.350	BC 191	$20.00N $14.00LN
PE 73	28	19	1000	.350	BC 375	$24.50N
DM 21	14	3.3	235	.090	BC 312	$3.45N
DM 21CX	28	1.6	235	.090	BC 312	$3.45N
DM 25	12	2.3	250	.050	BC 367	$2.49LN
DM 28R	28	1.25	275	.070	BC 348	$8.95N
DM 33	28	7	540	.250	BC 456	5.50
DM 42	14	46	515 1030 2/8	.110 .050	SCR 506	$6.50LN
PE 55	12	25	500	.400	SCR 245	$5.25LN
PE 86	28	1.25	250	.060	RC 36	$3.95N
PE 101 C	13/26	12.6/6.3	400 800 9 AC	.135 .020 1.12	SCR 515	$5.25N
BD AR 93	28	3.25	375	.150		$4.95N
23350	27	1.75	285	.075	APN-1	$3.50N
35X045B	28	1.2	250	.060		$3.50N
ZA .0515	12/24	4/2	500	.050		$3.95N
B-19 pack	12	9.4	275 500	.110 .050	Mark II	$9.95N

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COMMUNICATIONS EQUIPMENT CO.

PHONE DI-9-4124 CABLE "COMSUPO"

Honor Roll, and informs us that *C6HH* is no longer in Hanchung. He is now located in Nanking, the capital of China, and has the new call of *C1AG*.

By the way, we strongly suspect that Herb's present trip is not entirely for business purposes. You see, after his long vigil at the receiver, endlessly twisting the dial, and patiently waiting for that signal that will mean a new zone or country, Herb has become tired. He really needs relaxation, and a long rest away from it all.Only the other day I heard him mumble something about writing a book entitled, "Two Years at the Telephone, or How I Worked W.A.Z." So now we leave you with that increasingly popular saying, "We'll see you, on Channel 2."

QTHs

ARIN, (Beyrouth), via REF
CR6AU, Joao Roxo, Box 180, Luanda
EA3DY, Box 1312, Barcelona
EA3MA, Box 1312, Barcelona
EA3YR, R. Ferrando, 323 Diagonal, Barcelona
EA8CO, Crescencio Olias, Apartado 346, Las Palmas, Gran Canaria, Canary Is., Af.
EP1J, c/o W4IYT, 4860 S. W. 5th St., Miani, Fla.
IS1FIC, Sam Giovanti 208, Cagliari, Sardinia
HP1BR, Box 1098, Panama
HK3CK, A. Linero, Box 584, Bogota
MD4BPC, Box 50, Hargeisa, British Somaliland
OE7FR, via RSGB
PJ5KO, via ARRL
ST2GH, I.A.L., Juba
ST2JB, c/o International Aeradio, Ltd., Malakal
ST2PW, Box 25, Malakal
SVØWA, U. S. Army Group, c/o American Embassy, Athens
TA6OBM, via W6OBM
VP8AO, Dennis Farmer, Port Stanley, Falkland Is. (Stn. at So. Shetland Is.)
VP8AP, Ralph Lenton, Port Stanley, Falkland Is. (Stn. at So. Orkney Is.)
VP8AM, Terry Randall, Port Stanley, Falkland Is. (Stn. at Antarctica)
VQ4CUR, P. O. Box 110, Mackinnon Road, Kenya Colony
VQ4FCA, Aeradio Station, Mombasa, Kenya Colony
VQ4IMS, Ivan Morris, c/o East Africa Airways Corp., Box 1010, Nairobi, Kenya Colony
YN1FTB, Francis T. Brown, U. S. Embassy, Managua
ZB2E, via RSGB
ZC1AZ, R.A.F. Command, Amman, Transjorda
ZC6UNJ, via K2UN
ZD3A, Box 16, Bathurst
ZS3B, Box 404, Windhoek, Southwest Africa

SCRATCHI

(from page 10)

driven by powerful master oscillator, except for sooper high frequency stuff, where there are klystrons and magnetrons in profusion. On main control plane are switch which are governing type of emission, such as see-w, eye see-w, pulse modulation, AM, FM, single-sideband, etc. Also on control panel are big cathode ray toob screen which are part of panaramascope showing what are going on over the spectrum.

I are just about to put out a seek-you when the shack door opens and in comes Lil. Evidentally she are, in this dream, my XYL, as she are sporting a wedding ring. She looks my rig over for a minute, and then asks me why I are insisting on playing with all this antiquated gear, because when she are trying to hold her weekly skedule with the moon last Tuesday the cosmic QRN were just more than she could cope with. I are evidentally waking up after this last remark. Hon. Ed., are this married stuff all it are advertised?

That afternoon Lil are calling up on the telephone and she are apologizing for making fun of Scratchi's rig. So, I guess I are misjudging Lil, but to play safe I are going to have to spend my free evenings building up a single-sideband rig.

Respectively yours,
Hashafisti Scratchi

STORAGE and DRY BATTERIES

EVEREADY Hevi-Duty Minimax BA43p/oSCR284 90/45 & 1½V for Recvr & Xmtr use w/octal socket & handle 2⅝ x 4¾ x 6¼", 7.3 lbs metal case triple sld pkg Late '47 date Ea **$1.39** 2 for **$2.49**; 10 for **$10.00**
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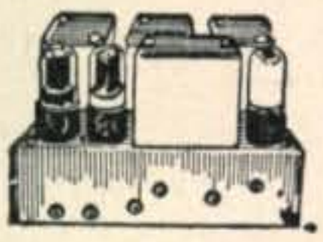

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SCR-522 144-Mc. Transmitter/Receiver
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THE YL'S FREQUENCY

(*from page 46*)

for two stations, including antennas. Must be DX they're after!

Speaking of DX, Helen, W2NFR, recently received her DXCC award. Ironically enough, Helen, who recently has had to observe quiet hours because of TVI, is now studying and working at television show script writing. Guess she figures if she can't be on the air in one way, she will another—hi!

