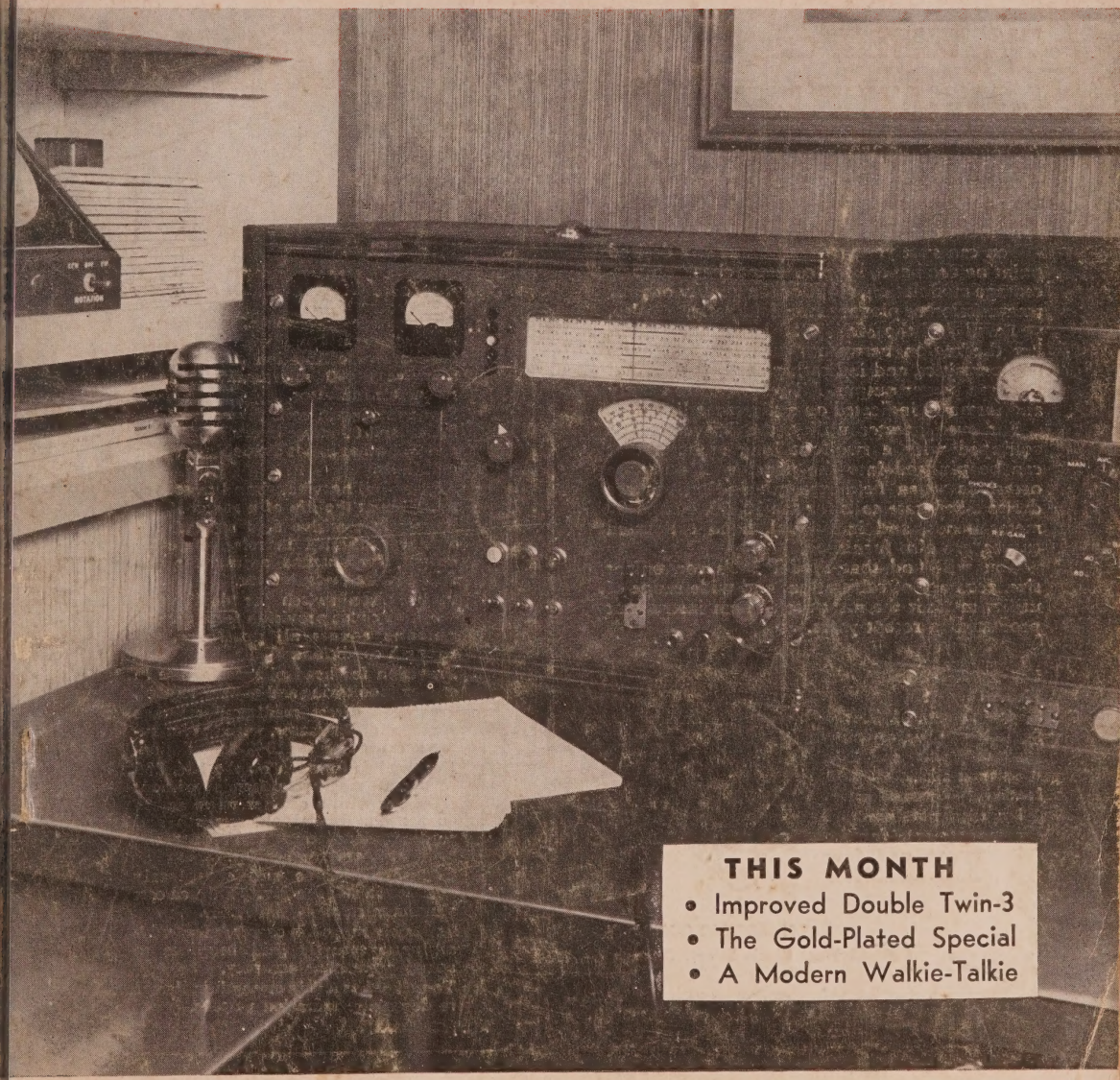
CQ

OCTOBER, 1948

The Radio Amateurs' Journal

35¢



THIS MONTH

- Improved Double Twin-3
- The Gold-Plated Special
- A Modern Walkie-Talkie

Published by RADIO MAGAZINES, INC. Subscription $2.50 a year

BE SURE YOU'RE ON THE BAND

KNOW YOUR MODULATION PERCENTAGE

MEASURE YOUR FIELD STRENGTH

With the Simpson Model 380

WAVEMETER and MODULATION INDICATOR . . .

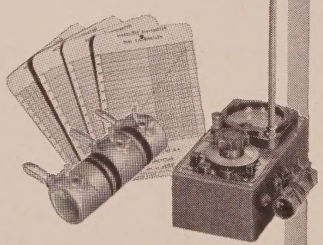
Although Model 380 is no larger than a man's hand, it has the fine Simpson meter movement and precision engineering that assure lasting accuracy. It is protectively housed in a cast aluminum case.

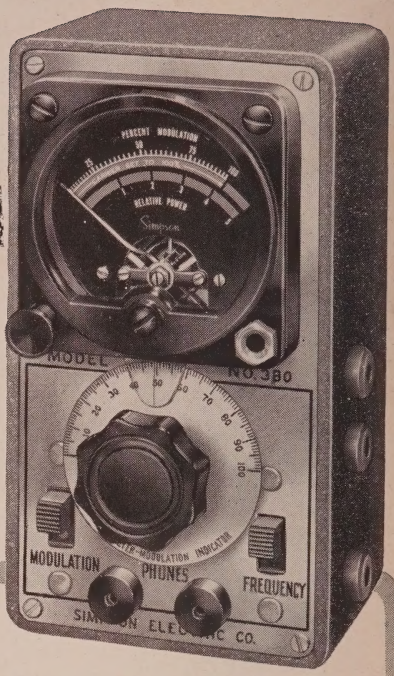
You can spot your transmitter at any desired point on the band, keep constant check on percentage modulation, monitor the quality of your transmission or plot antenna field patterns. Also, you will find the Model 380 handy for searching the region between bands for harmonics and parasitics, and indicating changes in actual radiated power output. All readings are clearly and instantly indicated on a direct-reading dial.

For even greater utility, the Wavemeter is equipped with a two-foot long antenna that can be plugged into the panel well on those occasions when field strength indications are desired. Separate coils for the 10, 20, 40 and 80 meter bands, and individual, hand calibrated curves, are also furnished.

You will find that Model 380's convenient size, accuracy of calibration, and wide range of utility make it the most useful ham instrument produced in recent years.

Size: 2" x 2¼" x 5¼"
Weight: 1¾ lbs.
Shipping weight: 2½ lbs.
Dealer's net price, complete with 4 coils and 2-ft. antenna $37.85
Leatherette-covered carrying case with separate compartments for the instrument and four coils $6.75





Important WAVEMETER *Features*

1. An accurate wavemeter, band-spread for each ham band with individual hand-drawn calibration curves and a sensitive 0-100 microammeter as a resonance indicator.
2. Separate plug-in coils for each of 10, 20, 40 and 80 meter bands supplied—coils for other bands available at slight extra cost.
3. Additional between-band coverage available at the flip of a switch.
4. Extremely sensitive field strength indicator calibrated in relative power output, for antenna adjustment and field pattern measurement.
5. Push button switch for dual meter sensitivity plus provision for a plug-in antenna covers all possible field strength conditions.
6. Provision for head phones for use in station monitoring and quality control.
7. Finally, a direct reading Percentage Modulation Indicator, with the instrument calibrated 0-110% Modulation.
8. Designed to function on the 144, 235 and 420 megacycle bands without coils, but with a quarter wave antenna section. Reads field strength and percent modulation and spots the band at these frequencies.
9. Compact in size and completely shielded in an attractively finished cast aluminum case.
10. Extremely rugged in construction, with all parts securely held in place to assure permanent accuracy.
11. To be used as a field strength indicator to determine radiation pattern.

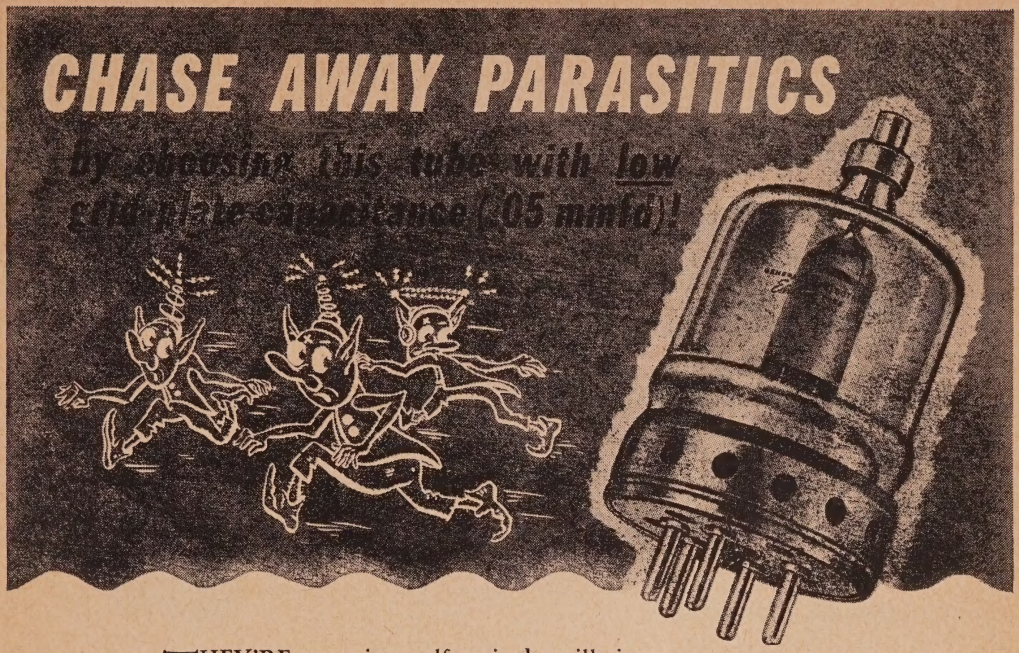
Ask your jobber, or write for descriptive literature

SIMPSON ELECTRIC COMPANY
5200-18 West Kinzie Street, Chicago 44, Ill.

Simpson
INSTRUMENTS THAT STAY ACCURATE

CHASE AWAY PARASITICS

by choosing this tube with low grid-plate capacitance (.05 mmfd)!



THEY'RE annoying, self-excited oscillations . . . and they invite Grand Island QSL cards! In a screen-grid tube, these gremlins batten on a high grid-plate capacitance; but extremely low g-p capacitance acts like a whiff of DDT powder.

Good circuit layout is your follow-up, if you want to give parasitics a knockout. To a GL-4D21/4-125A tube add correct circuit design, and you've set the stage for a *clean* signal.

In many other ways G.E.'s fine v-h-f tetrode is the right tube for your final, singly or in push-pull. Lots of power—a pair will take 1 kw input CW, or 760 w input phone! Yet drive is economically low. Only 5 w and 6.6 w respectively are needed for the input figures given.

Your circuit design is simplified, since no neutralizing is required at most frequencies. The tube is modern in every feature, including a compact, streamlined contour that bespeaks the structural sturdiness within. This tetrode will stand up!

See the GL-4D21/4-125A at your nearby G-E tube distributor. Price and full performance information also are available there. Or write *Electronics Dept., General Electric Company, Schenectady 5, New York.*

Get *Ham News* regularly! Ask your G-E tube distributor to reserve a copy of each bi-monthly issue for you. This helpful, free magazine is jampacked with circuit suggestions sure to aid you in your progress. To read G. E.'s *Ham News* is to become a more proficient radio amateur!

GL-4D21/4-125A TETRODE

500 W MAX CW INPUT. 120 MC FREQUENCY AT MAX RATINGS

ELECTRICAL CHARACTERISTICS

Filament voltage	5 v
current	6.5 amp
Avg interelectrode capacitances:	
grid-plate	.05 mmfd
filament-grid	10.8 mmfd
filament-plate	3.1 mmfd

MAXIMUM RATINGS, CLASS C TELEGRAPHY

Plate voltage	3,000 v
Screen voltage	400 v
Plate current	225 ma
dissipation	125 w

ELECTRONIC TUBES OF ALL TYPES FOR THE RADIO AMATEUR

GENERAL ELECTRIC

161-GA10-8850

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Your BUD Distributor Has Them!

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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

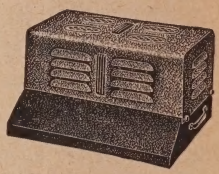
Buy the best . . . BUY BUD



BUD Cabinets



BUD Chassis Bases



BUD Amplifier Foundations



BUD Utility Cabinets

The mark BUD of perfection

BUD RADIO Inc.

2120 East 55th St.,
Cleveland 3, Ohio

CQ

The Radio Amateurs' Journal

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Vol. 4 **OCTOBER, 1948** **No. 10**

In This Issue

COVER—The Gold-Plated Special is more than a transmitter—it is the nerve center for an up-to-the-minute modern station. Despite its custom-built appearance, it is constructed from, and built around, standard components such as the Collins PTO, the new National series knobs, the B & W small butterfly condenser, etc. Directly calibrated v.f.o., instantaneous break-in, self-monitoring, driver or medium-power transmitter capabilities, harmonic suppression for minimum TVI and BCI, are but a few of its features. For the whole story on this complete and unique transmitter turn to the article starting on page 20. *Photo by W2DTE.*

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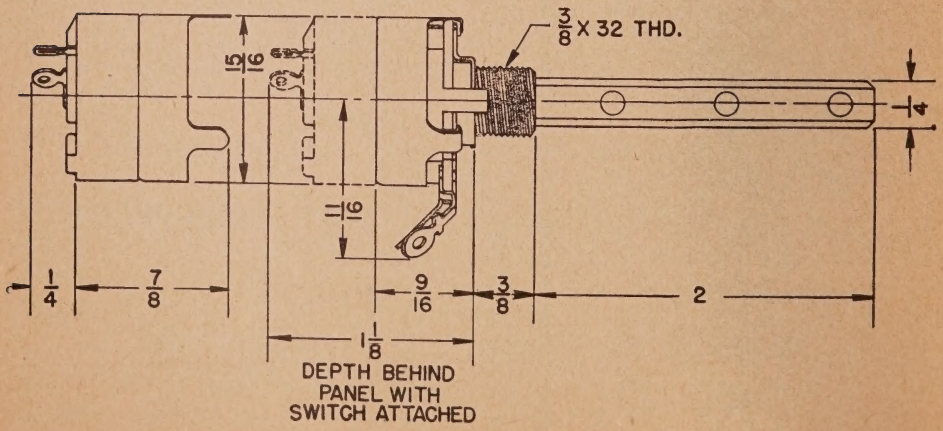
Dear OM:

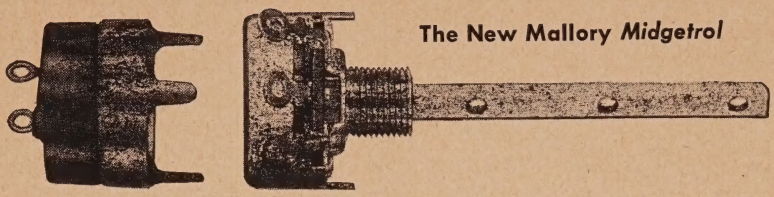
When you stop to think about it, there have been few, if any, real technical improvements in the Variable Carbon Control since it first made its appearance many years ago. The average Volume Control of today still has many of the same failings its Great-grand-pappy had. For example, it still incorporates a metal shaft rubbing against a metal bearing. We've all experienced the disagreeable audible effect a little dirt on this bearing surface has in a sensitive amplifier circuit.

Since the first Carbon Control, it has been the usual design to provide for one, and only one, shaft bearing. As a result, shaft wobble and eccentricity of operation have plagued the innocent user.

Another sore point has been the problem of the attachable switch. In many instances the Control itself must be practically disassembled before attaching the switch. And—as if that isn't enough!—long and complicated instructions must be adhered to exactly before reasonable assurance is had that the switch will continue to function after it has been attached.

You and I have put up with these and other shortcomings for years with only an occasional squawk and a hope that some day, somewhere, some smart engineer would come up with a practical answer to a few of these problems.





The New Mallory *Midgetrol*

It is with considerable pleasure and with no fear of contradiction, that I am able to announce that I have examined and actually tried a brand new Carbon Control which answers every serious complaint I've ever had about Carbon Controls. This Control is the new Mallory *Midgetrol.*

This smooth little Mallory *Midgetrol* has a one-piece molded plastic rotor assembly which does away with all metal to metal bearing surfaces. It has 2 rotor bearings, one at the front and one at the rear. The attachable switch was designed and manufactured entirely by Mallory. It is almost fool-proof, and may be attached without modifying the Control housing at all!

And that's not all! The Mallory *Midgetrol* is only $^{15}/_{16}''$ in diameter which makes it a swell bet for use in compact portable equipment. But don't let that small size fool you. By actual test its power dissipation is equivalent to that of the larger $1\frac{1}{8}''$ diameter standard Carbon Control.

I'd suggest you get one of these new Mallory *Midgetrols* from your Distributor and examine it for yourself. You're in for a pleasant surprise.

73,

YOUR ROVING REPORTER

P.S. *Ask your Distributor to tell you how that flat shaft works. It's good.*

YRR

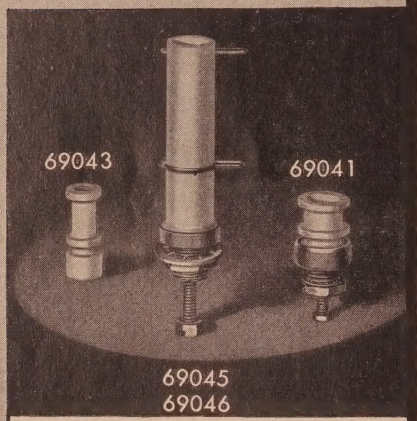
P. R. MALLORY & CO., Inc.
INDIANAPOLIS 6 INDIANA

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MALLORY

Designed for

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Application



The No. 69040 Series
of
PERMEABILITY TUNED CERAMIC FORMS

In addition to the popular shielded plug-in permeability tuned forms, 74000 series, the 69040 series of ceramic permeability tuned unshielded forms are available as standard stock items. Winding diameters and lengths of winding space are 13/32 x 7/32; 1/4 x 3/8; and 1/2 x 1 1/16, for the 69041, 69043 and 69045 respectively. Nos. 69043 and 69046 have powdered iron slugs while Nos. 69041 and 69045 have copper slugs.

JAMES MILLEN MFG. CO., INC.

MAIN OFFICE AND FACTORY
MALDEN
MASSACHUSETTS

M

★ ★ ★ Letters ★ ★ ★

Reciprocal Licensing Agreements

11 Windsor Ave., Westmount,
Quebec, Canada

Editor, *CQ*:

In common with all U.S. citizens residing in Canada and Canadians living in the U.S., I am unable to operate an amateur radio station. W2PJP's being off the air for a couple of years leaves me frustrated enough, but the additional fact that private pilots like me can't get R/T operator's licenses and are thus denied what is more than a luxury in cross-country flying seems to point up an anomalous situation.

Our two countries have a long history of cooperation in many spheres of activity. Newspapers record almost daily instances of military coordination. Many of us were in the services of the country other than that of our citizenship during the war, often in top-secret work. Surely, some reciprocal licensing scheme could be worked out for long-time or permanent residents other than that of their citizenship; such arrangements exist between many other countries. We should be among the first to adopt some workable plan, not the last.

None of us would have any objection to undergoing a second set of examinations in the country of residence; we would abide by the rules of the country in which we were operating, or by an additional set of rules. I'd be tickled pink to operate v.h.f. only, if that were felt necessary (I'm a 20-meter phone/c-w man ordinarily!). But give us a chance to pursue a hobby that can operate to the benefit of all.

The logic of the situation is clear as crystal—what do you think can be done about it?