Dot, W1FTJ, has come up with another DX award—the WPR-50, (Worked Puerto Rico, 50 stations), and as with the WPR-25 award, Dot is the first YL outside of KP4 land to receive it.

And still on the subject of DX, we hear from Jira, OK1MI, that 10 meters will soon be opened by KSR (which is the same as our FCC), to OK operators holding Class B licenses, and she is hoping to meet many of the YLs on 10 phone. Jira adds: "There is another newly licensed OK YL—Mrs. Skohoutilova, OK1YL. She is the chief secretary in the headquarters of CAV (amateur radio society), and is a young and gay girl, married about four months ago. Now we are six licensed YLs here in Czechoslovakia." Hmmm!

YL of the Month

So many are the YLs who take up ham radio in self defense. So also goes the story of our present YL of the Month, Josephine Opacity, W2QQH, of Eatontown, N. J. But unlike many, instead of getting into the hobby to "protect" herself at home, it was at work that Jo felt she was "left out."

YL of the month, Josephine Opacity, W2QQH.

"I was introduced to amateur radio at the outbreak of the war," Jo writes, "where by chance and circumstance I was thrown amidst numerous radio engineers and hams at the Signal Corps Engineering Laboratory at Ft. Monmouth, N. J. And, like a weed, I began to sprout in a hotbed of receivers, transmitters, tubes, etc. Perpetual reverberations about DX, BCI, QRM, CQ, QSO, etc., began to haunt me. Completely bewildered and confused by such lingo, like a 'displaced' soul in a strange environment I knew my only salvation was to become a part of this 'little world.' I had already learned Morse and familiarized myself with the key, as I handled Army communications, both phone and c.w., during field service tests, so it wasn't too difficult for me to get my ticket. The eventful day was on the 19th of April, 1946.

"My own station consists of a home-built 40-80 meter c-w rig (mostly 80 meters) using a 6C5 crystal oscillator and a 6L6 beam-power amplifier with 25 watts output to an end-fed Hertz. The receiver is an HRO. My frequencies are restricted to those of my 'donated' crystals, mainly 3700, 3650, and 3509 kc."

But Jo's activities are not limited to her home station. She is an active member of the Monmouth County Amateur Radio Assn. and the Ft. Mon-

Build YOUR OWN TEST EQUIPMENT

Heathkit ELECTRONIC SWITCH KIT
DOUBLES THE UTILITY OF ANY SCOPE

$34.50

Gives two separately controllable traces with individual inputs on any scope.

See both the input and output traces, locate distortion, phase shift, etc., immediately.

Individual gain controls and positioning control. Coarse and fine sweeping rate controls. Complete Heathkit matches others, with 5 tubes, All metal parts are punched, formed and cadmium plated. Complete with tubes, all parts, detailed blueprints and instructions. Shipping Wt. 13 lbs.

Nothing ELSE TO BUY

HEATHKIT CONDENSER CHECKER KIT

$19.50

Nothing ELSE TO BUY

A condenser checker anyone can afford to own. Measures capacity and leakage from .00001 to 1000 MFD on calibrated scales with test voltage up to 500 volts. No need for tables or multipliers. Reads resistance 500 ohms to 2 megohms. 110V 60 cycle transformer operated complete with rectifier and magic eye indicator tubes.

Easy quick assembly with clear detailed blueprints and instructions. Small convenient size 9" x 6" x 4¾". Wt. 4 lbs.

HEATHKIT SIGNAL GENERATOR KIT

$19.50

NOTHING ELSE TO BUY

Every shop needs a good signal generator. The Heathkit fulfills every servicing need, fundamentals from 150 Kc. to 30 megacycles with strong harmonics over 100 megacycles covering the new television and FM bands. 110V 60 cycle transformer operated power supply.

400 cycle audio available for 30% modulation or audio testing. Uses 6SN7 as RF oscillator and audio amplifier. Complete kit has every part necessary and detailed blueprints and instructions enable the builder to assemble it in a few hours. Large easy to read calibration. Convenient size 9" x 6" x 4¾". Wt. 4½ lbs.

HEATHKIT SIGNAL TRACER KIT

$19.50

Nothing ELSE TO BUY

Reduces service time and greatly increases profits of any service shop. Uses crystal diode to follow signal from antenna to speaker. Locates faults immediately. Internal amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprints and instructions.

Small portable 9" x 6" x 4¾". Wt. 6 pounds. Ideal for taking on service calls. Complete your service shop with this instrument.

HEATHKIT SINE AND SQUARE WAVE AUDIO GENERATOR KIT

$34.50

Nothing ELSE TO BUY

The ideal instrument for checking audio amplifiers, television response, distortion, etc. Supplies excellent sine wave 20 cycles to 20,000 cycles and in addition supplies square wave over same range. Extremely low distortion, less than 1%, large calibrated dial, beautiful 2 color panel, 1% precision calibrating resistors, 110 V 60 cycle power transformer, 5 tubes, detailed blueprints and instructions. R.C. type circuit with excellent stability. Shipping weight 15 pounds.

THE NEW HEATHKIT VACUUM TUBE VOLTMETER KIT

$24.50

Nothing ELSE TO BUY

The most essential tool a radio man can have, now within the reach of his pocketbook. The Heathkit VTVM is equal in quality to instruments selling for $75.00 or more. Features 500 microamp meter, transformer power supply, 1% glass enclosed divider resistors, ceramic selector switches, 11 megohms input resistance, linear AC and DC scale, electronic AC reading RMS. Circuit uses 6SN7 in balanced bridge circuit, a 6H6 as AC rectifier and 6 x 5 as transformer power supply rectifier. Included is means of calibrating without standards. Average assembly time less than four pleasant hours and you have the most useful test instrument you will ever own. Ranges 0-3, 30, 100, 300, 1000 volts AC and DC. Ohmmeter has ranges of scale times 1, 100, 1000, 10M and 1 megohm, giving range .1 ohm to 1000 megohms. Complete with detailed instructions. Add postage for 8 lbs.