B. R. Benson, W2PJP

(Reciprocal licensing was proposed by A.R.R.L. over a year ago and turned down cold. Because the laws of both countries make citizenship a prime requisite for licensing there is little immediate prospect for any change in the official position, at least not until international affairs are more settled.—*Editor*)

Teen-Age Net

1815 North Taylor St.,
Little Rock, Ark.

Editor, *CQ*:

W5NWB, W5ONL and I are forming a teen-age net on 40 meters. All teen-age hams interested in joining, please write me for details.

Charles Plowman, W5LUY

A Card for a Card

87 Ennerdale Rd., Richmond,
Surrey, England

Editor, *CQ*:

During the latter half of 1947 and early 1948, I migrated to 28-mc phone and worked over 200 W stations there. To date I have received only 21 QSL cards, although I have QSL'd 100 per cent to all W QSOs. How about it, boys? If you're not going to send me a card, do you mind taking mine off the shack wall and sending it back?

To the first W station who sends me a card confirming a genuine QSO had before April 30, 1948 (any band), I will send a gift of English glassware. The XYL will act as official judge.

Vic. J. Copley-May, G3AAG

MODERN DESIGN IS COMPACT!





Because they're *compact*—with real big-tube performance—Ken-Rad precision-made miniatures are a "must" for your streamlined rig!

THESE tubes simplify your design problems, giving you extra working space with no increase in chassis area. Also, Ken-Rad miniatures run neck-and-neck in performance with their larger counterparts—*excelling* them in r-f work, where short internal leads allow operation at higher frequencies.

Close side-by-side tube mounting is possible with Ken-Rad miniature tubes—an important aid to h-f rig efficiency. And because miniatures have no bases, external lead inductance is cut.

Group these advantages, then add advanced tube design, and you have Type 12AT7. This tube was specially developed by Ken-Rad and General Electric engineers to serve as a converter and r-f amplifier in FM and Television. It's a great little tube for *you* as an amateur—a two-in-one marvel ready to become the heart of any h-f converter unit you're building!

One triode section will serve as mixer, the other as oscillator. Operating frequencies range up to 300 mc. With each section of the tube having its own cathode, you retain full freedom of layout in respect to biasing and coil-tapping.

See the 12AT7—and other precision-made Ken-Rad miniatures—at your nearby Ken-Rad distributor or dealer. You'll like their small size with sturdy structure . . . high-rating performance . . . versatility . . . *economy prices!*

K
KEN-RAD

12AT7
9-pin miniature high-g_m
TWIN TRIODE



CHARACTERISTICS

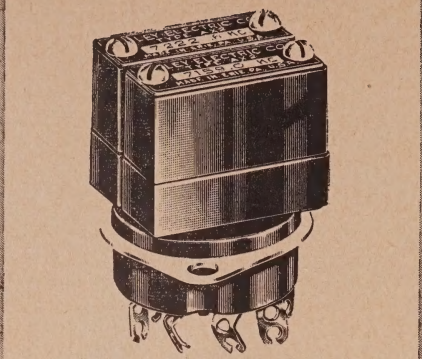
Heater voltage	12.6 v	or 6.3 v
current	150 ma	300 ma
Max plate voltage		300 v
Max plate dissipation, per section		2.5 w

178-GA10-8850

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

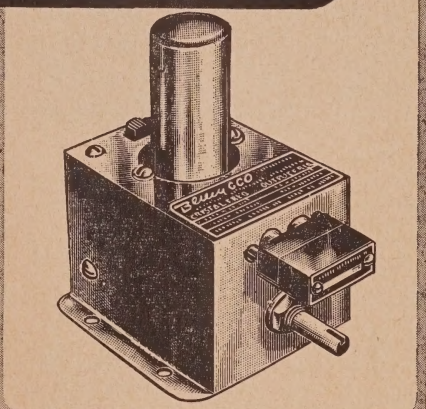
CRYSTALS



TYPE AX2, the first plated crystal for amateur frequencies, is just one example of the advanced design and "techniquality" that are yours in Bliley crystals . . . first on the amateur bands since 1932.

Ask your Bliley distributor for BULLETIN 35

OSCILLATORS



CCO-2A another Bliley "first". . . a completely packaged crystal controlled oscillator for the 2-6-10-11 meter bands. An ideal nucleus for new construction or conversion of existing equipment. Uses Bliley Crystals Types AX2 and AX3.

Ask your Bliley distributor for BULLETIN 35

Bliley
CRYSTALS

BLILEY ELECTRIC CO. • UNION STATION BLDG. • ERIE, PA.

On Discussing Frequencies

740 Cowper St., Victoria, B.C.
Canada

Editor, *CQ*:

May I state that the present discussion of the Canadian 50-kc phone bands in your editorials is in bad taste? Relations between W and VE amateurs have always been very friendly, and any differences we amateurs have between us will no doubt be settled in the traditional Canadian-American way—by friendly discussion between our respective governments. . . .

R. V. Parrett, VE7TG

(The purpose of the *CQ* editorial dealing with the Canadian phone allocations is to do exactly what has been expressed above—to settle the matter in the traditional Canadian-American way, by discussion. We like to think that our readers are the true representatives of their government, in amateur matters at any rate, and their governments should do what the majority of the amateurs desire. If we do not discuss such matters in the open, they may never be acted upon.—*Editor*)

Bouquets from England

34 Harrow View Rd., N. Ealing W5,
London, England

Editor, *CQ*:

I am writing to let you know how much I appreciate and enjoy *CQ* every month I am surprised how early in the month each issue arrives, and in perfect condition, too.

The short story in June issue came as a treat, it was such a gem. I would like more of them, but I doubt if it is possible to produce masterpieces very often.

Regarding antenna polarization, your boys seem puzzled as to whether to employ vertical or horizontal plane elements in their rigs. The British ham has neatly got over the problem and standardized into using the horizontal plane. The reason for this is that BBC transmits the country's television service on a vertical element system and so all the television receiving antennas employ a simple beam antenna with vertical elements. To reduce interference to viewers, the hams here employ the opposite type antenna, and so have standardized into using the horizontal plane elements. If all your television transmissions are broadcast on one type of element, why not standardize as our boys have done? It certainly saves a lot of figuring out.

William J. Morgan

Hold These Dates

October 29, 30, 31 November 5, 6, 7

CQ's World Wide DX Contest

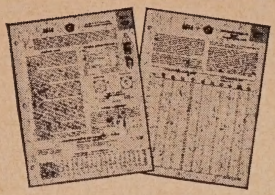
1 WEEKEND C.W. 1 WEEKEND PHONE

Spread the word around overseas. Complete details in August issue. We are going to help you take the pain out of keeping a DX contest log. Special "World Wide DX Contest" log sheets have been prepared so that they may be used in duplicate—you keep one for your log and submit one with your score. Send directly to the New York office for your forms. Ask for as many as you or your friends need. Forms will be mailed in ample time for the contest. Watch for additional details on the rules and regulations. It's a contest for big and little DXers alike.

How Hams are using the HYTRON 5514



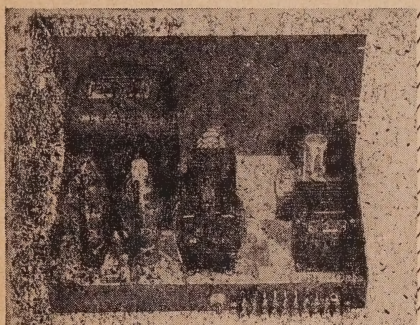
HYTRON
5514
$4.95



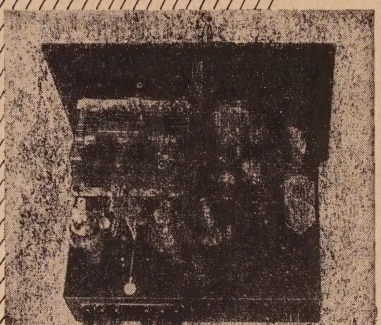
Most complete characteristics sheet for a transmitting triode; typical operation data for 8 plate potentials. Also class B Interchangeability Chart demonstrating comparatively the 5514's superiority over other triodes. Write for both.



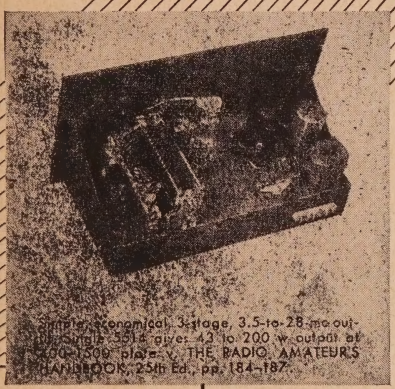
W1PEK's complete 350-w, 3.5-to-28-mc, 'phone/c-w transmitter uses 4 Hytron 5514's — class B and C — and only 7 cubic feet of space. QST for Sept., 1947, pp. 37–46.



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 42 to 200 w output at 1000–1500 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

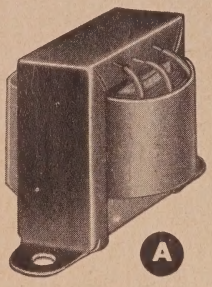
HYTRON
RADIO AND ELECTRONICS CORP.

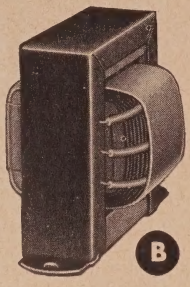
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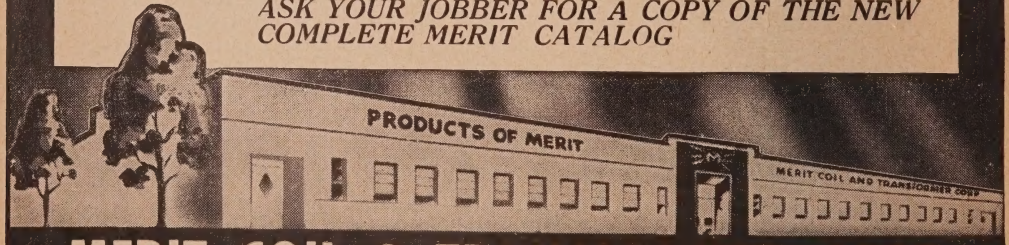


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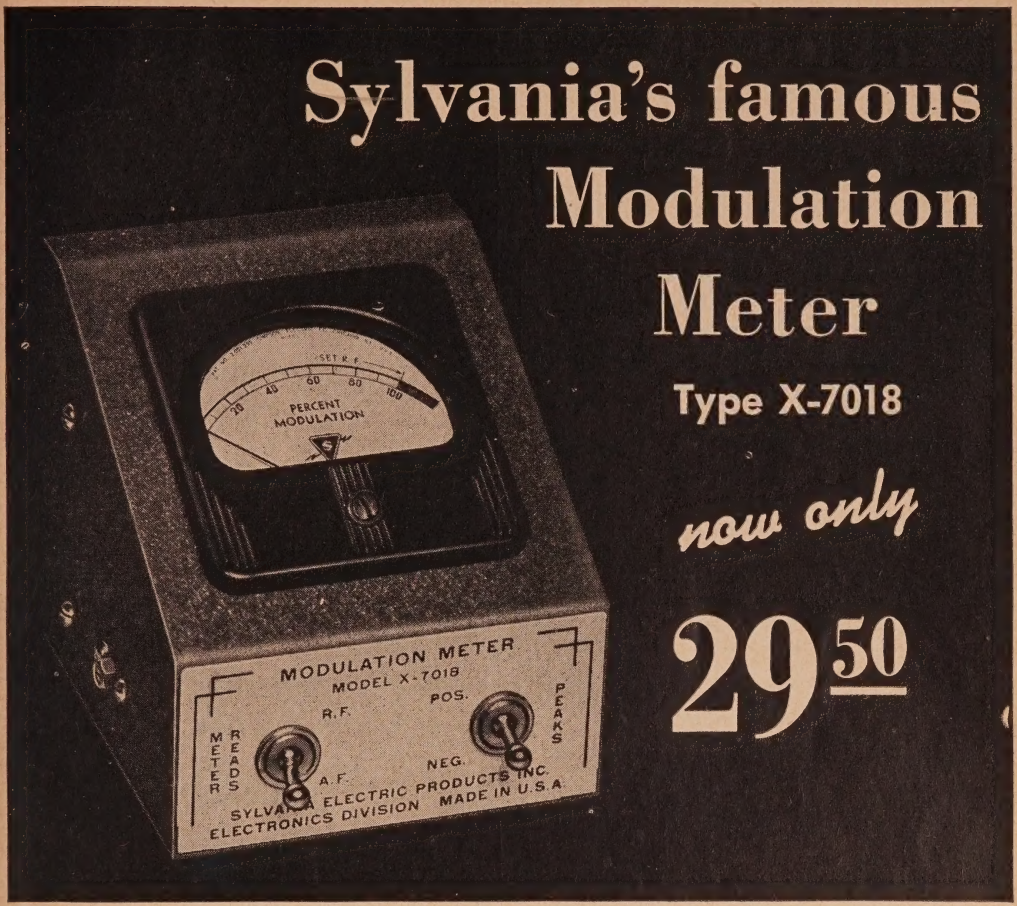
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Feenix, Ariz.

Deer Hon. Ed:

I am writing to you for my good boy friend, Scratchi, who at moment are undeposed, or in tecknical langwige, out like a light. It are a long wind of a story, but it are explaining why I are writing instead of himself Scratchi.

Beginning two weeks ago Scratchi are up to dumb old tricks like using giant cactis for antennis. He up on arms of same stringing wires round bout, all monkey-like, when he are suddenly flat on ground. Itchi try to help Scratchi up, but same screech and screech that he not able to stand up.Itchi decide it broken leg. He are smart, boy Itchi. So—with help from neighbor down road, they make stretcher and take Scratchi to Feenix to see doctor. Hon. Doctor put Scratchi in hosspitall. There are dear, sweet Scratchi, legs up in air, wires and junk all over place, and himself wondering if he can use wire for antenna for bedside radio.

Now I, being Scratchi good girl friend and someday wife, spend much time in hosspitall seeing Scratchi and helping him make much comfort. But when bad temper start up, I decide to stay way day or two to teach bad Scratchi good lesson. Time on hand, I go back to ranch to see if what can be done. Itchi nice housekeeper, so nothing for myself to do. Then get big ideas of maybe looking at famous radio Scratchi calls rig. Wonder what is wonderful with such junk costing so much to keep me from marriage with Scratchi. Many buttons to push, many wires all over—pretty lights, too. Decide can maybe have fun. Scratchi all time seem have fun. Wonder again why.

Push a few buttons, turn some knobs. I never hears such noises. Almost I run away, but being most determine young lady of intelligence, push few more things round. Suddenly there most beautiful voice in room. Sweet voice saying he are in El Paso. Then he say come in, someone. So turn a few more buttons and say am I in? Voice come back, I swoon somewhats, and hear say, "Hi, dreamboat, whatcha think your're doin'?"

Situation are most amusing, so decide to chat with young man, seeing no harm, since he are far away. He say, "What's your handle?" I tell him, most dignity, I not like fresh young man. He say he not fresh and laugh. Nice laugh. Then he ask, "What's your Cutie-H?". Then I in big mad tell him he are quite a cad, if he not cut out fresh talk I tell Scratchi that young man insult girl friend and then Scratchi can give poke in eye. Golly whiz! Voice just laugh some more and say he know Scratchi. He say his Handle is Bill, and he decide just then he better come see me and tomorrow will be here via jeep.

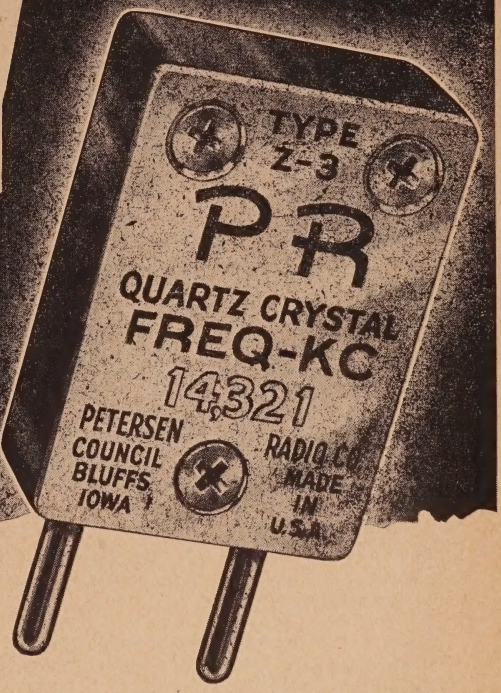
I agree things a bit out of control by now, but Scratchi still in bad temper next day, so think maybe

(*Continued on page 93*)

ARE YOU A...

GYPSY ON TEN?





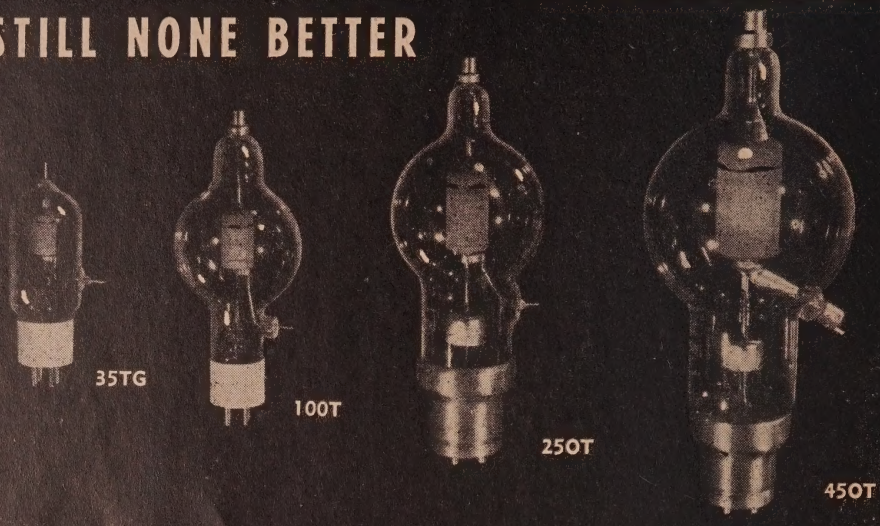
More and more the boys with "know how" on crowded phone bands are saying: "I've learned to stay put. No more of this gypsy business for me." Take 10 meters for example! On weekends trapesing up and down the band just doesn't do the trick. Usually a move puts you in a worse spot than before. Smart 10 meter operators are using three or four PRs for spot frequencies—low end, middle, medium high and near the top. Try it for a month! See if your luck doesn't improve—on 10, 20 or 75! *For accuracy, stability, low drift and high output use PR Precision Crystals.* Unconditionally guaranteed. Your EXACT FREQUENCY (integral kilocycle) WITHIN AMATEUR BANDS, AT NO EXTRA COST! See your Jobber. — Petersen Radio Company, Inc., 2800 West Broadway, Council Bluffs, Iowa. (Telephone 2760.)

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Tube Data

ELECTRICAL CHARACTERISTICS	35TG	100TH	250TH	450TH
Filament: Thoriated Tungsten				
Voltage	5.0 volts	5.0 volts	5.0 volts	7.5 volts
Current	4.0 amperes	6.3 amperes	10.5 amperes	12.0 amperes
Amplification Factor (Average)	39	40	37	38
MAXIMUM RATINGS				
Plate Dissipation	50 watts	100 watts	250 watts	450 watts
D-C Plate Voltage	2000 volts	3000 volts	4000 volts	6000 volts
D-C Plate Current	150 ma.	225 ma.	350 ma.	600 ma.
Grid Dissipation	15 watts	20 watts	40 watts	80 watts
RADIO FREQUENCY POWER AMPLIFIER AND OSCILLATOR				
Class-C Telegraphy (Key down conditions)				
Typical Operation—1 Tube				
D-C Plate Voltage	1500 volts	2000 volts	3000 volts	4000 volts
D-C Plate Current	125 ma.	165 ma.	333 ma.	450 ma.
D-C Grid Current	40 ma.	39 ma.	90 ma.	85 ma.
D-C Grid Voltage	—120 volts	—80 volts	—150 volts	—200 volts
Plate Power Output	141 watts	235 watts	750 watts	1350 watts
Plate Input	188 watts	335 watts	1000 watts	1800 watts
Plate Dissipation	47 watts	100 watts	250 watts	450 watts
Peak R. F. Grid Input Voltage, (approx.)	250 volts	230 volts	395 volts	410 volts
Driving Power, (approx.)	9 watts	8 watts	32 watts	35 watts

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ZERO BIAS

EDITORIAL

All amateurs will mourn the sudden death on Sept, 2, of Kenneth B. Warner, W1EH, managing secretary of A.R.R.L. since 1919.