HEATHKIT FM AND TELEVISION SWEEP GENERATOR KIT

$24.50

NOTHING ELSE TO BUY

THE BASIC FM AND TELEVISION SERVICE INSTRUMENT

At the lowest cost possible, anyone can now service FM and television receivers. The Heathkit sweep generator kit operates with oscilloscope and covers all necessary frequencies. A few pleasant hours assembling this kit puts any organization in position to share the profits of the FM and TV boom.

Every part supplied — grey crackle cabinet, two color calibrated panel, all metal parts punched, formed and plated. 5 tubes, complete detailed instructions for assembly and use. Shipping weight 6 lbs.

The NEW 1948 HEATHKIT 5 INCH OSCILLOSCOPE KIT

$39.50

NOTHING ELSE TO BUY

New improved model of the famous Heathkit Oscilloscope. Building an oscilloscope is the finest training for television and newer servicing technique and you save two-thirds the cost. All the features and quality of instruments selling for $100.00 or more. Supplied complete with cabinet, two color panel, 5BP1 tube, 2 5Y3 tubes, 2 6SJ7 tubes and 884 sweep generator tube. Power transformer supplies 1000V negative and 350 volt positive. Sweep generator 15 cycles to 30 M. cycles. Has vertical and horizontal amplifiers. Oil filled filter condensers for long life. Complete blueprints and instructions included.

The HEATH COMPANY
DEPT. Q . . . BENTON HARBOR, MICHIGAN

mouth Radio Club. As a member of the FMRC she operates on 10, 20, 40 and 80 meters, phone or c.w., at the club station, W2OEC. Jo tells us her first experience with phone was on MCARA's last Field Day where she operated for some 15 hours, and adds: "I enjoy phone immensely and plan to be on 10 or 75 soon."

However, hamming is strictly a hobby with Jo, and is only one of her interests. Her other hobbies are designing and sewing her own clothes, and dancing a good rhumba or Lindy hop.

Since July, 1942, Jo has been working at Coles Signal Laboratory as a radio engineer. "My assignment is in the d-f antenna section," she explains, "and the work deals mostly with the design and measurement of antennas and antenna systems in the low-frequency spectrum. As all antenna installations and field strength measurements are made in the field, a great deal of the work is out of doors, which I enjoy immensely. I should, by virtue of my job, exhibit a super-duper deluxe ham antenna array, but space and structure limitations in the housing project where I live prevent me from so doing—so I have to fall back upon the old faithful Hertz." [How about a balloon-supported antenna, Jo?—hi!]

Jo concludes: "The highlight of my career was in August, 1946, when General Ingles presented me with the Meritorious Civilian Award for outstanding work—an occasion which I shall always remember." To the best of our knowledge, Jo was the only YL in the agency to be so honored, and probably one of the few in the country—indeed a tribute.

OTHER FELLOW'S STATION

(*from page 34*)

junior operator, she received notice the government was issuing 6BOY for her home station. Sure enough—it *was* a boy. The boy is W6VDR, Lewis (LU) Kirk, very active in the Mission Trail Net.

Moving to Reno, Nevada, Jim Kirk built the first broadcasting station in that state, KFFR. Then back to California again and W6DEG, a call he has now held about 20 years. A few months ago W6VDR named his son James, and both Daddy and Grandfather are already planning on another op in the family. W6DEG's interests in ham radio are chiefly building, experimenting and "chewing the rag."

GROUND PLANE ANTENNA

(*from page 30*)

be too soft to stand up to the spring winds. But it is satisfactory for the vertical part on 10 meters alone. The same size tubing made of the stiffer alloys of aluminum is fine for the main part of the vertical section on both frequencies.

The main requirement of the insulators at the top of the pole is strength as they are subject to leverage from the tubing they support when there is a stiff wind blowing, as well as the strain put upon them when raising the pole. One type of insulator found satisfactory is that of porcelain furnished with a prewar type of house-mounted whip antenna made by Philco. No doubt several other types of insulators may be found that are as good or better.

(*QSY to page 70*)

MEGACYCLE METER

MODEL 59

A multi-purpose grid-dip oscillator that will prove most useful to the amateur or engineer in either receiver or transmitter work. An important instrument for the radio serviceman.

FREQUENCY
2.2 Mc. to 400 Mc.

MODULATION
CW or 120 cycles, or external

POWER SUPPLY
110-120 volts
50-60 cycles

MEASUREMENTS CORPORATION
BOONTON NEW JERSEY

A REMARKABLE NEW LINE!

High QUALITY - High POWER Custom-Built AM-FM Chassis

You need no longer hesitate to replace your outmoded radio receiver with a modern, lowpriced, powerful ESPEY replacement chassis. The Model 511 (illustrated) is typical of the complete ESPEY line, and features 12 tubes, plus Rectifier and Tuning indicator. This high quality AM-FM receiver, drift compensated, is supplied complete with 25 watt speaker, both antennas, and all necessary hardware. It's your best bet! Consult your nearest radio service-dealer for full details, or write to Dept. E-12 today.

ESPEY MFG. CO. INC.
528 East 72nd St., New York 21, N. Y.
"ESTABLISHED — 1928"

AC POWER SUPPLY AND SPEAKER

Completely wired power supply and speaker, with volume control C.W. and on & off switch, housed in metal cabinet. For Command Receivers, with connections to plug into receiver or rack, and 110 Volt 60 Cycle line.
Price—Completely Wired.....**$14.95**
Price: Kit of Parts only.....**$9.95**

MODULATION TRANSFORMER

(At Left) 20 Watt Output. Pri. 6000 Z; Sec. 6000 Z Test Volt 3000. Used with TCS equip.—1625 Tube ideal for Comm. Trans. Size: 2½" x 2¾" x 3½". NEW:.....**$3.95**

AUDIO OUTPUT TRANSFORMER—Pri. 7500 Z; Sec. 500 Z. Used with TCS equip. 12A6 Tube. Sizex 2⅜" x 2⅜" x 3". NEW:.....**$1.25**

MICROPHONE TRANSFORMER—Pri. 75 OHM; Sec. 125,000 OHM. Used with TCS equip. 1625 Tube. Size: 1½" x 1¾" x 2¼". NEW:.....**$1.25**

OUTPUT TRANSFORMER—Pri. 500 OHM; Sec. 6 OHM. Used with TCS equip. to match Output Item to speaker. Size: 2⅜" Mtg. Holes. NEW:.....**$1.00**

FILTER CHOKE—8 Hy. 100 Mill. Res. 200 OHM DC. Used with TCS equip. Size: 2¾" x 2¾" x 3½". NEW:.....**$1.25**

BC-454 COMMAND RECEIVER

3 to 6 Megacycles. Price with Schematics—NEW:.....**$6.95**
TUNING CRANK for Comm. Rec.....**.65c** ea.

TRANSFORMER For COMM. RECEIVER

115 Volt, 60 cycle Primary Sec. 250-0-250 Volt, 50 MA; 6.3 Volt and 24 Volt, with AC Schematic—NEW:.....**$2.95**

MOBILE DYNAMOTORS FOR COMMAND RECEIVER—P. M. Field Dynamotors, operate 6 Volt DC input; Output 240 Volt 50 MA. Normally 12-24 Volt Volt input; Output 500 Volt 50 MA. Size: 4"W. x 3"D. x 7½"L. NEW:.....**$1.95**

COMMAND TRANSMITTERS WITH SCHEMATICS

BC-696 3 to 4 Mc. NEW: **$18.95** USED:.....**$14.95**
BC-457 4 to 5.3 Mc. USED:.....**$5.95**
BC-458 5.3 to 7 Mc. NEW: **$7.95** USED:.....**$5.95**
BC-456 MODULATOR for Command Trans., Price—USED:.....**$2.50**

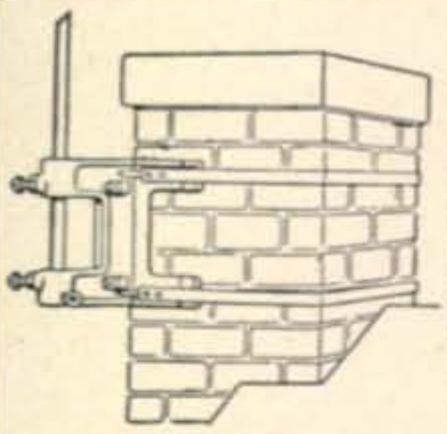
TRANSFORMER FOR COMMAND TRANSMITTER

Primary 110 Volts 60 cycle; Sec. 525-0-525 Volt 250 MA; 12-12 or 24 Volt, 3 amp., 5 Volt, 3 Amp. Price—NEW:.....**$9.95**
DUAL TRANSMITTER RACK—NEW:.....**$1.50**

WHIP ANTENNA FOR MOBILE & STATIONARY USE

MP-48 Mast Base Mounting with heavy vertical Coil Spring, insulated at top to receive Mast Sect. MS-53. Mast Base only—NEW:.....**$2.95**

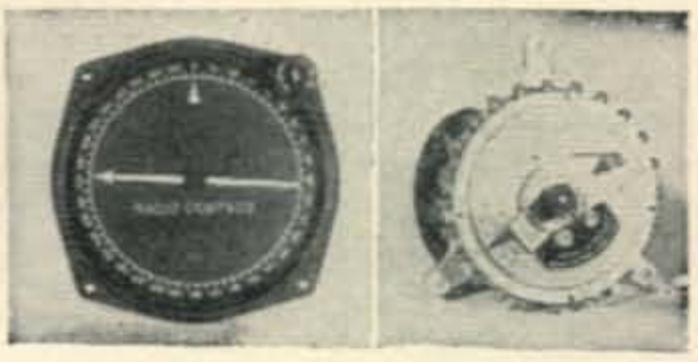
MAST SECTIONS—For above MP-48, tubular steel, copper coated, painted—in 3 foot sections. Bottom section MS-53 can be used to make any length. MS-52-51-50-49 for taper. Screw-in type. NEW:.....**.50c** ea.



ANTENNA MAST MOUNT

MULTIPLE MAST MOUNT—Can be mounted on chimneys, on gable or flat roofs, or on sides or corners of brick or frame walls. Ideal for holding all popular types of Television and FM antenna in sizes up to 1¼" diameter. Made of aluminum, with plated steel hardware. Complete with banding for chimney mounting—Price:.....**$4.50**
Price—Less chimney banding:.....**$3.00**

SELSYN TRANSMITTER AND INDICATOR



Ideal as Radio Beam position indicator for Ham, Television, or Commercial use. Complete with I-82 Five inch indicator, Autosyn Trans., 12 Volt 60 cycle Transformer, and wiring instructions. Price—NEW:.....**$7.95**
Price: I-82 Indicator only.....**$4.95**

ADDRESS DEPT. CQ • ALL PRICES ARE F.O.B., LIMA, OHIO • 25% DEPOSIT ON C.O.D. ORDERS

FAIR RADIO SALES • • 132 SOUTH MAIN ST. LIMA, OHIO

Variations on the antenna mounting sketched can easily be devised to fit different situations as, for instance, the case where it is desired to mount the supporting pole directly on the ground. This can be done without any particular trouble because the angle of the guy-wire radials is not at all critical.