IN AMATEUR RADIO, at least, everything isn't beset with difficulties or disputes as one might be led to believe by reading "Zero Bias" month in and month out. On the contrary, it is the relative serenity of our hobby, the intense enjoyment that the participants derive, that makes it necessary for a page such as ours to point out the faults of our hobby. If we didn't they might pass unnoticed by the great majority of amateurs until the matter was past correction. "Zero Bias" tries at times to be the conscience of amateurs who are too busy to do anything but pursue their own course. But remember, at best it represents the opinion of one amateur, possessing all the human frailties plus those of the dyed-in-the-wool ham. We mention this because several recent letters have asked, "Is anything all right with amateur radio?" Sure, almost everything is all right. In fact, one of the few big troubles today is that there aren't enough amateurs to enjoy its blessings.

We can see the hackles rising on the necks of amateurs everywhere. But when the smoke clears away, the fact is there just aren't enough amateurs. Sure, all the bands are badly crowded at one time or another, but take 14 mc for example. In every 24-hour period there are more hours when 20 is relatively free from QRM than QRMd. Every other band could stand more occupancy based on this measure. Now it is true that you can't confine a new licensee to operating when QRM is the lightest. But why not try to encourage new licensees whose normal operating habits would fit into this grove. There is such a class and they make the best kind of amateur material.

Not so many years ago, when we might have been typed as a young squirt, we can remember going to every hamfest within walking or hitching distance of our home QTH. Two things stand permanently etched in our memories about these gatherings. The wonderful times we had and how we could always renew old acquaintances at them. Certainly one of the contributing factors to those wonderful times was the fact that there were so many amateurs pretty much our own age. We still have a good time today and we are still renewing old friendships, but they're the same old ones—the same faces and calls that we've known for ten or more years. There are far fewer young amateurs to be seen, and talking to them on the air will verify this.

Amateur radio today is attracting older men. There may be several explanations for this. It is more expensive to get going than before the war. Equipment prices have been forced higher along with everything else in our daily lives. Manufacturers know that they may be pricing themselves out of the lowest income market, but are powerless to do anything about it. A second, and perhaps even more compelling reason for this lack of enthusiasm for our hobby by the younger, or youngest generation, is they have had little encouragement.

It's an old story how the first amateurs have grown up and out of the tinkering stage. And so it is with the second generation and even third generation of amateurs. The war years have caused a tremendous gap between youngsters of today and the youngest pre-war group of amateurs. They have nothing in common, no talking or meeting grounds. It isn't a case of a high school junior talking to a young man starting college—it's a case of a kid in high school trying to talk to a man already out in the world trying to make his own way. Amateur radio could be a common meeting ground, but we are not giving it a chance. And what is happening is that we are creating a lost generation of amateurs—a generation that amateur radio can sorely afford to lose. We must have new amateurs to replace those who drop out, those who find other interests or have too little time, and at the present moment we're not doing that.

Don't think not having these youngsters means less QRM, because the active amateurs of today won't appreciate the difference in their lifetime of operation. It does mean that eventually there may be less QRM, and there may be less year after year until ham radio isn't justified in terms of its frequency allocations. It would be a crime laid directly on the steps of present day amateurs because in order to protect themselves against more QRM they didn't want to encourage new amateurs—they would be so selfish as to deprive others of the pleasure they themselves derive from amateur radio.

Now earlier in this discussion we mentioned how we thought all of our bands could stand greater tenancy during most of the day. And youngsters would give it the occupancy during these hours. While the OM was out bringing home the bacon they could be pounding brass. Between classes in the afternoon and dinner you could tolerate plenty more QRM. In the morning there is quite a difference between dashing off for the commuters train to get you to work at 8:30 and the youngster who can take a leisurely dash down the street to get into classes at 9. Sure they might even snag some of the choice DX, but that's a mighty slim reason to exclude them. And 40 and 80, with great wide open spaces would welcome some thumping and pounding. What does it add up to?

Well OM, and we do mean "old man," it is high time that present-day amateurs started a real "hell-for-leather" program to encourage new amateurs. Radio clubs in every city should organize classes, arrange cooperative programs with science teachers, etc. Code practice classes, simple theory,

(Continued on page 99)



"...accuracy with a vengeance!!"

W1BFT

W1BFT (Carl B. Evans, above) of Concord, New Hampshire, knows accuracy when he sees it. He is a member of the DXCC, A-1 Operators' Club, RCC and ORS, OPS, ex-SCM of N.H., WAS, WAVE, and has been an active licensed ham since February, 1925, thus automatically qualifying for the Old Timers' Club as well. On July 19 last he wrote us:

"I participated in the last frequency measuring test conducted by the A.R.R.L. over W1AW using a Collins 75A receiver and a 100 kc frequency standard. What I was trying to do was to see if I could qualify as a class II Official Observer with that equipment. Much to my surprise, the results were better than five times as good as required for Class I O.O. I thought you might be interested in the figures, so here they are:

"Number of measurements made were 14; 3 on 3.5, 3 on 7, 4 on 14 and 4 on 28 mc bands. *Average* error .00133% or 13.3 parts per million; Class I O.O requirements are 71.43 parts per million!! Best measurement was .02 kc low on 28 mc!!!

"That is what I call accuracy with a vengeance!! I knew the receiver was good, but hardly realized it was that good!"

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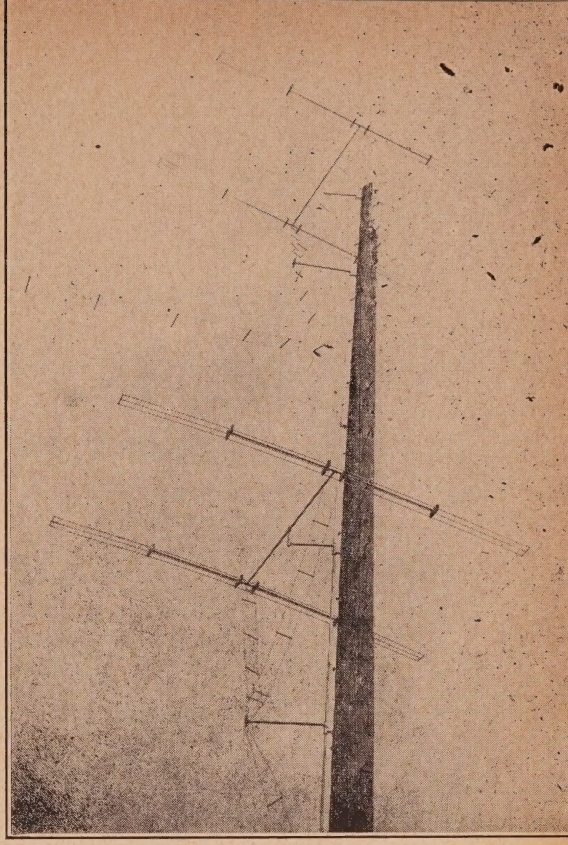


Fig. 1. This beam takes a big stick to support it. Spacing between sections on 28 mc is 25 feet.

The Improved Double Twin-3

HAROLD E. TAYLOR, W8RNC*

Further improvements and refinements of the popular Twin-3 beam giving greater gain and control of the vertical radiation pattern.

THE BASIC PRINCIPLES of the Single Twin-3 † and the Double Twin-3 ‡ have been known for the past few years. The original Twin-3 was developed by Dr. John D. Kraus, W8JK, of Ohio State University. The design is that of two half-waves spaced one-fifth wavelength apart and fed 180 degrees out of phase. Each 3-element doublet is constructed of 3 ultra close-spaced in-phase conductors with a spacing of 3 inches between centers. This has the effect of raising the feed-point impedance to match a 600-ohm open line.

The first Double Twin-3 built by the author was stacked at a distance of 0.45 wavelength.‡ Like all amateurs who are constantly looking for improvements, it was decided to increase this spacing to 0.75 wavelength. Theoretically, this would noticeably increase the power gain. An antenna of this spacing was built and is described here. The results obtained over a long period of 10-meter band operation have shown that the array does have more gain at this greater spacing. Quite possibly a still greater improvement might result if the spacing further approached 1.0 wavelength. In addition to this gain, a switching and phasing arrangement has been made where the operator may manually control the vertical radiation pattern.

*c/o Michigan Bell Telephone Co., 333 State St., Detroit 26, Mich.

†J. D. Kraus, "Twin-Three Flat-Top," *Radio*, Nov., 1939, P. 11.

‡H. E. Taylor and J. D. Kraus, "The Double Twin-3 Beam Antenna," *Radio*, Oct., 1940, p. 20.

Characteristics of the Twin-

For those who may be unfamiliar with this antenna, the advantages of the improved Twin-3 rotary beam over the customary two, three, and four-element parasitic beams are quite pronounced. The Twin-3 is entirely pretuned, prespaced and prematched by direct physical measurements. There is no pruning or need for adjustments once the beam is up in the air. The radiation pattern of the antenna described is similar to that of the conventional horizontal doublet with a figure of 8 pattern. The beam width is 60 degrees between the half-power points. Although the gain of these arrays is difficult to compute the probable gain at the 10-degree vertical angle is about 12 db above that of an isotropic radiator in free space. The radiation resistance is very high, thus precluding wet weather effects. The match between the transmission lines and the elements is excellent, insuring a very low SWR, even when operated broad-band from 10 to 11 meters.

Mechanically, the improved Twin-3 need only rotate 90-degrees either side of the starting position. This greatly simplifies the construction problem. It can be built at a reasonable cost and is light in weight. The use of tubing for the elements provides sufficient strength so that they will not bend out of shape due to ice loads. A variety of feed systems may be employed to suit the individual requirements.

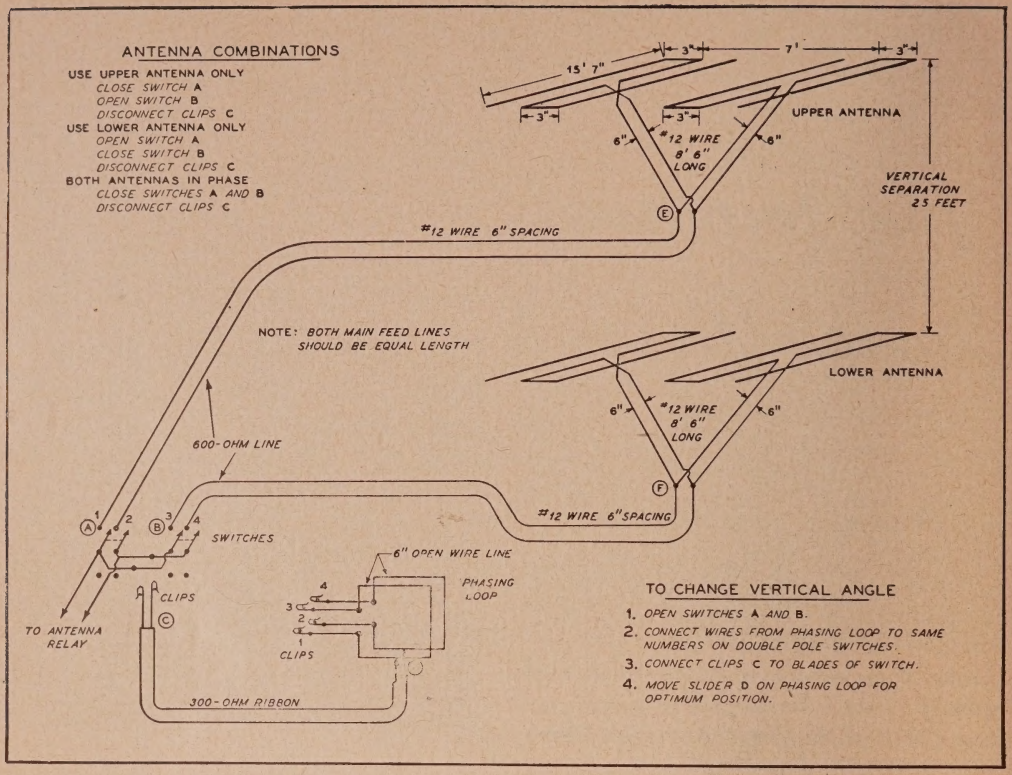


Fig. 2. Suggested method for mounting and switching the improved Double Twin-3.

Construction

The assembled beam is shown in *Fig. 1*. The array consists of two identical Twin-3 antennas spaced vertically 25 feet apart. Both antennas are supported from a ½-inch diameter vertical pipe running up the side of the telephone pole. This pipe is supported by five pipe flanges and five 2-inch long nipples. At the outer end of the nipples are ¾-inch tees. The vertical pipe is fed through the tees. This permits the pipe to be turned freely by the rotating mechanism.

Above ground on the main vertical pipe 24½ feet high is a tee fitting used to hold a short piece of ¾-inch water pipe about 20 inches long perpendicular from the telephone pole. This pipe guides the feed line that is connected to the bottom of the "V" section of the lower antenna. Ten feet from the top antenna, on the main vertical pipe, another tee fitting was used to serve the same purpose; i.e., to guide the feed line serving the upper antenna. Unlike the earlier Twin-3 models separate feed lines run from each antenna into the shack.

At a somewhat lower point each main feed line is fastened to the pole with insulators to relieve the strain on the guide arm. The top antenna in *Fig. 1* is 57 feet above ground and the lower antenna is 32 feet. When the array is turned both guide arms rotate to keep the feeders from becoming tangled. Any standard rotating device can be used for changing direction of the antenna.

A suggested method of mounting the radiators is shown in the photo. The cradle unit may be used as illustrated or the center crossarm fitting may be enlarged until the whole antenna is mounted on one vertical pole. The elements are 3/8 inch diameter aluminum tubing. The spacing between tubing is three inches center-to-center.

The *Q* sections and main feed lines are all made of No. 12 wire spaced 6 inches apart. It is not necessary to use high-cost insulators because the voltages are fairly low on the line. Wooden dowel rods, 6 inches long, well varnished, have been in use at W8RNC and have served very well. The two quarter-wave *Q* sections feeding the upper Twin-3 hang in the customary "V" as shown in *Fig. 2*. The same principle applies to the lower Twin-3 beam also. From the bottom of the "V" as shown in each antenna is a separate 600-onm line that connects to switches in the shack. Both lines were kept as far apart as possible outside the building to prevent mutual coupling.

In one of the *Q* section legs to each Twin-3 is an ordinary transposition block. The common 2-inch type has proven to be satisfactory. The fact that the line changes spacing for such a short distance is of no consequence as far as an impedance irregularity is concerned.

Dimensions

The Twin-3 described in this article was designed for operation at 28.7 mc. The radiator and *Q* section

lengths may be scaled to any other frequency in the 10 and 11-meter band. The basic length of the radiator is 0.91 of the free space wavelength.

It would be customary to make both main feed lines equal in length. An alternate method would be to make one feed line a half-wavelength longer, but transposed at the point where the two feed lines join together at the station. This transposition would keep the two lines in-phase because of the difference in their lengths.

All linear dimensions were made on the tubing of the radiators before crimping the ends, used for holding the 3-inch tie pieces. Brass nuts and bolts should be used for fastening the tie pieces to the elements. The feed lines are also fastened to the radiators with small size brass nuts and bolts.

It is particularly important that the SWR be very near unity on both main transmission lines. If by some error in construction, the SWR is abnormal on either line it can be lowered by using a very short length matching stub.[1] The SWR, current or voltage, on each feed line tested separately should be less than 1.2:1. If the ratio exceeds this value there will be a noticeable change in the final tank plate current when using the phasing loop described below.

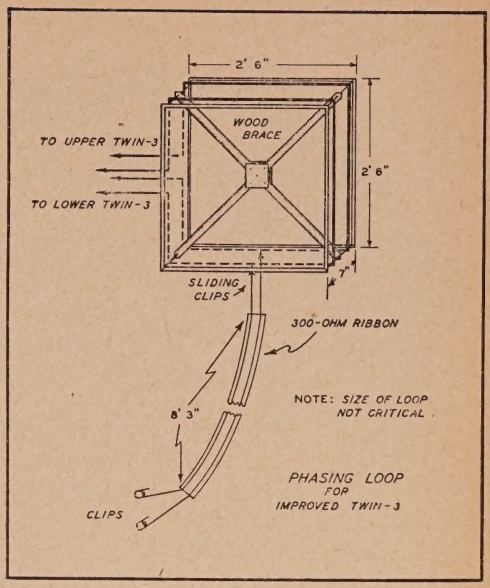


Fig. 3. Phasing loop, which in conjunction with feeder switches permits control of angle of radiation from operating position.

Phasing Feed Systems

There are two different practical methods by which it is possible to control the vertical angle of radiation. Both methods are in use at W8RNC. In the first method each feed line is terminated on a separate double-pole switch. The arrangement is shown in *Fig. 2*. The blades of both switches are tied together so that it is possible to shift from one antenna to the other; i.e., from the upper Twin-3 to the lower Twin-3.

If both switches are thrown in at the same time, the two beams, upper and lower, are driven in phase. The feed line from each antenna is poled properly at the switches. This can be readily detected by listening to signals on the receiver when poling first one lead and then the other. The poling giving the greatest S-point reading is the correct one to use.

Changes in the angle of radiation, of course, result from the difference in height above ground of the two antennas. There is no one best vertical angle suitable for all skip distances and hence no one best height for an antenna above ground. In theory, a good arrangement would be to put the antenna on some type of vertical lift or elevator and then adjust the height above ground to optimum for each contact. A much simpler and nearly equivalent arrangement is to have two antennas at different heights (ideally the vertical lobe pattern at one height should have maxima where the other has nulls, so that the combination of the two fills in at all vertical angles). Thus, by switching in one, or the other, or both together with the phasing loop, the best angle can be found for each contact.

The above assumes a good ground reflection factor which means little in the way of obstructions in the vicinity of the antenna. Gains of 6 db can be obtained when the direct and reflected waves add in phase. Therefore, phasing is an important point to consider in obtaining added signal strength.

The second method of controlling the angle of radiation employs the phasing principle. The phase

(*Continued on page 80*)

[1] H. E. Stewart, "Feeding the Beam," *CQ*, Mar., 1948, p. 42, Fig. 6.