Electrically, this arrangement has low angle radiation and a good impedance match, because drooping the radials tends to raise the center impedance as compared to the approximately 30-ohm center impedance of the conventional ground plane antenna. This makes the center impedance of this array a pretty close match to the 50-ohm surge impedance of the RG8/U.

If one wants to worry about more exact figures, use 95% of a free-space quarter wave for the vertical section and 100% of a free-space quarter wave for the radial wires at your favorite frequency. For 10 and 11-meter operation cut the elements for 28 megacycles.

A lot of loading troubles can be eliminated and physically loose coupling between the antenna and tank coil maintained if series tuning of the antenna pickup coil is used. A small variable condenser of 50 or 75 $\mu\mu$f may be used as the voltage is low with up to medium power. On 10 meters the ordinary 2 or 3-turn coil usually has enough inductance to hit resonance within the range of the condenser. If resonance is not achieved with the plates fully in, a larger link or some added series inductance is in order. The added inductance or rather large pickup coil is certain to be needed on 20 meters.

BANDSPREAD FOR THE BC-348

(*from page 40*)

on noise to avoid image difficulties. When the mixer trimmer is adjusted, it will be necessary to retune the receiver slightly to retain the signal, since the mixer trimmer affects the oscillator frequency.

The matter of calibrating the new tuning ranges is left up to the individual. The simplest procedure is to prepare a chart or curve showing the important frequencies in the band concerned plotted against the corresponding settings on the band 5 or 6 dial plate. This method of calibration is employed occasionally in commercial communications receivers and has proven quite satisfactory for the author's requirements. The provision of more elaborate dial arrangements for the new frequencies is limited only by the ingenuity of the builder.

REFLECTION AT 144 MC

(*from page 36*)

tions were placed along the same azimuth, a station 20 miles removed in either direction could hear stronger or considerably weaker signals depending upon the distance of the DX station and the point of incidence. The situation is further complicated by the addition of the third dimension to this picture, spreading the inversion over a much greater area.

It is also to be noted particularly, that this warp-

ing will have an effect upon the true great circle bearings between DX stations. An azimuth variation of plus or minus 5° should not be uncommon. It is rather doubtful that a fixed beam for inland work would be entirely satisfactory at 2 meters.

Fading

More evidence to support the near grazing incidence reflection has been found by the CRPL in their recordings made of field strengths of FM broadcast stations. During the middle of the summer day or in the winter months, when few ducts are to be found, the received fields at intermediate distances are weaker, and are characterized by somewhat more rapid fading. This rapid variation has been attributed to near grazing incidence reflections from a multiplicity of small inversions at heights between 5000 and 15,000 feet. These cause comparatively sharp discontinuties in the refractive index as shown in *Fig. 2*. The observed signal fluctuations appear to be due to phase interference between wave components which have been reflected from these various points in the troposphere.

Under such circumstances the time variation of the instantaneous intensity of the received waves should be expected to follow the mathematical laws of a Rayleigh distribution. An example of theoretical and observational correlation is shown in *Fig. 3*. This provides strong support for the explanation of phase interference from small high altitude inversions.

In summary, very strong 6 and 2-meter signals are often observed when the modified index criterion indicates no trapping is taking place. Although the reflection theory for oblique transmission has not been entirely perfected, it does give reasonable answers when transmission via the duct is theoretically impossible. Quite likely both theories, as well as the diffraction formula will need to be eventually restated. With increasing frequency the effectiveness of atmospheric ducts becomes greater while the boundary or inversion layer reflection coefficients decrease. Since these two tendencies affect attenuation of radio waves in opposite ways, it seems probable that there will exist for a particular set of conditions an optimum frequency for working v-h-f DX

THE "FINAL" FINAL

(*from page 21*)

No mention of parasitic elimination has been made, possibly because it proved so simple in this particular final amplifier. The u-h-f parasitics (they were there all right) immediately yielded to the treatment of increasing the length of the plate leads in the form of parasitic chokes. Careful checking under all combinations of grid and plate circuit tuning, at high and low plate voltages, with and without grid drive failed to show the slightest indication. We feel strongly the fact that this stage is completely neutralized may account in part for this docility.

Early in the testing a dandy low-frequency oscillation occurred which promptly burned up the r-f choke in the B+ lead. This was traced to an external resonant circuit wherein the grid and plate

(*Continued on page 77*)

Classified Ads

Advertising in this section must pertain to amateur radio activities. Rates: 25c per word per insertion for commercial advertisements. 5c per word for non-commercial advertisements by bona fide amateurs. Remittance in full must accompany copy. No agency or term or cash discounts allowed. No display or special typographical ad setups allowed. "CQ" does not guarantee any product or service advertised in the Classified Section. Closing date for ads is the 25th of the 2nd month preceding publication date.

GET YOURS NOW! Bound volumes of "CQ" January-December 1947 still available, handsomely bookbound in tan cloth with gold foil lettering on a black panel. Price $8.50. Order from Bound Volume Dept., CQ, 342 Madison Ave., New York 17, N. Y.

QSLs—SWLs cards save money. Samples. Join American Amateur Association, 2219 Parkside Ave., Los Angeles 31, Calif.

BINDERS FOR YOUR CQ ISSUES available! Rich red Dupont Fabricord, stainproof and washable. Backbone gold stamped with CQ and year—1945, 1946, 1947, 1948, specified in order. Center channel to keep magazines fastened in position. $2.00 each postpaid. Foreign orders—add 25c per binder. Plain binders on special order at no extra cost.

OUR BUSINESS . . . Buying, totally and completely refinishing and selling . . . amateur radio transmitters. Transmitter Exchange, Wakefield, Rhode Island.

10-METER 3-ELEMENT BEAMS—$19.50. Send card for free information. Riverside Tool Co., Box 87, Riverside, Illinois.

AMATEUR RADIO LICENSES. Complete theory preparation for passing amateur radio examinations. Home study and resident courses. American Radio Institute, 101 West 63rd Street, New York City.