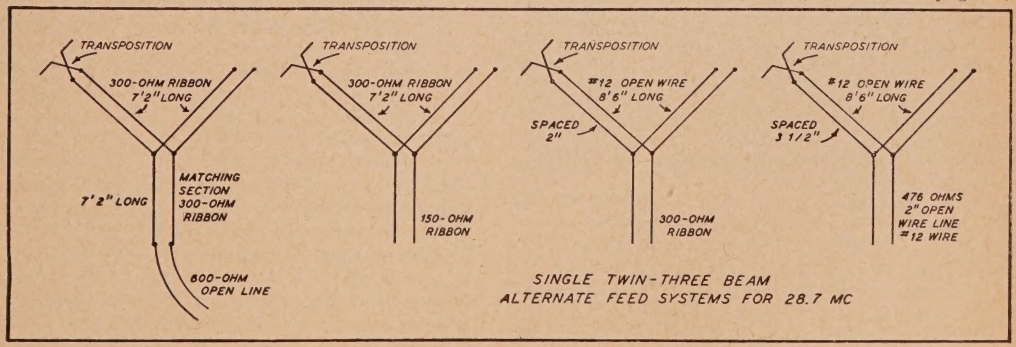
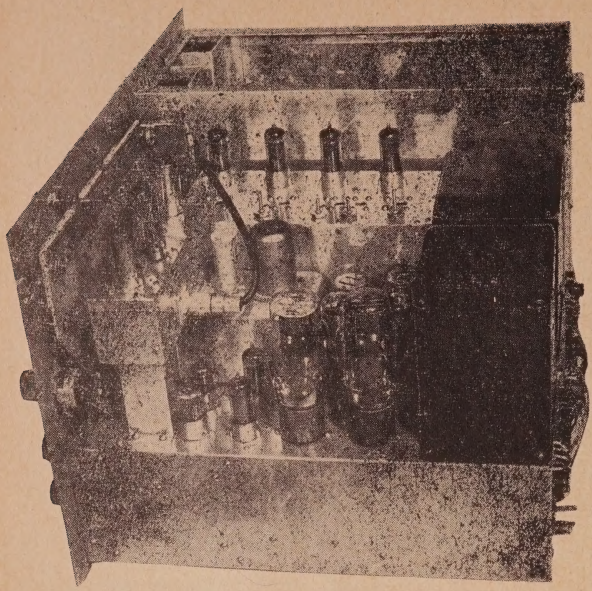


Fig. 4. Alternate feed systems for installations where standard 600-ohm line is impractical.



Interior view. The 70E-8 v-f-o subpanel with dial is at the left. The isolator-modulator chassis is parallel to the front panel, and is mounted on top of the v-f-o case. In the foreground may be seen the bracket supporting the Jones power plug at this end of the chassis. The flexible shaft for the 3.5-mc doubler trimmer may be seen running to the panel. The r-f coax output lead goes to the left of the ganged doubler chassis on which may be seen the four 6AQ5s, the slug tuning screws, and the holes for the tracking trimmers.

The two low-power transformers are at the right. The four VR105s are to the right of the v-f-o case and the two 5R4GYs are in front of these. The four miniature tubes on the main chassis are the 12AU7 gating amplifier and a-f oscillator, 6AU6 speech amplifier, and the two keying control tubes. The deviation control pot is on the panel in the left foreground. At the extreme rear is the final amplifier compartment. The completely shielded grid and plate meters are at the left end. The r-f output connectors are at upper right.

Gold-Plated Special

WILFRED M. SCHERER, W2AEF*

NO TWO EXPERIENCED operators will agree upon the most desirable features to be incorporated in an amateur transmitter. And so it was in one of those very common bull sessions among amateurs that this author made the fateful mistake of asking our friend W2IOP to set down on paper what he would consider the ultimate in exciters based on correspondence across his desk and, even more important, his personal operating experiences. The results were staggering—he wanted everything but a built-in rotary. Before outlining the requirements, let us say with some relish that they all were met. The final transmitter is of necessity fairly complex, and in cost will approach that of an average communications receiver, but it incorporates all the versatility that we have come to expect of our receivers, a feature still unique in transmitter design. Because of its completeness, and in acknowledgment of the fact that cost was not the primary consideration, we have affectionately labeled the completed rig the "Gold-Plated Special."

The requirements, and thus the salient features of the Gold-Plated Special are as follows:

1. A precision v.f.o. directly calibrated.
2. Bandswitching and gang tuning on 80, 40, 20, 15, 11, and 10, with the exception of the PA coil which is accessible through a door in the front panel.
3. A final amplifier which will operate efficiently at low input for driving or efficiently as a complete transmitter capable of running up to a quarter kilowatt input.
4. Low impedance output coupling link adjustable from the front panel.
5. Absolutely clean, chirpless and clickless keying.
6. Variable audio tone keying monitor.
7. Gating amplifier for automatically cutting receiver output during c-w or phone transmissions for complete break-in operation.
8. Phase modulation on all bands.
9. Integral precautions for TVI and BCI reduction.
10. Automatic protection from excitation failure.
11. Conveniently grouped controls for all types of operation.
12. Maximum accessibility of components for maintenance purposes.

In addition to the above features, the layout is such as to permit construction of only portions of the unit, in case the builder wishes to make changes to meet individual requirements. For instance, it may be desirable to build only the v.f.o. and ganged doubler, or exciter section of the unit to drive an already constructed final. Or a smaller final may be installed in the left-hand compartment in which there would then be left sufficient space for an

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Designed as either an exciter or transmitter the Gold-Plated Special works like this: The headphone output of the receiver feeds directly into the front panel of the transmitter. Headphone output is taken from an adjacent jack. Throwing the control switch up feeds a signal from the v.f.o. into the receiver for spotting. The continuously running v.f.o. is completely inaudible unless this switch is closed. In neutral position the receiver feeds through to the headphones and all transmitter functions are dormant. With the control switch down the receiver is still heard—until the key is closed. At that instant the receiver is muted and an audio monitoring tone is heard. If desired, in conjunction with the plate control switch on a standard communications receiver, this switch when depressed will cut the receiver B+, or control any other external circuits, such as antenna change-over relays, high-power primary control relays, etc. Design refinements include the v.f.o. and principal control circuits on the right-hand side for maximum operating ease. Keying is clean, break-in instantaneous. Phone operation excellent. The one coil to be changed is accessible through a carefully shielded front trap door. Calibration is direct on all bands. In three weeks of varied operation as an exciter and transmitter, WAC on phone and c.w. was worked almost daily. In a competitive operating event on average of 47 stations per hour were worked. Due to internal precautions, the rig has caused no BC1 or TV1. It is versatility plus!

amplitude modulator. Or the power supply may be constructed externally and its space used for some other purpose.

Circuit Description

The heart of the Gold-Plated Special is the v.f.o., a Collins 70E-8 permeability tuned oscillator. The use of a commercially manufactured v.f.o. saves a tremendous amount of work, especially since the 70E-8 is compactly built and completely finished. It is a precision instrument with directly calibrated dial scales having graduations every 500 cycles at 3.5 mc, 1 kc at 7 mc, 2 kc at 14 mc, and every 5 kc at 21 and 28 mc. The 27-mc band also is included in the calibration. Reference to calibration charts or the necessity of interpolation is not required. Once set with WWV, the calibration may be relied upon to within 0.015%—that's ½ kc on 80!

The 70E-8 has one disadvantage, it does not readily lend itself to keying. This could be bothersome for break-in operation on 3.5 mc; however, with the shielding and loading employed absolute isolation was realized. There is no trace of the oscillator signal on 80 when dead beat, even with the receiver gain wide open!

The oscillator, which operates from 1600 to 2000 kc, is followed by a capacitively coupled untuned Class A isolation stage utilizing a miniature 6AU6. The very low g-p capacitance of this tube makes it ideal from the standpoint of maximum isolation and minimum leakage. A 6AK6 will deliver a slightly higher output but will have less isolation.

From the circuit diagram, *Fig. 1*, it will be noted that the output of the oscillator is by-passed to ground through a 100-$\mu\mu$f capacitor, C_3. This serves two purposes. First, the entire output of the v.f.o. is not required and reduction by this method considerably enhances minimization of r-f leakage at 3.5 mc. Second, variations of loading caused by changes in the following stage are virtually washed out, thus making possible chirpless keying of the isolation stage.

The next stage is a 3.5-mc doubler using a 6AK6. Its output tank is both slug and capacitively tuned. Ganging of the tuning of this circuit in conjunction with the other stages is unnecessary. The trimmer capacitor, however, is controlled from the front of the panel because an optimum adjustment is required for phase modulation of this stage. This will be fully explained later.

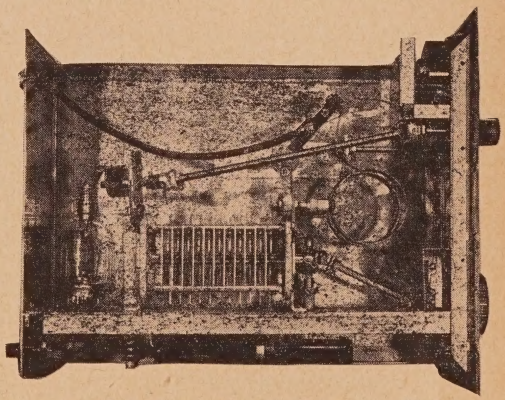
The output from the 3.5-mc doubler is not sufficient to drive the final amplifier, so it is coupled to a 6AQ5 3.5-mc amplifier which is used to drive the final. The 6AK6 is connected to the 6AQ5 through a low-impedance link fed directly to the 6AQ5 grid. Neutralization of this stage is then not required.

On the other bands, grid drive for the final is obtained from a 6AQ5 7-mc doubler, a 6AQ5 14-mc doubler or 21-mc tripler, and a 6AQ5 27-28 mc doubler.

Gang-Tuned Multipliers

The 6AQ5 3.5-mc amplifier and the following frequency multipliers are band-switched and gang-tuned with the main oscillator dial. Ganging of the final output stage was originally considered but, due to lack of suitable space and the lack of ready-built components adaptable for such use, it was ruled out. Only slight trimming of the final is usually required anyway, and the additional complications necessary for the very slight added convenience of ganging the final was deemed unnecessary.

Ganged tuning of the driver stages is employed in preference to "broadbanding" because sufficient drive for the output stage would then require larger doubler tubes and a considerable waste of power. The possibility of TVI is also lessened.



Interior of final amplifier compartment. The 4-65 and the plate trap are at the left. The final 6AQ5 and VR105 keying tubes are hidden by the 4-65. The plate choke is on a stand-off under the coil. The small plate on the compartment side behind the coupling link mount covers the doubler grid trimmer holes. Note the meter shields. The shielded micro-switch interlock is in the lower right foreground.

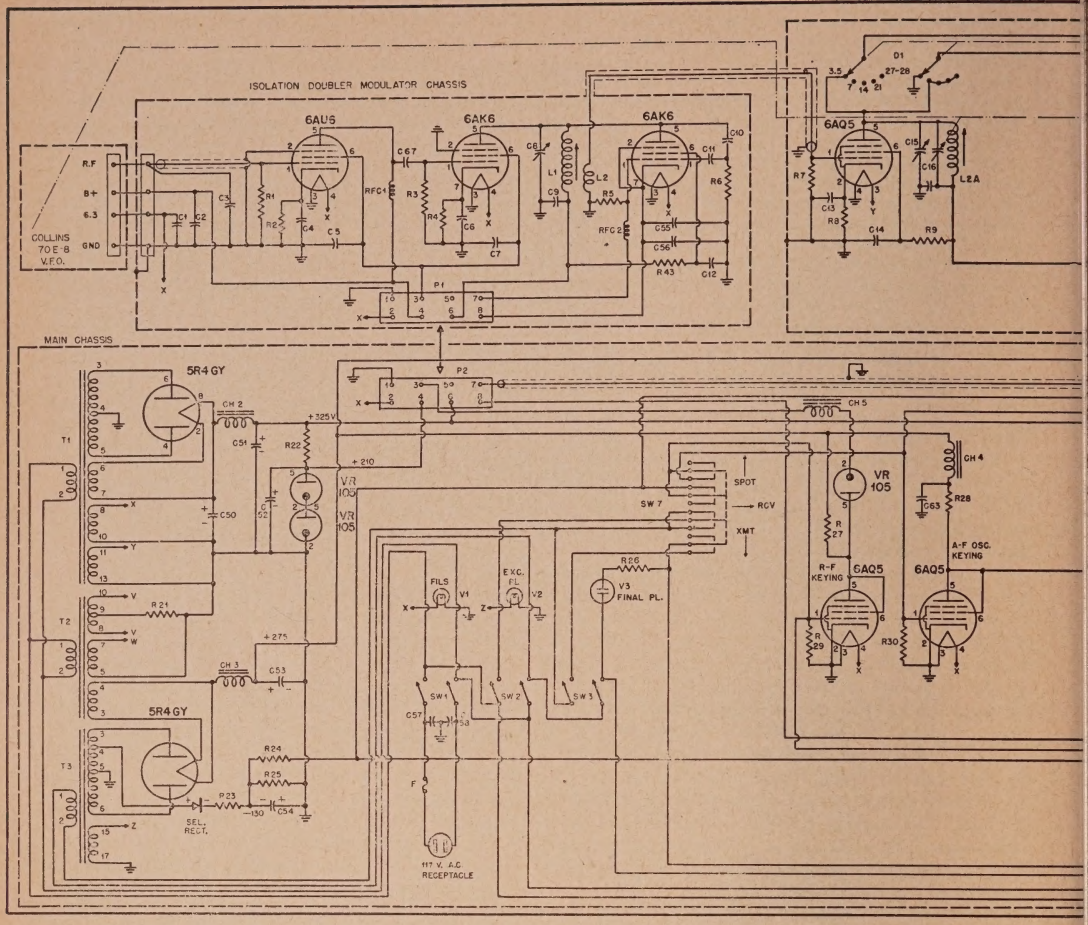
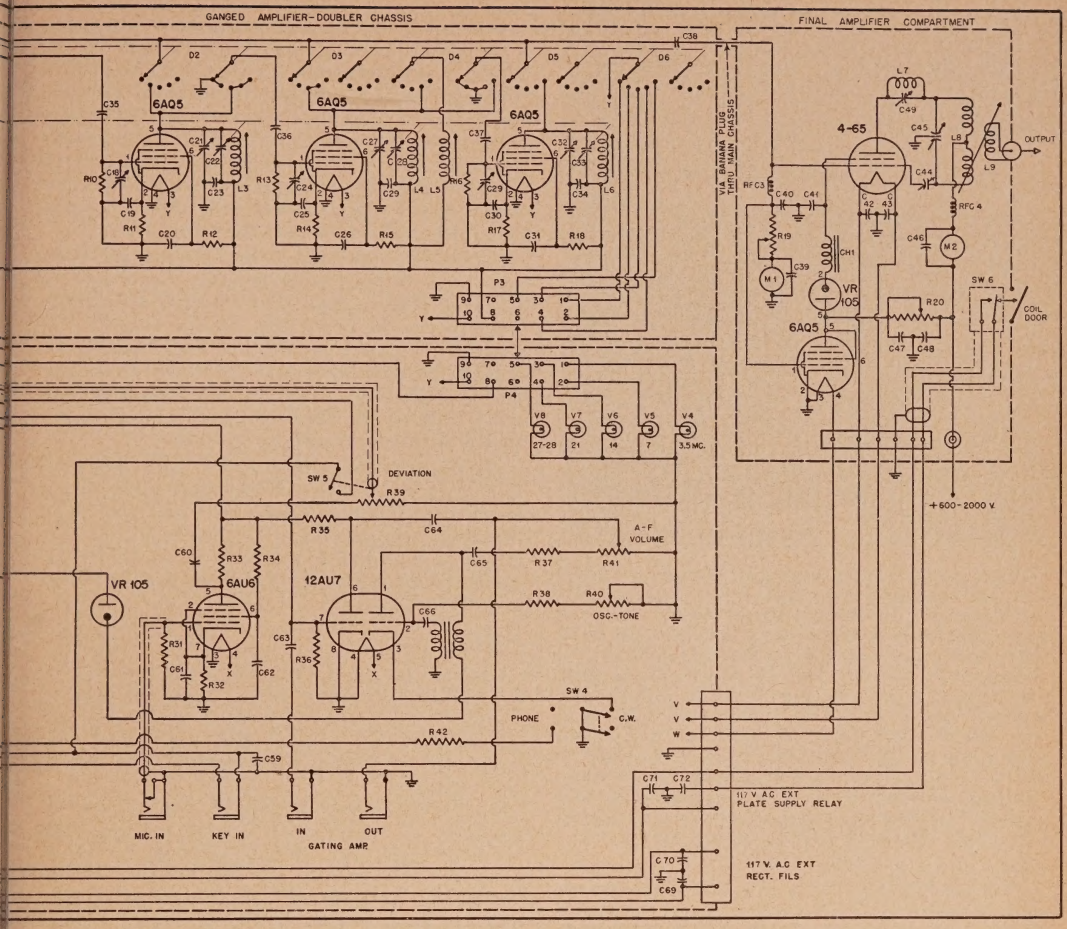


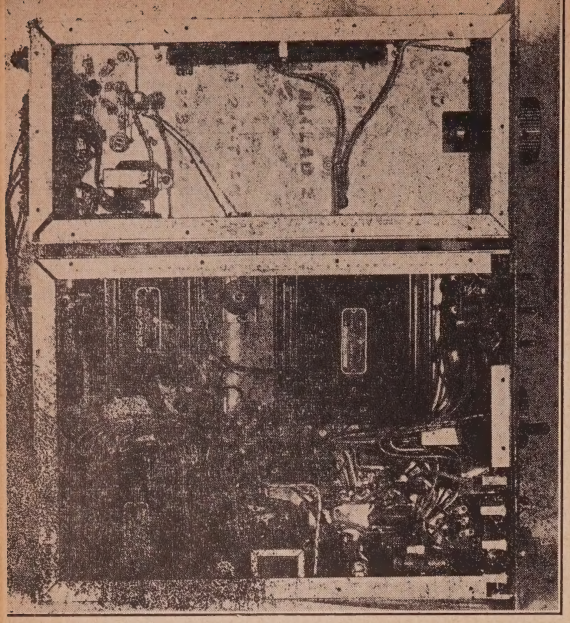
Fig. 1. The complete circuit and parts list for the

C1, C2, C4, C6, C9, C13, C14, C17, C19, C20, C23, C25, C26, C30, C31, C34—.01 μf, 500 v., Centralab Hi-Kap.
C3—100 μμf, zero temp.
C5, C7, C11, C12—.001 μf, 500 v., Centralab Hi-Kap.
C8—50 μμf, Hammarlund APC.
C10—2.5 μμf, Centralab NPO.
C15—13-45 μμf, Ceramicon trimmer.
C16, C33—National UM50.
C18, C24, C29—5-30 μμf, compressor-type trimmer.
C21, C27, C32—3-12 μμf, Ceramicon trimmer.
C22, C28—National UM15.
C35, C36, C37, C38, C67—100 μμf, 500 v., Hi-Kap.
C39, C42, C43, C46—.01 μf, 500 v., mica.
C40, C41—.002 μf, 500 v., mica.
C44—Neutralizing, see text.
C45—100 μμf, B&W type JCX100E.
C47, C48—.001 μf, 500 v.,mica.
C49—National UM75.
C50, C51, C52, C53, C54, C68—8 μf, 450 v.
C55—.005 μf, 500 v., Centralab Hi-Kap.
C56, C61—10 μf, 20 v., electrolytic.
C57, C58, C69, C70, C71, C72—.002 μf, 500 v., mica.
C59, C60, C63, C64—.01 μf, 400 v., paper.
C62, C65—.1 μf, 400 v., paper.
C66—.005 μf, 400 v., paper.
R1, R3, R7, R10, R13, R16, R25, R35—100K, ½ w.
R2, R4—500 ohms, ½ w.
R5—1M, ½ w.
R6—1000 ohms, ½ w.
R8, R11, R14, R17—560 ohms, 1 w.
R9, R12, R15, R18—15K, 1 w.
R19—6K, 25 w.
R20—25K, 100 w, for voltage over 1250, add 15K.
R21—250 ohms, 10 w.
R22—5K, 25 w.
R23—50K, 1 w.
R24—50K, ½ w.
R26—20K, ½ w.
R27, R28—10K, 10 w.
R29, R30, R31, R36—2M, ½ w.
R32—2100 ohms, ½ w.
R33—1.2M, ½ w.
R34—470K, ½ w.
R37—220K, ½ w.
R38—5K, ½ w.
R39—1M pot with SPST switch.
R40, R41—50K pot.
R42—2250 ohms, ½ w.
R43—15K, ½ w.
(All resistors standard IRC).
CH1, CH4—6 hy, 30 ma, midget.



Gold-Plated Special. Each integral section is enclosed in dotted lines.

CH2—Kenyon T376.
CH3—Kenyon T510.
CH5—15 hy, 10 ma, midget.
T1—Kenyon T206.
T2—Kenyon T515.
T3—Kenyon T215.
Sel. Rect.—Selenium Rectifier, 50 ma.
SW1, SW2, SW3, SW4—DPST toggle.
SW5—SPST attached to pot.
SW6—Microswitch, press to close.
SW7—4PDT anti-capacity switch.
V1—Pilot 6.3 v. (blue).
V2—Pilot 6.3 v. (green).
V3—Neon NE51, Bayonet (red).
V4, V5, V6, V7, V8—Bandswitch pilots, 6.3 v.
RFC1, RFC2, RFC3—2.5 mh, National R100S.
RFC4—2.5 mh, National R100U.
F—Fuse, 3 amp.
P1—Jones Plug, P-308-AB.
P2—Jones plug, S-308-AB.
P3—Jones plug, P-310-AB.
P4—Jones plug, S-310-AB.
M1—0-25 ma.
M2—0-250 ma.
D1—SW deck #1. Mallory 191C.
D2—SW deck #2. Mallory 191C.
D3—SW deck #3. Mallory 191C.
D4—SW deck #4. Mallory 191C.
D5—SW deck #5. Mallory 191C.
D6—SW deck #6. Mallory 191C.
L1—140 turns No. 38 enam. close wound on National XR50 slug form.
L2—10 turns No. 32 enam. close wound at bottom of L1.
L2A—35 turns No. 26 enam. close wound on National XR50 slug form.
L3—26 turns No. 26 enam. close wound on National XR50 slug form.
L4—12 turns No. 22 enam. close wound on National XR50 slug form.
L5—10 turns No. 22 enam. close wound on National XR50 slug form.
L6—4 turns No. 22 enam. double space wound on National XR50 slug form.
L7—5 turns No. 14 enam. 5/16" I.D.
L8—3.5 mc: B&W 80 BVL.
7 mc: B&W 40 BVL.
14 mc: B&W 20 BVL.
21 mc: B&W 20 BVL (one turn removed from each half).
28 mc: B&W 10 BVL.
L9—B&W BVL swinging link.



Bottom view. Main chassis, at bottom, is packed full, but all components are readily accessible for maintenance. The filament transformer (T3) is at bottom. The small choke at top is CH2 and the larger one is CH3. Between these chokes is the banana plug receptacle for r-f output from the ganged stages which runs through upper side of main chassis to final compartment above. In the lower left corner of the final stage are the 6AQ5 and VR105 sockets, and at their right is the screen choke CH1. Above the choke is the round polystyrene feed-through for the neutralizing lead. The grid choke is at the right of the 4-65 socket. HV connector on rear of amplifier is at upper left. Note shielded h-v leads. R20 is at top.

The employment of iron slug-tuned inductances together with variable capacitor padders produces circuits of good *Q* and makes tracking alignment simple.

The 4-65 Power Amplifier

The final amplifier tube is an Eimac 4-65 tetrode, chosen because of its low grid drive requirements (approximately 2 watts), and because it is highly efficient with plate potentials of from 600 to 2000 volts. When driving a 1-kw final it will just loaf along, or, when feeding an antenna directly, may be loaded up to 250 watts input.

The 4-65 is capacitively coupled to the preceding stage. From the standpoint of TVI, link coupling would have been preferable, but the complications involved with the additional tuned circuit plus the additional switching of the link would not be worth the possible improvement.

No special precaution for grid and plate isolation is followed inasmuch as it is more satisfactory to employ neutralization. The use of the new type B & W butterfly variable tank capacitor permits an ideal layout for maximum circuit efficiency.

The final tank inductances are the B & W plug-in type. Plug-in coils are used in preference to a band-switch turret for highest efficiency and because there is no such commercial unit available with variable output links. The variable output link is a "must" for an all-around exciter-transmitter. The use of plug-in coils is made convenient through the installation of a small door on the front panel so the coils may be changed from the front of the unit, thereby eliminating the usual inconvenience of plugging in coils from the back of a rack or through the top of a cabinet. As a personal safety measure, an interlock removes the high voltage from the final when the coil door is opened. The output coupling link is adjustable from the front of the panel.

In order to attenuate harmonic radiation, which may cause TVI, a parallel resonant trap is included in the 4-65 plate lead. For optimum adjustment, the trap may be tuned from the front panel. The range of the trap is 50 to 85 mc and, of course, will handle only one harmonic. If an additional harmonic in this range should require attenuation, another trap for the desired frequency could be installed in series with the present trap.

As an added precaution against TVI, the entire final amplifier, including the grid and plate meters, is mounted in a closed aluminum compartment. All power leads are isolated or by-passed, and an additional r-f output receptacle is included for the installation of an antenna feed line harmonic shorting stub, if required.

Clickless Keying

Clickless keying is obtained through the use of the VR tube keying system. This was recently described in *CQ*[1], so explanation of its operation will not be made. The control tubes used are 6AQ5s. Initial keying bias is obtained from the regular power supply.

One VR tube keying setup is used to key the screens of the 6AU6 isolation stage and the 6AK6 3.5-mc doubler, with the final being automatically screen keyed by another VR tube system. At first this was not quite the ultimate because some slight click was noticeable on the keying "make." Oscilloscope observations showed that the VR tube keying system produced too steep a keyed wavefront. A small choke inserted in the keyed screen line of the low powered stages together with a similar choke in the final screen lead completely cleared up the difficulty by slightly sloping the wave front and rounding off the top leading edge without introducing any audible lag.

Some click was originally found on "break" and was readily cleaned up by a .01-μf capacitor (*C59*) connected from the "cold" side of the key to ground. A larger capacitor will produce a noticeable lag. Automatic VR tube keying of the final has the added advantage of protecting the 4-65 from excitation failure.

Audio Keying Monitor and Gating Amplifier

At first the audio keying monitor and gating amplifier, as recently described by W2ESO,[2] was installed. Bias for keying the VR keying control tube was obtained from the keyed bias produced by the a-f oscillator through the 6AL5 rectifier and applied to the gating amplifier. This worked well

1 Mack Seybold, "Clickless Keying Using VR Tubes," CQ, May 1948, p. 37.

2 Eugene Black, "The T9'er," CQ, April 1948, p. 17.

except that sufficient filtering for elimination of audio tone modulation of the bias applied to the 6AQ5 VR control tube introduced too much lag. It was therefore necessary to modify the system so that the gating amplifier and the 6AQ5 control tube obtained keyed cut-off bias directly from a separate d-c bias supply. Some method was then required to key the a-f oscillator. It could have been keyed in its cathode, but this would have required a keying relay in-as-much as the key was already in use in the VR keying control tube bias line. Rather than use a relay, another VR tube control circuit is used to key the a-f oscillator plate supply.

Phone Operation

One of the objectives of this exciter-transmitter is the reduction or elimination of possible TVI and BCI. The clickless keying system accomplishes this from one standpoint. Phase modulation adds another feature for interference reduction.

Modulation is obtained by a 6AK6 variable reactance tube which produces phase modulation of the 3.5-mc 6AK6 doubler. The general principles of this system have been outlined in numerous publications. Phase modulation of an amplifier, especially in this case, has an advantage over frequency modulation of an oscillator in that the oscillator is left undisturbed and frequency stability is assured.

As previously mentioned, the 3.5-mc doubler includes a trimmer capacitor adjustable from the front panel. This is necessary for proper phase modulation as the doubler plate tank must be tuned slightly off resonance to obtain maximum deviation. In this unit, the deviation is adequate for 3.5-mc operation and is more than sufficient for the higher frequency bands. A 6AU6 speech amplifier is included together with a deviation control.

Power Supply and Control Circuits

All filament voltage is supplied by transformers mounted within the unit. All plate power, except that for the final, is also self contained. Final plate power is obtained externally, primarily to add to the versatility of the unit, since the 4-65 may be operated at high efficiency over a wide range of plate potentials. Keying bias is obtained through a selenium rectifier from a tap on the high voltage winding of one of the internal power transformers.

The first toggle switch (to the left) operates all the filaments. Extra terminals are provided at the rear of the chassis so this switch will also operate external rectifier filaments. The low-voltage supply for the v.f.o. and audio system is turned on simultaneously.

A second switch closes the a-c circuit for the plate supply feeding the ganged amplifier and doublers, but it is arranged so that plate power can not be actually applied until the anti-capacity SEND-RECEIVE control switch is in the correct position.

The third toggle closes the a-c circuit to terminals at the rear of the unit connected to an external relay for the final plate supply. If desired, an antenna relay may also be bridged across these terminals. The circuit likewise is not actually completed until the anti-capacity switch is in the correct position. The PA door interlock also must be closed before completion of the circuit.

The plate switches are connected in an interlocking arrangement so that doubler plate power is not available unless the filament switch is on, and final plate power is not available until the doubler plate switch is on.

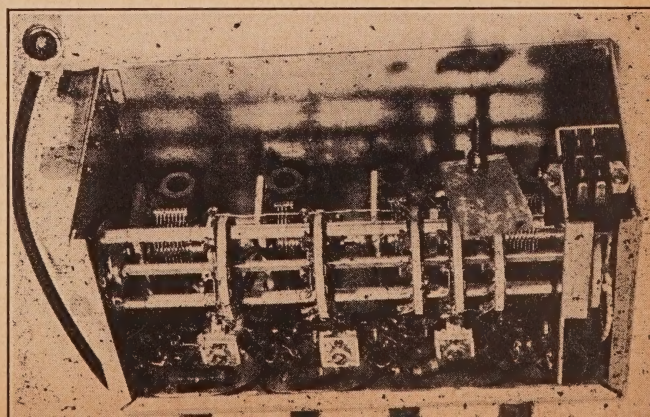
For receiving, the anti-capacity switch is in the neutral position. For frequency spotting, the switch must be placed in the "up" position where it completes the a-c circuit for the doubler plate supply, and where it also shorts the key jack so screen voltage will be applied to the isolation and 3.5-mc doubler stage. Simultaneously the key bias line to the a-f oscillator and the gating amplifier is opened to permit receiver output to be heard for frequency spotting.

With the switch in "down" position, the unit is ready for transmitting; provided, the two plate switches are on. In this position the a-c circuit to the doublers and the final plate relay is completed, and the a-f oscillator and the gating amplifier are connected for keying operation. When the key is closed the transmitter is on the air, the monitor tone is fed through the headphones and the receiver output blocked.

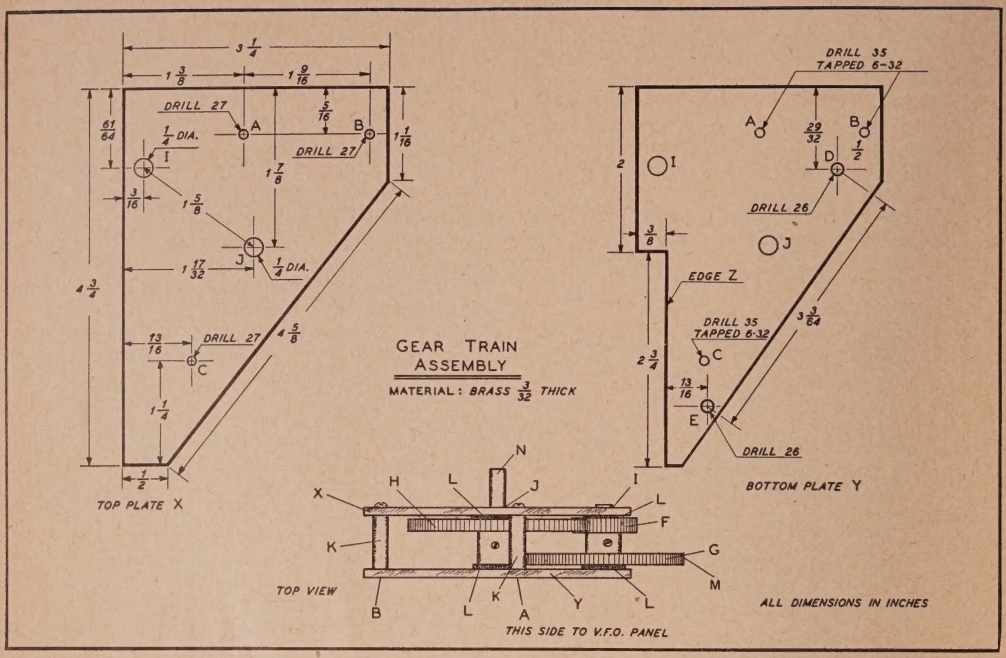
For phone operation, a C.W.-PHONE switch is placed in the "phone" position where it opens the bias line to the a-f oscillator control tube and completes the cathode circuit of the 6AK6 phase modulator. The deviation control is advanced, closing the attached switch which shorts the key jack.

Physical Layout

There are two separate sections comprising the transmitter. On the right is the low power main chassis. On the left is the final amplifier compartment. This reversal from the customary practice of having the final on the right was made so the exciter-transmitter could be set at the left of the



Interior view of the ganged doubler chassis. The 3.5-mc amplifier is at the left and is followed by the 7-mc doubler, etc. Slug tuned coils are along the rear and sockets are in foreground. Compressor type grid trimmers are positioned so adjustment is possible through side of chassis. Above bandswitch is the polystyrene strip with the r-f output banana plug. This strip is bolted to the side of chassis. The shield for supporting one end of bandswitch and the Jones power plug is at right. The pilot light switch deck is under the Jones plug.



receiver, enabling easy operation of the key and receiver controls by the right hand without getting one's arms all tangled up.

The 70E-8 v.f.o. is mounted at the center of the low-power section above the main chassis. The 6AU6 Class A isolation stage, the 6AK6 3.5-mc doubler, and the 6AK6 phase modulator are mounted on a small homemade aluminum chassis which is mounted on top of the front part of the v.f.o., so the banana pin jacks, comprising the oscillator power terminals, plug into the bottom of the small chassis at its left. Mounted underneath the right end of this chassis is a male Jones plug which plugs into a companion plug mounted on a standoff bracket above the main chassis. This plug accommodates the power and audio leads for the plug-in unit and the v.f.o.

The r-f output is taken from the rear of the small chassis and is fed through a short length of coax to the ganged amplifier and doubler stages, which are built on another homemade chassis plugged in at the left of the v.f.o. This chassis also has a male Jones plug for power connections mounted underneath. The r-f output to the final is fed through a banana plug also at the bottom.

The ganged variable capacitors on this chassis are coupled to a simple gear train mounted on the v.f.o. Mechanical connection is made by a Millen 39006 detachable flexible isolantite coupling which makes possible easy removal of the chassis. The band-switch is connected to its panel control by a sleeve type coupling.

The aforementioned gear train is made using standard gears. Its appearance makes it look com-

Fig. 3. Gear Train Assembly

The bottom plate *Y* is cut and drilled the same as the top plate *X*, except holes *A*, *B*, and *C*. These are drilled with a #35 drill and are then tapped for 6-32 screws. Two additional holes *D* and *E* are drilled in the bottom plate. These should line up with existing holes on the v-f-o subpanel and are used for fastening the gear train assembly to the v.f.o. An additional long slot is cut along edge *Z* of the bottom plate to clear the "*U*" bracket supporting the oscillator.

When drilling the two plates, clamp them together so the holes for both plates may be drilled simultaneously, thereby assuring accurate alignment.

Gear *H* (Boston gear #G149) is furnished with a hub and has a 5/16" diameter shaft hole. Therefore it is necessary to insert a split sleeve reducing the hole to ¼". The sleeve should be squeezed tight by a set screw in the hub, when it is mounted on the ¼" shaft *J*. A ⅜" sleeve might be more easily obtained; if so the 5/16" hole may be drilled to *H*"l

Gear *G* (Boston gear #G148) requires only a set screw in its hub.

Gear *F* (Boston gear #G139) is furnished without a hub and with a 3/16" hole. This must be drilled and reamed to ¼". Drill the hole several times in small steps using increasingly larger drills until almost ¼" is reached. It should then be reamed until it makes a tight fit on the ¼" shaft *I*. A few slight burrs should be made with a centerpunch around the portion of the shaft intended to accommodate the gear before forcing it on. If the "wedge fit" arrangement is not used, the gear may be soldered to the hub of gear *G* after both are mounted on the shaft.

The top and bottom plate are held together by 6-32 screws through the *H*" spacers ⅝. Brass washers *L* are inserted so the through the ½" spacers *K*. Brass washers **F** are inserted so the gear teeth will clear the side plates and to balance or eliminate end play which may throw the gears out of mesh.

When the assembly is mounted on the 70E-8 v.f.o., edge *M* of gear *G* should mesh with the gear already furnished on the v.f.o. for operating the dial cord.

The doubler ganged capacitors are coupled to the ¼" shaft *J* at *N*. 180° rotation of the capacitors will result over the full range of the v-f-o dial.

plicated but, actually, it is very simple and will be explained under "construction."

Immediately behind the small "isolation-modulator" chassis and mounted on the main chassis are the 6AU6 speech amplifier and the 12AU7 a-f oscillator and gating amplifier. Behind these are the 6AQ5 oscillator and screen keying control tubes. The two 5R4GY rectifiers are along the right edge of the chassis and, in the center, behind the v.f.o., are the screen keying VR105, the oscillator keying VR105, and the two VR105s for the v.f.o.

Along the rear are the two plate transformers. All other transformers and chokes are mounted underneath the main chassis.

The 4-65 is at the rear of the final compartment. Next to it are the 6AQ5 and VR105 final keying tubes. The plate trap is mounted on a 3" isolantite stand-off next to the 4-65. The final plate coils are plugged into a mounting at the front of the butterfly capacitor. Along the right side of the compartment is a small swinging cover for shielding three holes through which grid trimmers on the doublers in the multiplier stage chassis may be adjusted. Note that the grid and plate meters are completely shielded.

On the panel, the two knobs under the meters adjust the plate trap and the output link. The coil door is below these. A shielded microswitch, serving as a high-voltage safety interlock, is mounted behind the lower left corner of the door.

The five bandset pilot jewels may be seen at the left of the slide rule dial. Below these is the bandswitch. Further down are the pilots and switches for filament and plate power. Above and slightly to the right of the center of the scale is a small knob which, through a flexible shaft, controls the trimmer capacitor of the 3.5-mc doubler.

Along the right edge of the panel starting from the bottom are the controls for the receiver gating amplifier and a-f oscillator volume, a-f oscillator tone, and modulation deviation. The c.w.-phone switch is to the left of these controls. The anti-capacity control switch is immediately below the v-f-o control knob. The jacks are, from left to right, microphone input, key, gating amplifier input and output.

Terminals at the rear of the main chassis are 117 v. a.c. in, 117 v. controlled a.c. for final plate relay or other control relays, 117 v. a.c. for final plate rectifier filaments, filament voltage for 4-65 and 6AQ5 final control tube, and a-c door interlock. There is also a fuse mounting, and on the rear of the final chassis is a safety connector for the high voltage.

Construction and Wiring

Data for construction of the gear train assembly are given in *Fig. 3*. Before mounting the gear train on the v-f-o unit a change in the dial cord may be required. On the 70E-8 used, the slide rule pointer went 1/16" off at the ends of the scale. This in no way impairs the accuracy of the unit, because the exact reading is taken from the vernier dial. This condition, nevertheless, is annoying. It may be rectified by installing a slightly smaller diameter dial cord. Sears & Roebuck #3910 (9 lb. test) fish line proved excellent for this purpose and resulted in exact tracking of the slide rule pointer.