QSLs QUALITY CARDS priced right. Samples. W9UTL, 1768 Fruitdale, Indianapolis, Ind.

VESTO self-supporting steel towers. No guys. Easily erected. Every ham can afford. Write The Vesto Company, Parkville, Mo.

QSLs. Samples for stamp. Henry L. Carter, Jr., W2RSW, 747 S. Plymouth, Rochester 8, N. Y.

QSLs? SWLs? Made-to-order. Samples 10c. Sackers, W8DED, Holland, Michigan.

SELL RME-45, complete, $120. Semel, W2SHE, 111-55 77th Avenue, Forest Hills, New York.

500 WATT TRANSMITTER, complete with 40-20-10 meter coils, fone and cw. Also Cardax model 950 microphone. Transmitter fully enclosed in steel cabinet. Take it all away for $150.00. Prefer buyer from New York metropolitan area. W2MJB, 31 Jackson St., Passaic, New Jersey.

ALUMINUM TUBING in 12 ft. lengths. Most Sizes. Send for list. Willard Radcliff, Fostoria, Ohio.

SELL: 1500 volts, 200 ma filtered (110 input). Steel encased. $30.00 or best offer. James Row, 1265 New Merrimac Road, Camden, New Jersey.

FOR SALE: New Bud v.f.o., never used. Coils 80 to 10 meters. Best offer. W5JPC, Box 1247, Kilgore, Texas.

500 WATT POWER SUPPLY and parts, also final parts and 807 driver parts, milliammeters, two UTC filter chokes, condensers, new Kenyon 2300 v at 300 ma. power transformer, four 813 tubes, two HK54 tubes, six foot relay racks, hinged rear door on rollers, final condenser 50-50 mfd, 1 kw. Write your needs. Sell at best offer, reduced prices. Everything practically all brand new, not surplus. W8KJ, Irving Davis, 5050 Grayton, Detroit 24, Michigan.

BIG STOCK: New and reconditioned Collins, National, Hallicrafters, Hammarlund, RME, Millen, Sonar, Meck, other receivers, transmitters, etc. Reconditioned S38 $35.00, S2OR $49.00, S40 $59.00, SX43 $119.00, HT18 $69.00, NC46 $59.00, NC200 $119.00, NC240D $149.00, NC183 $219.00, DB20 $29.00, RME45 $99.00, HQ129X $129.00, SP400X, SX24, SX25, S36A, SX28, SX28A, SX42, NC57, NC173, HRO, DB22A, VHF152A, HF-10-20, HT9, Meck T60, BC610, Tech-Rad T350XM, other receivers, transmitters, v.f.o.'s, etc. Easy terms. Shipped on trial. List free. Henry Radio, Butler, Missouri.

FOR SALE: Complete 375 watt phone transmitter. Includes 7C5-7C5-815 exciter, speech amplifier, and associated power supplies and rack contained final consisting of PP 812H power amplifier, PP 811 modulator and two 300 ma Hi-V power supplies. Fully metered. Make offer. Estate of W20XD, 10 Soundview Circle, White Plains, New York.

BARGAINS-NEW AND USED TRANSMITTERS-receivers-parts. New 150 watt phone $199.00; 60 watt phone $99.00; Globe Trotter $57.50; Abbott TR-4 $29.50; HT-9 $295.00; MB-611 $59.00; NC-173, SX-28 $149.00 ea.; HQ-129X $139.00; RME-45, SX-25 $99.50 ea.; RME-9D $39.50, SX-24 $75.00; S-40 $65.00; S-20R $49.00; NC-44, S-38 $35.00 ea.; Silver 701 $29.00; many others. Large stocks, trade-ins. Free trial. Terms financed by Leo-WØGFQ. Write for bargains and best deal to World Radio Labs., Council Bluffs, Iowa.

STANCOR 60-P transmitter, cabinet, meter; coils, crystal for 80—$65. National NC-1-10 receiver, all coils, power supply—$40. f.o.b. W2NLF, 351 Broadway, Lawrence, L. I., N. Y.

FOR SALE: N.B.F.M. exciter. Excellent condition. Circuit of Sonar XE-10 duplicated exactly. 40 meter output. $25. W2PWJ, 3521 Avenue D, Brooklyn 3, N. Y.

HEAVY DUTY deluxe black cabinet rack for sale. 30" panel space, overall width 23", depth 20½", shipping weight 123 pounds. Equipped with hinged rear door and angle shelves for chassis. Worth $30, cost you $17.50. W1IBY, 12 Sunnyside Ave., Wellesley, Mass.

ARTICLES WANTED: Material dealing with radio controlled models is desired for publication. For further details write the Editor, CQ-Radio Magazines, Inc., 342 Madison Ave., New York 17, N. Y.

QSLs, SWLs. Made the way you want them. Samples? W9BHV QSL Factory, 857 Burlington, Frankfort, Indiana.

FOR SALE: Bendix TA12B, supplied with conversion data for 80, 40, 20 and 10 meter amateur bands, will sell for $40. Also brand new NC-57 used only one month; cost $89.50 when bought, will sell for $60. John F. Ala, 23 Chestnut St., Kearny, N. J.

WANTED: Articles on any topics of interest to radio amateurs. Constructional articles of all sorts particularly desirable. For full details write to W2IOP, c/o CQ, 342 Madison Avenue, New York 17, N. Y.

ROYAL ORDER OF WOUFF HONG MEMBERS: Wouff Hong ash trays, souvenir of 1948 National ARRL Convention, $2.50 each prepaid. Milwaukee Radio Amateurs' Club, 1529 N. 37th Street, Milwaukee 8, Wisconsin.

AUTO TRANSFORMER, zero to one hundred thirty volts at two amps, primary draw, sell $8.00. Brand new. W8KJ.