Chassis

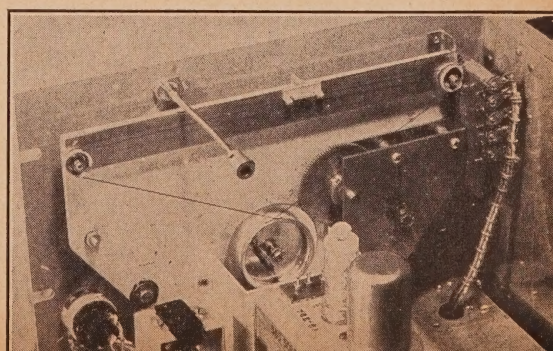
All chassis are made of 1/16" sheet aluminum or dural, and are held together at the edges by ½" dural right angle. For the main chassis and the final amplifier compartment, 6-32 screws are used with the right angle stock tapped, except along the front edge of the main chassis. Here it is secured to the panel using 6-32 brass nuts. Since the entire unit is installed in a "table-top" cabinet, support from the rear of the chassis to the top of the panel is unnecessary; however, if the unit were rack mounted, this step would be required because of the weight of the transformers.

The small "isolation-modulator" chassis and the "ganged doubler" chassis are built in a similar manner, but the ½" right angle is cut down to ¼" and 3-48 screws are used. If 3-48 screws are not available, they may be replaced by 4-36. ¼" square stock may be used in place of the right angle.

Dimensions for the chassis are given in *Fig. 4*. In order to simplify the drawings, the right angle joiners are not shown.

The isolation-modulator chassis is divided into three shielded sections, one for each stage. Small grounded copper shields are placed between the grid and plate halves of the 6AU6 isolator and the 3.5-mc doubler sockets. Employment of the National type XOA miniature sockets plus the small tubular Centralab Hi-Kap capacitors simplifies the placement of the components into the small available space. The 3.5-mc doubler trimmer is the APC type with a ¼" shaft soldered to its adjustment nut. Placement of most of the components can be left up to the builder; however, considerable detail can be seen in the photographs.

There are four miniature banana plugs at the top of the 70E-8 v.f.o. These are for the two filament power leads, the B+, and the oscillator r-f output. A receptacle, built in strip form, is furnished for the connecting leads. This is mounted on small pillars on the rear left side of the small chassis so it may be plugged in on top of the v.f.o. The power leads from the main chassis are brought up through the Jones plug at the other end of this small chassis for all the tubes in this unit. They also run over to the v-f-o



Rear view showing the gear train assembly attached to the v.f.o. One of the detachable halves of the Millen 39006 coupling is shown at the center of the assembly. To the right is the bracket for the five band-switched pilots. This bracket is screwed to the main panel. The miniature banana pins which plug into the bottom of the isolator-modulator chassis may be seen on the top of the v-f-o case; the Jones plug to the left.

plug within the chassis. By-passes C_1, C_2, and C_3 are mounted directly at the v-f-o receptacle. C_3 is also placed so that it is behind the grid side of the 6AU6 socket shield. The very short lead from the v-f-o output to the 6AU6 grid also is shielded.

On the left of the small chassis is a bracket which is screwed to the left side of the v-f-o mounting bracket after the unit is plugged in. This not only holds the chassis firmly in place, but also grounds the oscillator case to the small chassis over a very short path to the grounded filament terminal of the oscillator. This terminal *is not* connected internally to the case of the 70E-8 and leakage will result unless grounding is made in this manner.

Placement of the components within the ganged doubler chassis may be seen in the photographs. The National UM variable capacitors are furnished with right angle mounting brackets which are not always exactly 90 degrees. They must be filed or bent so that the capacitors will be in a 90 degree vertical position for proper physical alignment. For maximum flexibility, the Millen 39006 couplings are used. An additional shield at the rear of the chassis serves as an end support for the long bandswitch, a support for the Jones power plug, and as a shield between the r-f portions of the switch and the pilot light switch deck. Adjacent slug tuned coils are wound in opposite directions to minimize coupling and the B+ connection is made at the "mounting" end of the coil.

The bandswitch is made using 6 isolantite 2-circuit 5-position switch decks which are mounted on a long switch assembly now available from Mallory. The decks are turned around 180 degrees from the rear so as to permit more convenient wiring.

The banana plug for the r-f output is mounted on a ¼" thick strip of polystyrene screwed on one side of the chassis in such a manner as to allow it to be received by a banana receptacle mounted on the main chassis. The r-f lead from this receptacle runs down and out the side of the main chassis, through a polystyrene feed-through, to the final amplifier compartment. As the amplifier grid is switched from one driver stage to another, the grid capacitance of the 4-65 drops out of the circuit of any of the stages not feeding this tube. To make up the difference, trimmers are automatically switched in where necessary. These trimmers are mounted so they may be adjusted through holes drilled along the left side of the ganged doubler chassis and through the right side of the final amplifier case.

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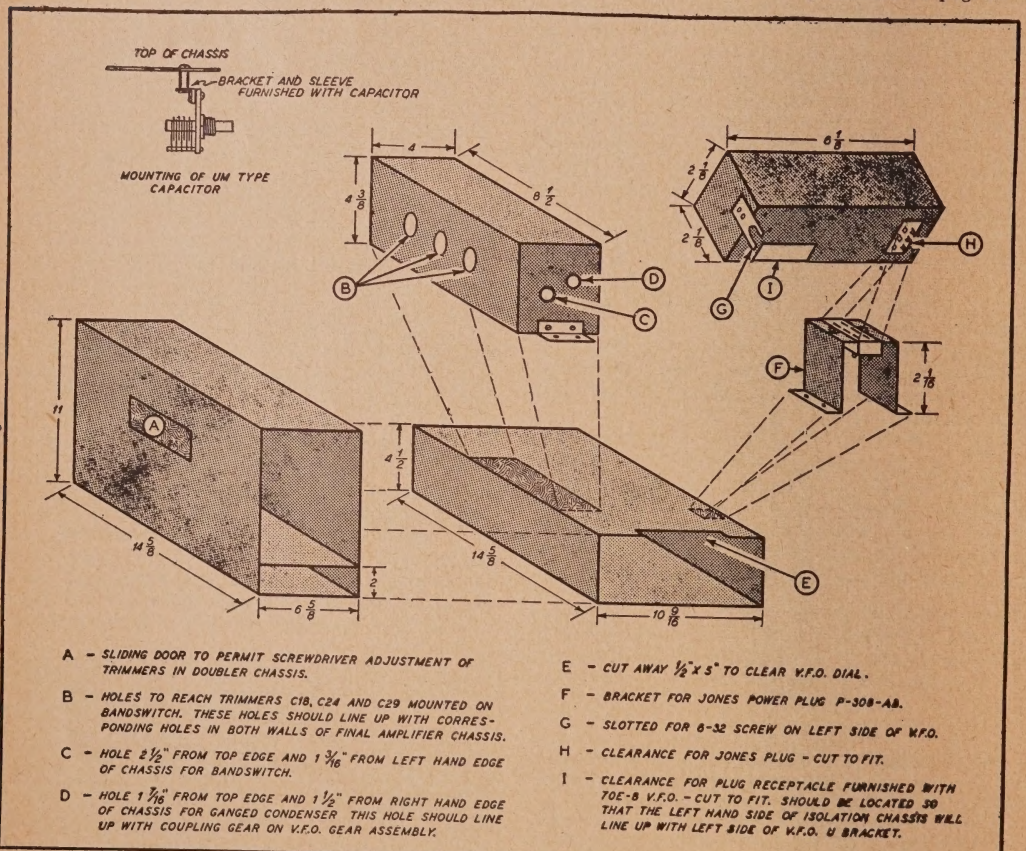
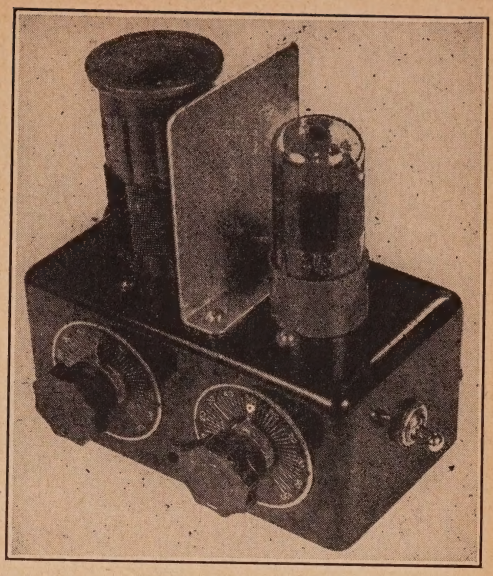


Fig. 4. Assembly drawing and dimensions for principal units in Gold-Plated Special. Sliding door A is actually only required on right side of cabinet.

Plug-in coils permit coverage of 80, 40 and 20. Controls are for regeneration and tuning.



117L7 Utility Receiver

LLOYD V. BRODERSON, W6CLV*

A handful of parts plus a few hours time go into this simple utility receiver.

To those who remember the "Miniature-Oscillator Transmitter" described in the December, 1946, issue of *CQ* no further introduction will be necessary. The receiver pictured is readily recognized as the companion unit to that transmitter. Although designed originally for the newcomer to scan quickly his favorite frequency with a minimum of expense, subsequent tests have proven that this single-tube regenerative receiver has all the necessary characteristics of a practical stand-by unit.

The Circuit

Figure 1 shows a single 117L7GT tube employed as a regenerative detector and half-wave rectifier. Regeneration is controlled by the potentiometer, *R2*, which varies the screen grid voltage. The "tickler" or feedback winding is that portion of the grid coil between the cathode tap and ground.

A combination of resistance and capacity effectively filters the a-c input. The resistor *R4*, while of sufficient resistance to aid in filtering, does not materially lower the resultant d-c output voltage. Typical of regenerative detectors, the most sensitive point of operation is found to be just sufficient voltage to keep the detector below oscillation. Other factors controlling regeneration are the loading capabilities of the receiving antenna and the value of the grid leak resistor.

The antenna coupling condenser, *C3*, should be adjusted so that a slight rushing sound occurs with the regeneration control, *R2*, about half-way on. Should the receiver regenerate too strongly, the amount of feedback may be decreased by moving the cathode tap and/or trying different grid leak values to insure maximum results.

Construction

Duplicating the physical dimensions of the miniature transmitter, the entire unit is mounted on a chassis measuring 5¼" long by 2½" high by 3" deep. These small sized chassis may be purchased ready-made or may be easily fashioned from sheet aluminum or other small gauge metal. The shielding effect offered by a metal chassis is a definite asset when constructing a receiver of this type.

The midget type bandspread condenser, *C2*, and regeneration control, *R2*, are mounted on the front panel. An SPST toggle switch is positioned in the center of the right-end apron. The rear panel is occupied by an antenna binding post and a rubber

**State Dept. of Agriculture, State Office Bldg. No. 1, Sacramento, Calif.*

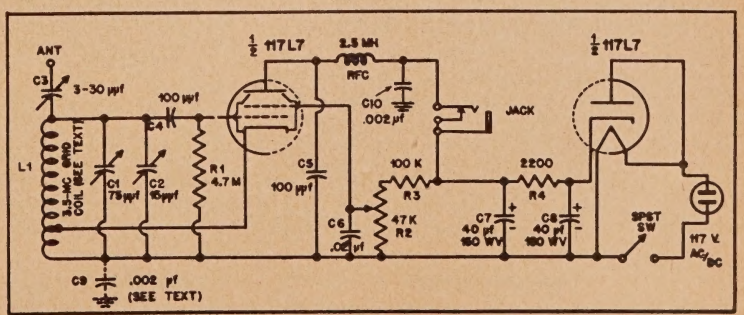
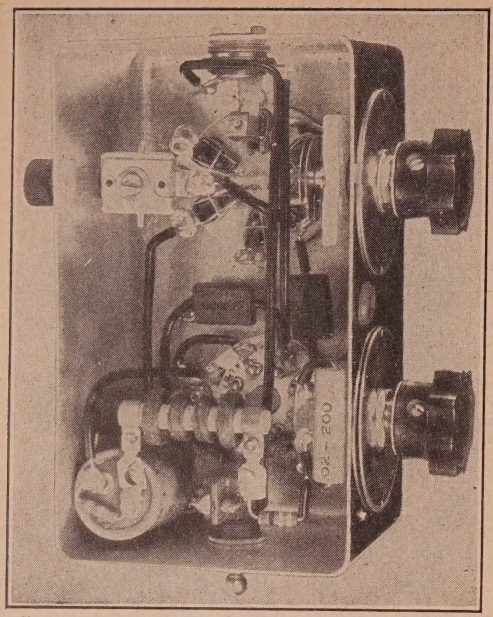


Fig. 1. Circuit diagram of the 117L7 utility receiver.



All components with the exception of the 117L7 and the coil are sub-chassis mounted.

grommet for the a-c line cord. The left-end apron takes the single circuit headphone jack. The coil, shield and tube are mounted above the chassis and complete the unit's outward appearance.

Those parts comprising the filter are mounted in one corner of the chassis, well separated from any r-f components. All leads are short and run directly to their respective connecting points. The antenna binding post and single circuit phone jack are both above ground, and must be insulated from the metal chassis. Both rotors of *C1* and *C2* are grounded to the chassis, as is one side of the toggle switch and one side of the regeneration control.

The aluminum shield mounted between the grid coil and the tube should literally hide these two from each other. In some instances, the addition of a glove type shield covering the 117L7GT will aid in eliminating objectionable a-c modulation.

Operation

The coil *L1* is designed to cover the 3.5-mc channel. It consists of 31 turns of #22 enameled copper wire, close-wound, on a 1½" diameter form. The cathode tap is taken off ten turns above ground. The band-set condenser, *C1*, is positioned on a mounting shelf within the coil form. Capacity is varied by adjusting the protruding rotor shaft set screw with an insulated rod.

The center of the 3.5-mc band is determined by setting the bandspread condenser, *C2*, at approximately half capacity, and the band-set condenser, *C1*, at minimum capacity. The latter is then increased until the desired frequency is located. A little "give and take" with these two condensers will place the center of the 3.5-mc band at the half division on the dial.

Improved performance may sometimes be realized by directly grounding the chassis to an external ground. If an a-c line is used as a source of power (instead of d.c.), the grounded lead may be determined by connecting a 110-volt lamp in series with the transmitter negative lead and ground. If the lamp does not light, it is permissible to ground the transmitter. Should the lamp light, the a-c plug must first be reversed before making the ground connection. Carefully note in which position the plug should always be inserted, or better yet, use only a single line to the a-c socket, completing the circuit through a permanent ground lead to the receiver. The mica condenser, *C9*, constitutes an r-f ground and may be substituted for a direct

(*Continued on page 101*)

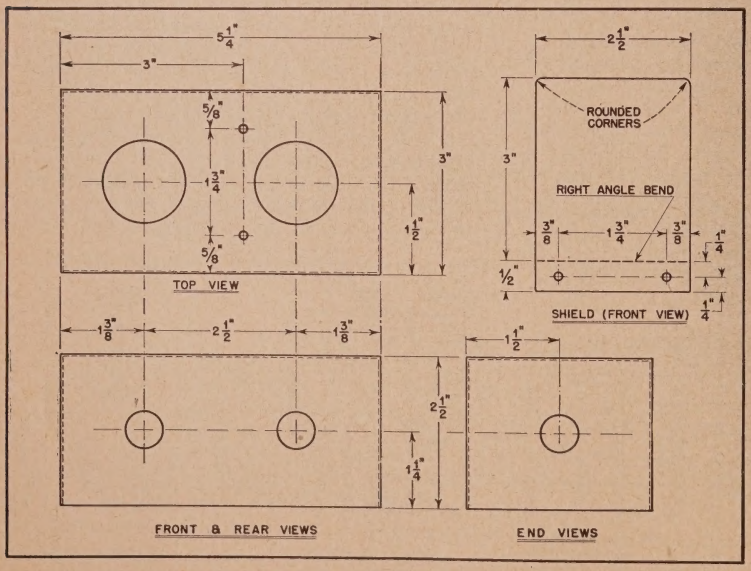


Fig. 2. Dimensions of the chassis for the utility receiver. This is the minimum recommended size and a larger chassis can be substituted.

Dr. Hideji Yagi tells J2ROC how to get more db from his beam.

Japan's Dai Ichi Scientist

CLAIRE H. BALL*



Father of the parasitic array, Dr. Hideji Yagi continues to make DX men happy.

AT ONE TIME or another every DX and V.H.F. man has dreamed up a "new" parasitic array. But particularly fortunate is Captain Stanley E. "Rod" Rodby, radio officer for Headquarters, Fifth Air Force, Nagoya, Japan, and No. 1 op at J2ROC, whose dream was of a super-duper job, with a forward gain of 20—he hoped.

After doodling up a ream of paper and wearing the numbers off the slip stick, "Eureka!" shouts Rod, "I think I have the answer." But before starting to scroung material from Mitsubishi Electric to put it together he jumps on the Allied Limited for Tokyo. Once there he inquires with a grin of almost any Japanese, "Doko ni Yagi-san, Raidyoo Yagi-san?" to get his directions.

These directions lead Rod to the home of Dr. Hideji Yagi. Seated comfortably in Dr. Yagi's living room, Rod can relax while the Doctor scrutinizes the drawings and calculations. He reaches for Rod's slide rule, checks his figures, makes a note here and there, then smiles broadly and nods his head.

"Yes, it should do very nicely. The spacings are good and the phasing is correct. The forward gain—maybe not 20 db, but good. Yes, very good."

So Rod catches the Allied Limited back to Nagoya, trying to relax in a too-short berth, and smilingly drifts off to sleep with the thought: "Those Joes who have been giving me a report of 60 db over S9 on the 4 element are going to have to get a new set of scales for their S-meters—thanks to Dr. Yagi."

And indeed it is thanks to Dr. Yagi. Of course, progress would have continued after Beverage had worked out the first directional antenna that offered a few db gain, but the work which Dr. Hideji Yagi started in 1924 is responsible in no small manner for the great impetus in directional arrays. Although a Japanese National, Dr. Yagi is indeed a world citizen.

Dr. Yagi retired from the public eye in May of 1945 when he resigned as Director of the Bureau of Technology in the Tojo Cabinet, due to differences of opinion as to the outcome of the war. Before his appointment to the Tojo cabinet post he was president of the Tokyo University of Technology, which post he held from 1941 through 1944.

After leaving the cabinet he returned to Osaka, where he had filled the post of Dean of the Faculty of Science at the Osaka Imperial University from 1933 to 1941, to find that B-29s had thoroughly incinerated his home, his laboratory and all his precious notes and library. He did not stay long in Osaka to mourn his loss, but returned to Tokyo to build a modest home where he spends his spare time applying the Japanese magic of making things grow in his little garden among the cinders of a once densely populated area.

The time he spends in his garden is limited indeed, since a man of Dr. Yagi's talents cannot remain hidden. The day after Americans entered Tokyo Dr. Karl Taylor Compton, President of M.I.T. was a Yagi visitor, and the procession of Americans has continued. Dr. Yagi is always the genial host and his fluent English is a most pleasant surprise to visiting Americans, many of whom have brought an interpreter with them.

His time spent with American visitors might be charged to extra-curricular activities, since it is his Japanese adherents who make the heavy demands on his time. He is consulting editor of "CQ" leading Japanese amateur radio magazine and assists in its publication, as well as being President of JARL (Japanese Amateur Radio League). He is sort of "The Old Man" of Japanese amateur radio, who no doubt kept a Samurai sword in place of the Wouff-Hong to deal with rotten fists and notes. He is also president of the Japanese Acoustical Society, and is constantly beseiged by other scientific organizations for counsel and advice.

Small wonder when you review Dr. Yagi's back-

(*Continued on page 96*)

**Public Information Office, Hqs. 5th AF, APO 710, San Francisco, Calif.*

Radio Clubs: Making 'em Work

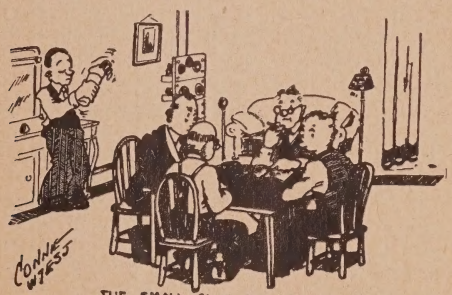
HERBERT S. BRIER, W9EGQ*

Good radio clubs aren't born — they're made. Here's how.

SIMPLEST OF ALL radio clubs is the purely social club where the members meet in each other's homes to talk about absent members, operate the host's rig, brag about their own, have a bite to eat, and go home. There are no dues, no officers, and no responsibilities for the members except to take their turn as host.

Where the membership is small such clubs often achieve a friendliness that is seldom approached in more formal groups. Unfortunately they usually fade away when the original members begin to drop out, because those remaining do not recruit replacements. However, the amateurs of Valparaiso and surrounding Indiana towns have had one for over 20 years, with many of the original members still active. Valparaiso Technical Institute always has many amateur students, who are welcomed as members of the club while they are attending the Institute, and this flux of new faces may be one reason the club continues to flourish.

A club governed by a constitution and by-laws is more likely to be permanent than an informal one, and having officers with clearly defined duties is a practical necessity when prospective or actual mem-



bership is large. Starting a club requires only one thing besides prospective members: someone to make the first move.

The primary requirement in the organizer is willingness to supply the time and effort. There are others, social consciousness for one, but anyone who is willing to make the effort probably has, or will quickly develop them.

Obviously one man cannot organize a club alone; so talk up the idea with others. You will quickly discover that most amateurs would like to belong to a radio club, but have no desire to help organize one. Keep talking until you have recruited two or three who are willing to help. You now have an organizing committee.

* *385 Johnson St., Gary, Ind.*

The Foundation for a Successful Club

The first task is to learn something about club organization in general. *The Lincoln Library Of Essential Information* contains a particularly clear and concise treatment of club organization under the title, "Parliamentary Law." And *Robert's Rules Of Order, Revised*, or *Cushing's Manual* will tell you a great deal more about the subject than you probably care to know.

Visit nearby radio clubs to learn how they work. Request copies of their constitutions and by-laws. After the committee has digested the available data, call an organizational meeting. A postal card announcement to all known local radio enthusiasts, supplemented by newspaper publicity and personal invitation, will insure a good turnout. Hold the meeting in your home if you have the room; otherwise rent a room from the YMCA, etc. (The committee may be reimbursed for this expenditure through a collection at the conclusion of the meeting, but do not depend on it.)

At the meeting the committee should greet all arrivals and introduce them to each other. Then one of the committee should make a brief speech on the desirability of a radio club and, unless there are objections, act as chairman of the meeting.

The chairman requests a motion on organizing a club to start debate, or less formally, the discussion starts spontaneously. Either way at the conclusion of the discussion a vote is taken, and if enough want a club, its organization begins with the election of temporary officers.

After the acting president assumes the chair he appoints constitutional and housing committees. Next he either requests suggestions for a club name, which the acting secretary records for later decision, or he appoints another committee to choose it. Finally, before adjournment, the secretary should take the names of all present, plus any additional ones that may be suggested in order to send them a postal-card notice of the next meeting.

The constitution expresses the fundamental aims and rules of the club, and there are two schools of thought on what it should contain. One believes a constitution should be a rigid document, prescribing rules for every situation that is likely to arise in the life of the club. The other favors a flexible document, covering the aims of the club, plus a few fun-

damental rules. In the appendix is an example of the latter type, followed by a set of typical by-laws.

In gathering material for this article I discovered that a constitution is an elusive thing. No club contacted could produce a copy of theirs immediately! Most of them did produce one, often the only one extant, after a determined search; although a few never did. I presume this proves something.

The Importance of a Meeting Place

Finding a suitable meeting place is sometimes difficult. Temporarily, at least, the new club may meet in a member's home, or in the local Community House, Civic Center, or school, where non-profit organizations may meet free of charge. Failing these, a room may always be rented.

In this connection the experiences of one club are interesting. When first organized, meetings were held in a member's home. Membership rapidly increased until meetings were transferred to a rented room. Although centrally located, and as pleasant as such rooms ever are, attendance immediately dropped. On returning to the private home, attendance again climbed until the walls now bulge at meetings. None of the members can explain it, but all agree that it seems more like a radio club with the transmitter and receiver standing in the corner.

Undoubtedly permanent quarters are the ideal solution. Few clubs can afford to rent them, but it is not impossible to obtain them rent-free. Members of the Indianapolis Radio Club discovered a room in the courthouse used as a catchall for discarded junk. Obtaining permission to use it, elbow grease, and used furniture donated by the members, turned it into a club room to be proud of. While they were lucky, probably every reader of this article can name one or more clubs who meet in rooms donated by local business organizations. The "luck" involved is for the club to have members who are willing to go out and find them.

To get back to organizing the club, the second meeting receives the reports of the committees, adopts the constitution, selects a permanent meeting place, and picks a name. Then dues are set, and permanent officers nominated in the manner specified by the new constitution. The amount of dues usually depends on whether the club has to rent a meeting place, because except for this, the main expenses are the secretary's postage, and possible refreshments. $2.50 to $3.00 a year are usual.

This leaves the club still to be named. Shakespeare asked, "What is in a name," but had he ever been present at the christening of a club, he would have known! To many it is of soul-stirring importance, requiring great study and debate. And as for changing the name later—there are some things better not discussed, and that is one of them.

The third meeting opens with the election of the permanent officers, who take office immediately. The club is then organized, and, paradoxically, begins the hardest part in its organization: keeping up interest. Both interest and attendance often begins to evaporate after the first few meetings. Surprisingly enough, one reason for dropping attendance is mere forgetfulness. All clubs, radio and others, have this problem to face. The simplest solution is a postal card timed to reach each member the day before the meeting.

Planned Meetings

Questioning club members reveals two main reasons for indifference: long business meetings and late starts. Almost all new clubs attempt to handle all business in regular meetings. And it just does not work! Most members have no more interest in such details than in the minutes of the Ladies' Aid Society. In deference to this feeling, some clubs authorize the officers to handle all business, and merely report the accomplished fact to the club. To eliminate the obvious defects of this plan, others appoint an executive committee.



One such executive committee consists of the elected officers, plus seven members appointed by the president. It considers new members, affiliations with other groups and, in fact, all matters usually handled in business meetings. Also the committee explores suggestions for club activities, and whips them into motions for approval or disapproval by the full membership. In addition, if any matter before the club results in inconclusive debate, the chairman is authorized to refer it to the executive committee for further study.

Making the committee fairly large permits including on it most members who care to be included. And the fact that any member is welcome to attend the committee meetings, and that the committee's actions are subject to review eliminates grounds for any member believing something is being put over on him.

Late starts often tie in with uninteresting meetings, for the same reasons it is easy to be late for an appointment with the dentist. Occasionally they indicate scheduling the meetings for too early an hour. And some members are late because they know the meeting will not start until they arrive. These things are usually the chairman's fault. When the meetings start on time, and *are worth attending*, the members will be on time if it is humanly possible.

What makes an interesting meeting depends on a number of things, not the least of which is the frequency of meetings. Not oftener than twice a month is recommended. Entertainment and re-

freshments are the principle ingredients. If both can be supplied, so much the better, but light refreshments, like coffee and doughnuts, or ice cream and cookies, are often better crowd pullers than routine entertainment.

Entertainment usually means speeches or demonstrations. In cities at least it is easy enough to get speakers; especially if the subjects are not limited strictly to radio. Talks on subjects like, "How Brokemeyer's Foundry Uses Vacuum Tubes in its Pyrometers," or "How the ABC Power Company Uses Carrier Current Telephony on 220,000 Volt Power Lines," go over well. If at all possible issue invitations to speakers in person; although a follow up letter to confirm arrangements may be wise.

A frequently neglected source of good speeches is fellow club members. Chats on subjects like, "How Putting the 807s in Parallel Cured the Parasitics in my Transmitter," or "What I Did When My CQ Raised Someone on the Telephone and at the Front and Back Doors," interest all of us, because they touch us personally.

Demonstrations of new equipment by a dealer or the proud owner go over big, and movies or a wire recorder are sure-fire. W9SNF recently recorded the signals of fellow members of The Lake County Amateur Radio Club over the air and played them at the next club meeting. It was fun, and at least one member (me) did some work on his transmitter after hearing the recording.

Actually, if the meetings are not too frequent, it is not necessary to have formal entertainment at



every one. The members welcome an opportunity of getting together with congenial company and chatting. This is especially true if there are light refreshments. I stress them, because every club official I talked to, even those who do not serve them, agreed that refreshments brought out a bigger, more sociable crowd.

All clubs require a constant flow of new members to replace those who drop out, and for healthy growth. Often prospective members attend a meeting and never return. There are many reasons over which the club has no control for this, but the following incident points its own moral:

An amateur moved into a certain city and dropped in at the radio club. He introduced himself to the chairman, who promptly forgot him. And from the time he arrived until he left, not a single member spoke to the stranger! His opinion of the club and its members can be well imagined!

A few weeks later another ham moved to the same city. He, too, heard about the club. But from then on things were different. The ham who invited him to the meeting called for him in his car, introduced him to other members, and in general, saw that he was not ignored. It was the same club with the same members, but what a different impression it made on the two visitors!

A good rule to follow is that a visitor to your club, like one to your home, is a guest and should be treated like one. Do not leave it to chance. Do it yourself, or see that the club appoints an official greeter.

Sustaining Member Interest

While it is demonstratably true that the average member is not interested in the inner workings of the club, nothing so unifies one as a project, like a ham-fest, a hidden transmitter hunt, or Field Day. And of these, Field Day, sponsored by A.R.R.L. each June, takes first place. Dozens of clubs hibernate between them. Then in the spring they awaken to a bustle of activity. Members rehash last year's mistakes, make plans to eliminate errors, and refurbish their emergency-powered equipment.

The vicinity is scoured for the best available location for portable operation, which is often used year after year. And a few days before the scheduled date, the entire club (in theory) turns out to erect antennas and install operating positions. With up to eight or more transmitters operating simultaneously within a few hundred feet, this takes careful planning. Then the transmitters must be manned for the 24 hours of the test, and the operators must be fed and sheltered. In truth, Field Day requires the best efforts of every club member. The licensed ones supervise installations, and operate the equipment. Unlicensed members help put up antennas, keep logs, take pictures, carry messages, open bottles, etc. Once a club has participated in a field day, its motto becomes, "We will do better next year!"

Picnics are universally recommended as wonderful club projects. While I would be the last to discourage a club from sponsoring one, experience over the years indicates that they are seldom as successful as expected. Except for quite small clubs, usually only a minute proportion of the membership attends, and the committee organizing it feel their efforts are not appreciated. And those who do attend generally expect more excitement, and feel vaguely disappointed to find that a radio club picnic is still only a picnic.

Merely as an opinion, I would say that the most successful picnic is one where congenial members and their families decide to have one, set a date and go, without attempting to make it a club project. Everybody then knows what to expect, and the kids enjoy it anyway.

The small amounts of money required by most radio clubs is most easily raised by membership

dues. Large amounts can be raised by public dances, bingo games, raffles, etc. Putting on a successful public party is an art in itself, and beyond the scope of this article. However, moderate amounts can be raised by several methods, the easiest of which is by selling chances on radio equipment. This is highly successful if several rules are observed: 1. Keep the prices of chances low; so all can afford them. 2. Have more than one prize to increase the chance of winning. 3. Do not think you can spend $2.49 for the prizes and sell $25.00 worth of chances. Remember you are not running a carnival that will disappear with the dawn. 4. Do not sell chances to non-members if members gripe when outsiders win.

In an emergency an assessment may be levied on the members, but is definitely a last-ditch move, because many members resent it.

A majority of clubs do not favor a club station. Their reasons run something like this: Most members have stations of their own; the club, being responsible for its operation, must prescribe rigid rules as to who may operate it, and those not permitted to do so, frequently resent it; it is expensive to build and maintain a station under the best of circumstances, and it is an added drain on the treasury to replace components that constantly disappear.

Those in favor argue that: A club station affords the only opportunity for many members to operate a high-powered one; the club's responsibilities extend only to seeing that none but licensed operators have access to the equipment, the operator signing the log being responsible for any given transmission; insuring the equipment will end loss from disappearing equipment, because the insurance company will replace it, and investigate who made it disappear.

These arguments bring obvious questions. Who is going to see that the log is properly kept and signed? And why should innocent members be quizzed and harried by insurance company detectives every time a part disappears? And so on and on . . .

It is easy to see why many clubs feel that it is simpler to avoid a club station. Nevertheless, some clubs do operate stations successfully. Many, but not all of them, are school clubs, where a faculty member has both the equipment and members.

We must not forget the club paper. Having had some experience writing, editing and publishing such papers, I can say that putting one out is a lot of work, but it is always read from cover to cover. All it takes to publish one is a man with a typewriter and a few mimeograph stencils. After the paper is established, the club may buy a mimeographing machine, but at first it is better to have a commercial company handle this. The service is quite reasonable if you cut the stencils. (Stencils are cut in a typewriter exactly like ordinary typing, except the ribbon is removed.)

We have now covered almost all problems of club organization except officers. From the point of view of their availability as officers, club members are divided into four groups. Members of group one are painfully eager to be elected. Too often the club is just as eager to "unelect" them after a few months

(*Continued on page 98*)

Postscripts

F. C. C. Rules and Regulations

Amendments to Part 12 of the Rules Governing Amateur Radio Service:

1. Section 12.91 is amended to read as follows:

Section 12.91 *Requirements for portable and mobile operation:*

(a) Within the continental limits of the United States, its territories, or possessions, an amateur station may be operated as either a portable or a mobile station on any frequency authorized and available for the amateur radio service. Whenever portable operation is, or is likely to be, for an over all period in excess of 48 hours away from the fixed transmitter location designated in the station license, the licensee shall give prior written notice to the Engineer in Charge of the radio inspection district in which such portable operation is intended. This notice is required even though the station is, or is likely to be, operated during any part of this over all period at the fixed transmitter location. Whenever mobile operation is, or is likely to be, for a period in excess of 48 hours without return to the fixed transmitter location designated in the station license, the licensee shall give prior written notice to the Engineer in Charge of the radio inspection district in which such mobile operation is intended. The notice required for either portable or mobile operation shall state the station call, the name of the licensee, the date or dates of proposed operation and the contemplated portable station locations, or mobile station itinerary, as specifically as possible. An amateur station operated under the provisions of this section shall not be operated during any period exceeding one month away from the fixed station location designated in the station license without giving additional notice to the Engineer in Charge of the radio inspection district in which the station is intended to be further operated, nor for more than four consecutive periods of one month each as portable at the same location. Mobile operation without return to the fixed transmitter location may be continued beyond the four consecutive periods of one month each provided that the above mentioned notice of mobile operation is given each month.

(b) Outside the continental limits of the United States, its territories or possessions, an amateur station may be operated as portable or mobile only in the amateur band 28.0 to 29.-7 mc. Within areas under the jurisdiction of a foreign government, operation is also limited to this band and then only with the permission of that government. Whenever such portable or mobile operation is, or is likely to be, for a period in excess of 48 hours away from the continental limits of the United States, its territories, or possessions, the licensee shall give prior written notice to the Engineer in Charge of the radio inspection district in which the fixed transmitter site designated in the station license is located. Only one such notice shall be required during any continued absence from the continental limits of the United States, its territories, or possessions.

2. *Section 12.92 is deleted.*

3. *A new Section 12.94 is added to read as follows:*

Section 12.94 Special provisions for mobile stations aboard ships or aircraft.—In addition to complying with all other applicable rules, an amateur mobile station operated on board a ship or aircraft must comply with all of the following special conditions: (1) The installation and operation of the amateur mobile station shall be approved by the master of the ship or captain of the aircraft; (2) The amateur mobile station shall be separate from and independent of all other radio equipment, if any, installed on board the same ship or aircraft; (3) The electrical installation of the amateur mobile station shall be in accord with the rules applicable to ships or aircraft as promulgated by the appropriate government agency; (4) The operation of the amateur mobile station shall not interfere with the efficient operation of any other radio equipment installed on board the same ship or aircraft; and (5) The amateur mobile station and its associated equipment, either in itself or in its method of operation, shall not constitute a hazard to the safety of life or property.

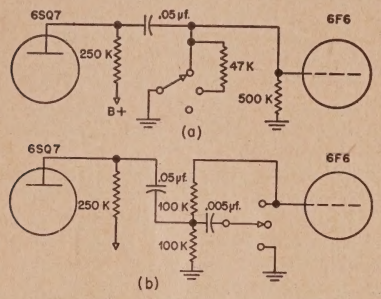
The F.C.C. rules governing amateur radio service have again been amended so that through December 31, 1948, it is *not* necessary to show proof of use of license for purposes of renewal of license without examination.

The F.C.C. rules have also been amended extending through July 41, 1949, the authority for amateurs to use narrow-band frequency or phase modulation emission for phone communication in the bands 3850 to 3900 kc; 14200 to 14250 kc; 28.5 to 29.0 mc, and 51.0 to 51.2 mc.

Inside the SHACK AND WORKSHOP

Treble Boost for Cutting Through QRM

After running the output of my communications receiver into an audio amplifier having separate controls of both bass and treble, I discovered that when the treble was boosted, 'phone signals came through automobile QRM with greater readability.



Part *a* of the schematic shows the original tone control which varied only the amount of treble, already present, and which offered no treble boost. Part *b* shows the revised circuit having treble boost as well as control of attenuation.

Cedric Currin, W9AVX

Crystals for BC-625 Transmitters

When selecting crystals for the BC-562, it is often easier and cheaper to buy the smaller type crystal, with the FT-243 holder. A bit of careful work with a pair of long-nose pliers will close up the spring fingers under the crystal board to where the fingers will grip the small pins properly. The holder spacing is the same and if the other type holders are available later, they can still be used.

John B. Riley, Los Angeles

Modifying the FT-243 Crystal Holder

Many fellows have the problem of utilizing the new type holders in equipment fitted with big-pin crystal sockets. The following modification obviates the need to replace the socket or to obtain adapters for the FT-243.

Take an old 5-prong tube and cut off a couple of the pins with a fine-toothed hacksaw blade. Slip one of these pins over each prong of the FT-243. It usually is a tight fit so the pin should stay in place. If it does not, squeeze the pin slightly before slipping it onto the FT-243.

Since the spacing is the same, the modified FT-243 will now fit the old type socket, and yet will be available to function in the normal manner at anytime.

Jim Rothsten, W2MXG

* *Address all contributions to S & W Department c/o CQ, 342 Madison Ave., N. Y. 17, New York.*

75-Meter Antenna on 20 Meters

An end-fed Zepp for the 75-meter 'phone band is usually 118-feet long making it difficult to load on 20. If a knife switch is inserted in the dead feeder, 15 feet from the antenna end, this will give the flat-top an effective length of 133 feet. This will then load nicely on both 20 'phone or c.w. Open the switch for 20 and close it for 75.

J. G. Freeland, W8GSN

Reducing Receiver Drift

My BC-348 receiver drifted on its upper band. Since the drift was to a lower frequency, I put a 5-$\mu\mu$f negative temperature coefficient condenser across the high-frequency oscillator. This cleaned up the drift in my 348 in short order.

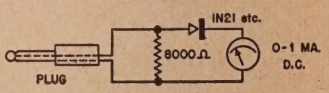
Many receivers could be greatly improved by such a slight modification. Just remember that if the receiver drifts to a *lower* frequency, apply a slight amount of *negative* coefficient capacity, and if the receiver drifts to a higher frequency (an unusual case) use a *positive* coefficient.

The high frequency trimmer must be reduced by the amount of the added capacity.

Floyd Gardner, W9BQJ

Null Indicator for BC-221

If you do not care to plug your headphones into your BC-221, it is a simple matter to wire up an accurate visual indicator of the null. This device is much more sensitive than any aural indication.



On a high-frequency beat note, a steady indication can be observed. As the beat approaches zero, the meter's pointer will begin to vibrate at the beat frequency. It is possible to obtain a beat note of a fractional part of a second, on this gadget which can be made up from parts from the junk box, plus one of those radar crystals.