PRINTED CIRCUITS: Learn to design and repair the new printed radio circuits. Conducting ink kits, instructions: standard $3.00, super $5.00 (with silver ink). Cash or M. O. Microcircuits Company, Dept. 5C, New Buffalo, Mich.

QSLs, SWLs. Quality cards. W5FAY Press, 6118 Goliad, Dallas, Texas.

CRYSTALS: Precision, low drift mounted units, 3500 to 9000 kilocycles, ± 5 kc. $1.00. Exact frequency $1.50. Specify mounting. Write for quotations all other frequencies. Breon Laboratories, Williamsport, Penna.

COMPLETE HAM STATION for sale. New one kilowatt transmitter, PP 4-125, push button control. HR05TA1 receiver, Meissner deluxe shifter, 25 watt Masco speech, 55C Shure dynamic microphone, two element motor driven beam. Beautiful equipment in perfect condition. Now in operation. Best offer over $1000. Reason for selling, building home. All letters answered. DeClaive, W6GIB, 5660 Strobridge Avenue, Castro Valley, California.

SELL ONE EACH: Eidson's type E-62, 1674 kc crystal in ceramic sealed holder, $5.00. Bliley type BC6, 1674 kc crystal in 6 V @ 9 amps. temperature controlled holder, $10.00. Doolittle #PR-2C 110 vac 7" standard rack mounted receiver, complete with 2142 kc crystal for 1674 kc channel, 8 tubes, 8" wall mounted speaker, full air-tuned, near new, $60.00. Motorola 6 vdc receiver #P69-18 complete with 1936 crystal for 1674 kc channel, used less than a year, $40.00. FB with converter. WØGJJ, 406½ Seventeenth Street, Bismarck, North Dakota.

WANTED: Aircraft Radios; BC-348, AN ART-13, RTA-1B, AN/APN-9, R5A/ARN-7, AN/ARC-1, AN/ARC-3, SCR-718, BC-788-C, I-152, MN-26-C, Tests set with TS or I prefix. State quantity, condition and best price first letter. HI-MU Electronics, Box 105, New Haven, Conn.

SELL A COUPLE 813s at $5.00 each. Guaranteed. W. Wipson, 159 East 4th, Emporium, Pennsylvania.

FOR SALE: Bandswitching exciter and 813 final, $30.00 less 813. Also 40 M rig 4D32. $18.00 with tube. Card for details. R. G. Talpey, W2PUD, 59 Orland Road, Rochester 9, N. Y.

TWIN CITY RADIO HAMS: I offer the three big cw transmitters at WØCO, in place at my station, and in "as is" operating condition, for cash, as follows: 40 meter 1,000 watts input $350.00; 80 meter 800 watts input $200.00; 20 meter 750 watts input $200.00; all three together $650.00. These rigs all crystal and temperature controlled. Make appointment to operate transmitters if interested. Sumner B. Young, Maplewoods, Wayzata, Minn.

COLORTONE QSLs. Snappy! Bright! Different! Big variety. Samples? Colortone Press, Tupelo, Mississippi.

SUBRACO DASHBOARD, mobile, brand new. Cost $89.50. Used once, perfect condition, $65.00. Meissner signal shifter, latest factory model, cost $120.00, with NBFM, $60.00. W2NCY, Dumont, New Jersey.

I HAVE A BELL and HOWELL disc recorder with separate amplifier and speaker for public address. The recorder is complete with crystal microphone, recording and playback needles, and one dozen blanks. The unit cost about $175.00 a short time ago. I will sell to best offer due to illness. Please send offer to Mrs. W. H. Irwin, Candler Field Branch P. O., Atlanta, Georgia.

CALL LETTER PLATES, aluminum. 1¼" raised letters. Black background. $1.00. Hawkins Radio Company, 621 East 31st Street, Kansas City 3, Missouri.

HAMMARLUND HQ129X, no speaker, slightly used. $120. E. Kindquist, 404 Riverside Drive, New York, N. Y.

FOR SALE: Deluxe kw transmitter built this year. PP 100THs, 805 modulators, and switching exciter. Individual power supplies. Complete relay control protection. Spare tubes, remote v.f.o., speech amplifier and grip-to-talk D104 microphone. $700.00. W2LHF, 529 North 6th Street, New Hyde Park, New York.

FOR SALE: Ampro sound projector, model Century, used one week, $345.00. Stancor 60N xmitters complete with tubes, xtal and 20-meter coils, $65.00. General Radio output power meter, type 583A, $65.00. New model "C" 522 with control head, $60.00. L. L. Jezorek, 364 Mulry Lane, Lawrence, L. I., New York.

CQ Ad Index

chokes provided the necessary inductance. Removing the grid by-pass stopped it immediately. Final measures were simple enough and account for the use of a fixed resistor in series with the grid choke before the by-pass. This resistor is not for the purpose of grid bias and should not be omitted.

In making harmonic checks don't forget to tune the parasitic chokes in the plate leads! The values given resonate somewhere around 80 mc and can give a decided increase in sixth harmonic output (14-mc operation) unless tuned. When so tuned, they represent parallel resonant trap circuits for this harmonic and are so used in this transmitter in addition to their regular function of detuning the plate circuit for u-h-f oscillation. Rather extensive search for harmonic output has clearly indicated the need for complete shielding of the final amplifier and all incoming power leads. It is very surprising to find different harmonics on individual power leads and regardless of the care taken to keep harmonics out of the antenna circuit all efforts will be undone unless the job is completed by shielding and filtering.

Here then is our new final amplifier. We like to think of it as our final-final, knowing of course that we will soon forget that we built this aluminum beauty by dint of much hard labor with file and hacksaw and start thinking about still another final. Even as we write these closing lines we are reminded of the commercial transmitter we once designed with motor-driven tuning capacitors and rotating coil turrets. Mmmmmm—all this—and TVI too! Maybe we had just better let this one be the final-final!

BEGINNERS SUPERHET

(*from page 30*)

Signals other than those on the amateur bands are excellent for test purposes and often will prove more satisfactory as they stay on for long periods, while the amateur signals will often cease just as that particular test or adjustment is reaching its peak.

Once reception is obtained, peak up the receiver by adjusting the i-f trimmers, *Ca* and *Cb*, until maximum i-f gain is obtained consistent with smooth regenerative action of the 6SH7.

A word of caution. Whenever working with the plate voltage on be very careful. Despite its low potential it can cause harm. In any case now is the time to cultivate the safety habit.

MOBILE ON 75

(*from page 33*)

6.6 and 12.6 db, without and with the loading coil. Thus the external loading coil produces an effective power gain of eight with an eight-foot whip and four with a 12-foot whip, over the same antennas with the loading coil built into the transmitter. When gains of this magnitude can be achieved by such simple means, even greater improvements in efficiency may well result from further development. Some of the commercial services have obtained marked improvement with a form of center-loading [2] which should be perfectly feasible for amateur operation.

[2] See QST, December.

INDEX TO CQ

Issues of Vol. 4, Nos. 1 through 12, for the year 1948

SINGLE SIDEBAND

TELEVISION INTERFERENCE

THEORY

(see also: AMATEUR NEWCOMER, ANTENNAS, MICROWAVES, PREDICTIONS and V.H.F. and U.H.F.)

TRANSMITTING

(see also: FREQUENCY MODULATION, RADIOTELEPHONY, V.H.F. and U.H.F., SINGLE SIDE-BAND)

V.H.F. and U.H.F.

(see also FREQUENCY MODULATION, RECEIVING and TRANSMITTING)

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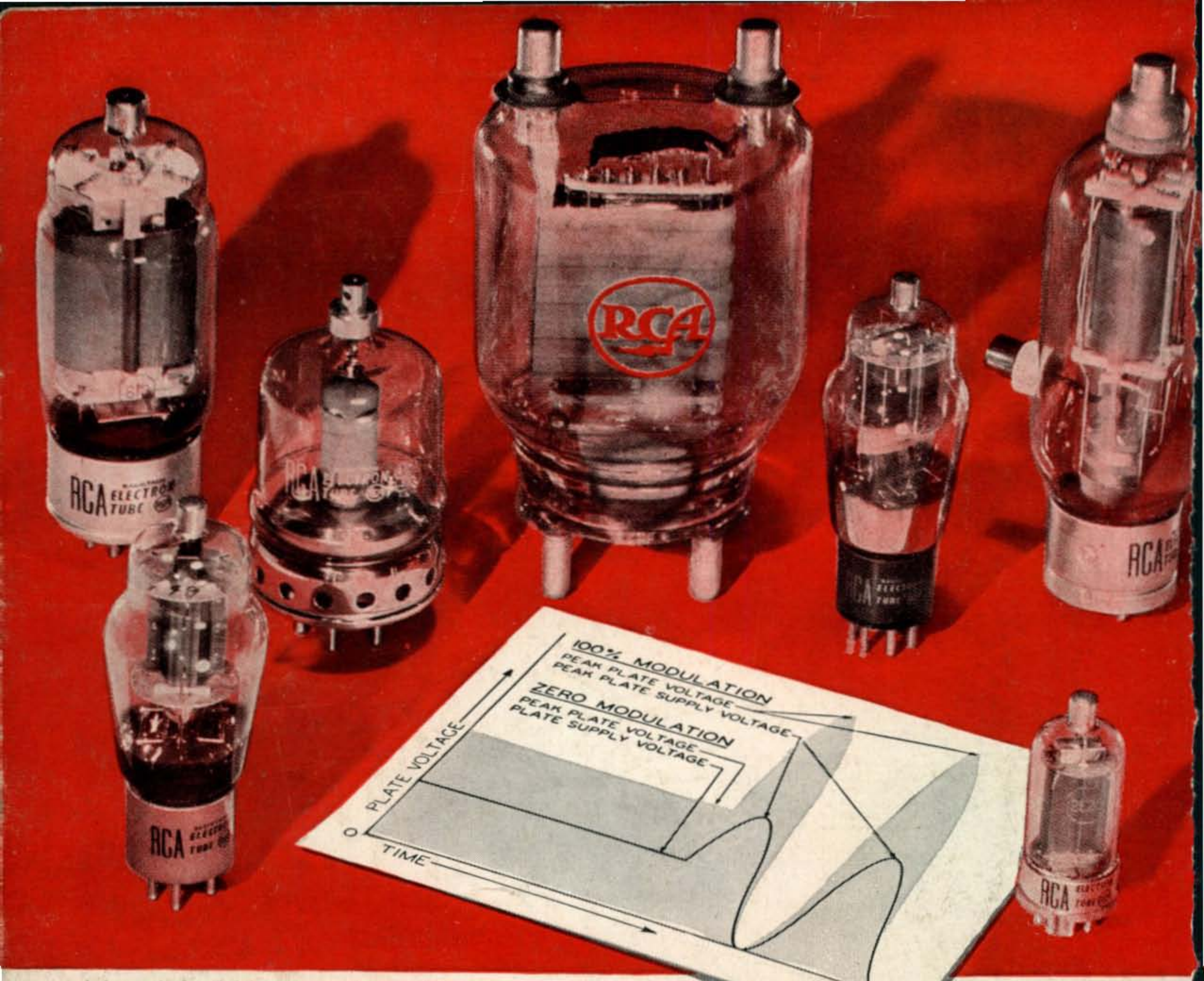

A few of the RCA power tubes used by amateur and broadcast stations alike.

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A FINAL amplifier tube in plate-modulated service is subjected to plate voltage peaks approximately *four times* the dc plate supply voltage. Plate voltage and plate current peaks are *double* those encountered in unmodulated service, and input power peaks *four times* as high. No wonder, then, that in plate-modulated finals it's *safety factor* that counts.

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