Joseph C. Juel, W9BGC

Eliminating Distortion in an SX-28

I recently checked the continuity of the output transformer on my SX-28 and was surprised to find that the two halves of the primary winding on the transformer had quite a noticeable difference in d-c resistance.

I replaced the transformer with a new one of good quality with a 10,000-ohm center-tapped primary and was pleasantly surprised to note that the distortion previously noted was gone.

The old transformer was apparently saturating, and the impedance was not correct, and was unbalanced.

Frank B. Frank, W5HKH

A New Frequency Modulation Method—

The Gerber Crystal Reactance System

H. W. BROWN, JR., W2OQN,* and P. D. GERBER*

MOST OF THE familiar systems of frequency modulation have certain inherent disadvantages, especially on the lower frequency amateur bands. If one desires the benefits of crystal control, he must provide for adequate frequency multiplication in order to obtain sufficient deviation even for narrow-band FM, or use relatively complicated systems employing phase modulation. The other alternative, modulating directly the frequency of a self-excited oscillator, requires specialized stabilizing systems which are beyond the scope of the average amateur. This article describes a new FM technique, known as the Gerber Crystal Reactance System, which overcomes some of these disadvantages. The new system has the desirable characteristics of relatively wide deviation at the fundamental frequency of the crystal thus eliminating the necessity of frequency multiplication, incorporates the stability of a crystal oscillator, and offers simplicity with ease of adjustment.

*Engineering Products Dept., RCA Victor Division, Camden, N. J.

Relatively wide deviation at the fundamental frequency of the crystal eliminates the necessity of frequency multiplication, incorporates the stability of a crystal oscillator, and offers simplicity with ease of adjustment.

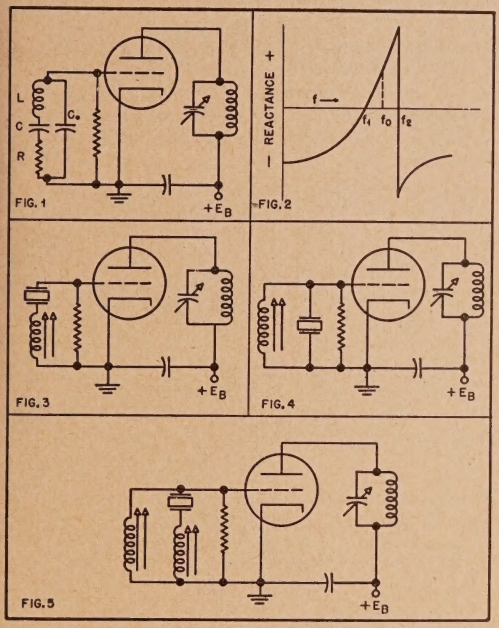


Fig. 1. The crystal appears as an equivalent RLC circuit in this crystal oscillator.

Fig. 2. Variations in crystal reactance plotted as a function of frequency.

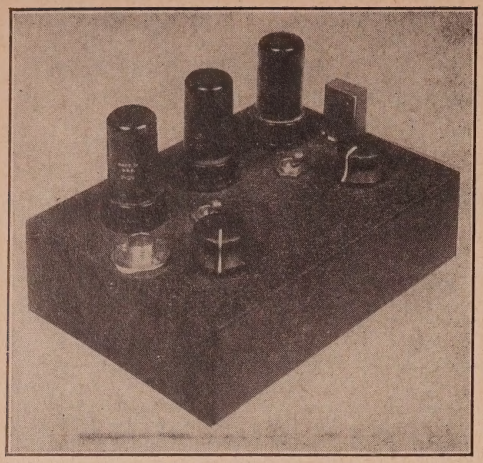
Fig. 3. Crystal oscillator circuit with inductance added in series with crystal to lower frequency.

Fig. 4. Crystal oscillator circuit with inductance added in parallel with crystal to produce higher operating frequency.

Fig. 5. Addition of series and parallel elements permits crystal frequency to vary in accordance with crystal reactance-frequency characteristic.

The Basic Circuits

In normal crystal oscillator operation, the crystal appears as an equivalent *RLC* circuit, connected to the grid of the oscillator tube. *Figure 1* illustrates this equivalent network, there C_0 represents the parallel shunt capacity, *R*, *L* and *C* representing the electrical equivalents of the vibrational characteristics of the quartz. Due to the inherent reactance-frequency characteristic of the crystal, the operating frequency will depend upon the value of crystal reactance. A typical characteristic is shown in *Fig. 2* where f_1 and f_2 are the frequencies of series and parallel resonance respectively and f_0 designates an operating frequency. Thus by changing circuit parameters, for example, the circuit input capacity, the crystal reactance and consequently the operating frequency, will follow the circuit input capacity change. If, instead of altering circuit parameters as illustrated in *Fig. 2*, an inductor is inserted in series with the crystal as shown in *Fig. 3*, the crystal will immediately assume a lower value of reactance, and consequently a lower frequency, in order for the combination to equal the original required reactance. Similarly, an inductor in parallel with the crystal, *Fig. 4*, results in an increased crystal reactance, producing a higher operating frequency. The net reactance of the combined elements will re-



The experimental FM exciter unit. The tube layout from left to right includes the 6SJ7 and 6J5 speech stages, followed by the 6AC7 reactance tube. In the center row is the microphone input, B+ and filament switches, and the crystal. The control on the lower left is the audio gain and on the right, the trimmer condenser, C11.

main constant, the crystal adjusting itself for any changes in added inductance. By including both series and parallel elements as shown in *Fig. 5*, the crystal frequency can be shifted up and down from its normal operating frequency in accordance with the crystal reactance-frequency characteristic. It is immediately apparent that if the reactance of the added inductors could be varied in accordance with speech or other signal, a stable frequency modulated crystal controlled oscillator would result. After reasonable performance was achieved with adjustable iron core inductors as series and parallel elements, efforts were directed toward a means of control where the magnitude of the reactances could be varied electronically.

Of the three possibilities outlined above, that using a series inductor appeared to be, after preliminary tests, the simplest and most promising. It was decided therefore to exploit this method. Continued investigation would undoubtedly bring forth improvements in any of the suggested systems.

A reactance tube modulator plate-cathode circuit is connected across the series inductor and is made to appear as an inductive reactance by exciting the modulator grid with a voltage which lags the voltage across the series element by 90°. This lagging grid voltage causes a lagging plate current, the plate cathode circuit thus appearing as an inductive reactance across the series tank. As the transconductance of the modulator is varied by an audio voltage on the grid, the magnitude of the inductance shunting the series inductor varies at the same rate. The limits of inductance swing and ultimately frequency are fixed by the inductor itself, varying between its nominal value and short circuit conditions according to the excitation to the reactance tube.

In order for the series element to have a positive reactance at the operating frequency it must resonate at a frequency slightly higher than that of the crystal. For a given audio excitation the deviation will then be dependent upon the relationship between the reactance of the inductor and that of the crystal. The reactance tube circuit may take on several configurations, the chief difference being in the method of obtaining the 90° phase shift on the grid. In some cases where it is desirable to completely isolate the r-f from the a-f circuits, the audio may be applied to a separate grid. This, however, may result in reduced sensitivity.

A Typical FM Exciter

Although the theory of operation may appear to be a bit complex, reducing the theory to practice is quite simple. *Figure 6* shows the circuit of an FM exciter embodying the principles set forth above. This circuit does not necessarily represent an ultimate of design, but is included because it was found to work satisfactorily.

The first two stages are those of a conventional audio amplifier used to provide adequate audio excitation voltage to the modulator. A 6AC7 tube was found to do an excellent job as a reactance modu-

(*Continued on page 100*)

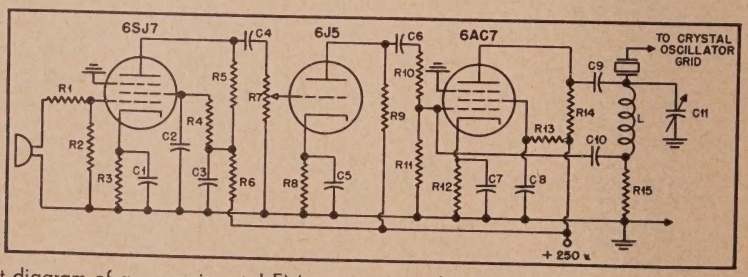
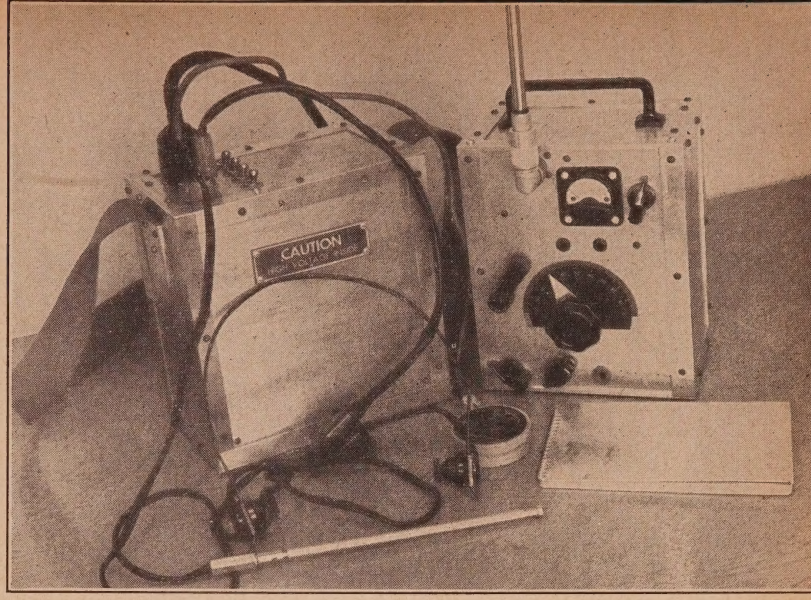


Fig. 6. Circuit diagram of an experimental FM exciter using the Gerber crystal reactance system with a 7-mc crystal. The output of this exciter feeds directly to the crystal oscillator grid. Addition of a 100-$\mu\mu$f mica capacitor in parallel with C11 brings the series tank within the reactance range for use with 3.5-mc crystals.

C1, C5—10 μf, 25 v.
C2, C4, C6, C7, C8—.01 μf, 400 v.
C3—8 μf, 350 v.
C9—3300 $\mu\mu$f. C10—100 $\mu\mu$f.
C11—25 $\mu\mu$f., variable.

R1, R6, R10, R13, R14—47000 ohms.
R2, R4—1 meg.
R3—1000 ohms.
R5—100,000 ohms.
R7—500,000-ohm pot.

R8—2700 ohms.
R9—220,000 ohms.
R11—560,000 ohms.
R12—560 ohms.
R15—22 ohms.
L—55 t. No. 22 enam. ½" dia.



Complete 10-tube portable station including cables, phones, mike and log. Rod in front is a portable light for reading the log when making entries.

A Modern Walkie-Talkie

CHARLES P. ELLER, W2SVI *

A crystal-controlled transmitter and superheterodyne receiver for 144 mc.

REALIZING THE OLD combination modulated oscillator and superregenerative type of walkie-talkie would now be out of the question on two meters, it was decided to make a streamlined-affair that could be readable on any double conversion superhet. Also in order to match the hoped-for performance of the crystal controlled transmitter, the receiver section had to be something extra special. The final choice was a superhet using a superregenerative second detector.

The transmitter-receiver portion of the walkie-talkie was built into an aluminum cabinet having the dimensions 6⅛" x 7¾" x 4¼". It weighs about 5½ pounds. The power supply fits into another aluminum box, this one measuring 7¼" x 7¾" x 4½". It weighs just under 13¼ pounds. Only one cable connects the transmitter-receiver unit to the power supply. Headphones and a separate microphone are used for great flexibility.

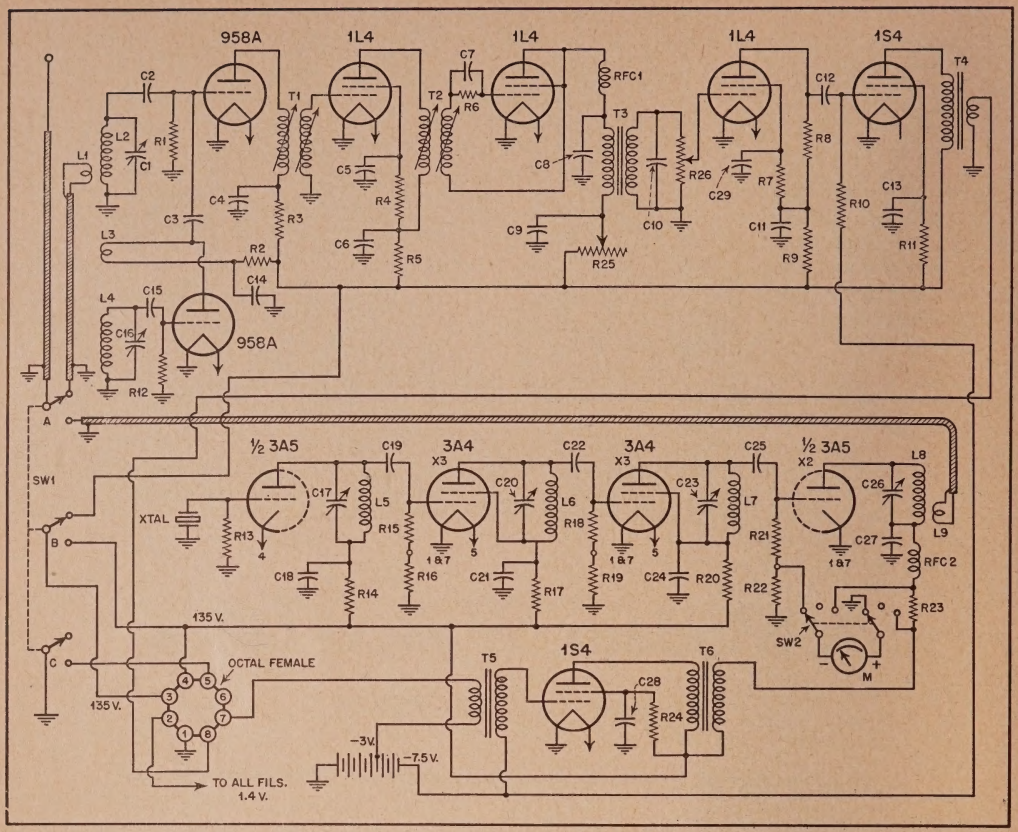
Receiver Circuit

The receiving section of the walkie-talkie contains its own audio system and is completely independent of the transmitter section. Thus, no complex switching arrangement is needed. This fact greatly simplifies construction and shielding problems.

The local oscillator in the receiver is a tickler feedback circuit using a 958A tube. Adjustment of the oscillator feedback coil was not critical and a tendency toward squegging was cured by changing the value of the grid leak resistor (*R12*). The grid and feedback coils are both wound in the same direction with the grid and plate of the tube connected to the outside ends of the coil. When the circuit is oscillating the 958A should draw about 4 ma plate current. Capacity coupling (*C3*) is used between the oscillator plate and the mixer grid. Another 958A is used as the mixer with the antenna inductively coupled to the mixer grid coil.

High frequency mixer circuits tune relatively broadly and no attempt was made to gang the mixer tuning condenser to that of the oscillator (*C16*). It was found that when the mixer grid was peaked at about 146 mc with *C1* there was only a very slight drop in sensitivity at the ends of the band. Once *C1* is set, it will not have to be readjusted unless the 958A is replaced. The plate of the mixer feeds into the first i-f transformer. The i-f stage uses a 1L4 tube at a frequency of 10.7 mc. The output of the i-f stage feeds into a triode connected 1L4 superregenerative second detector. The sensitivity of the superregen detector reduces the necessity of more i-f stages while at the same time provides a degree of noise limiting and a-v-c action. If the 1L4 fails to superregenerate smoothly, different values of the plate by-pass condenser (*C8*) may be tried.

*511 West 171st Street, New York 32, N. Y.



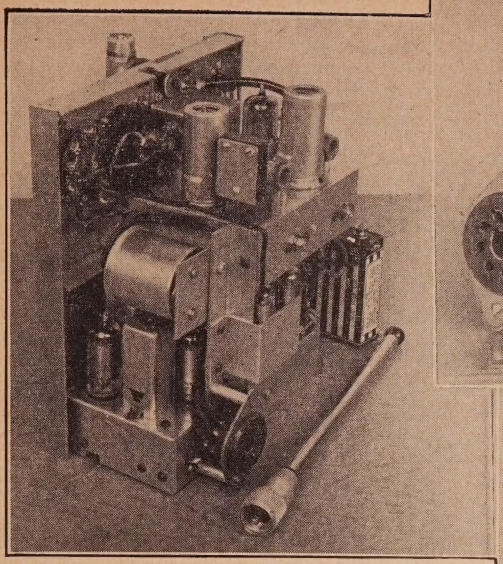
Circuit diagram of the 2-meter transmitter and receiver.

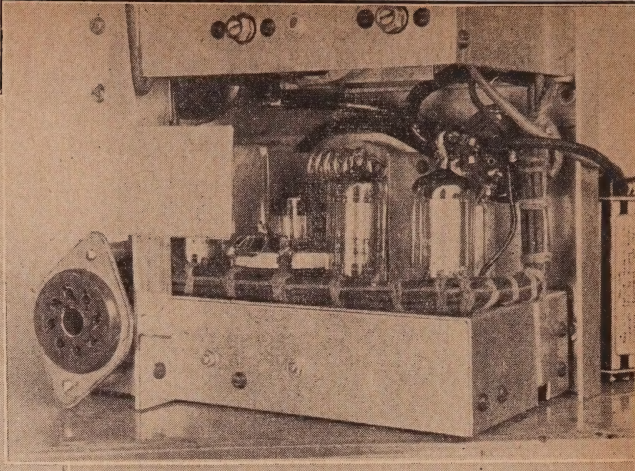
C1—3-13 μμf Ceramicon Trimmer.
C2, C25—50 μμf Ceramicon.
C3—2 μμf Ceramicon.
C4, C5, C6, C18, C21, C24—.001 μf.
C7, C8, C15—100 μμf.
C11—.01 μf paper
C9, C12, C28, C29—.01 μf.
C10—800 μμf.
C13—0.1 μf paper.
C14, C27—500 μμf Ceramicon.
C19, C22—90 μμf Ceramicon.
C16—2 plate midget variable.
C17—12 plate type APC.
C23—4 plate type APC.
C20, C26—3-plate type APC.
All capacitors postage stamp mica, except where noted.
R1, R6—10 megohms.
R2—8200 ohms.
R3, R4—100,000 ohms.
R5, R9, R16, R19, R22—2200 ohms.
R7—470,000 ohms.
R8, R10—270,000 ohms.
R11, R24—10,000 ohms.
R12—15,000 ohms.
R13—33,000 ohms.
R14, R17, R20—220 ohms.
R15, R18—330,000 ohms.
R21—68,000 ohms.
R23—5 ohms.
All resistors ½ watt.
R25—50,000 ohm potentiometer.
R26—500,000 ohm potentiometer (audio taper).
T1, T2—10.7 mc midget FM i-f transformer.
T3—3:1 midget audio, see text.
T4—Plate to low impedance phones, surplus stock, see text.
T5—Microphone transformer, see text.
T6—Modulation trans., see text.
L1—2 turn link of hookup wire.
L2—3 turns #14 3/8" I.D., 3/8" long.
L3—2 turns #14 1/4" I.D., 3/16" long.
L4—4 turns #14 1/4" I.D., 1/2" long.
L5—34 turns #32 DSC 1/2" I.D., close wound on form.
L6—12 turns #22 DCC 1/2" I.D., close wound on form.
L7—5 turns #18 5/16" I.D., 3/8" long.
L8—3 turns #14 3/8" I.D., 3/8" long.
L9—2 turn link of hookup wire.
S1—3 circuit double throw switch.
S2—2 circuit 3 position switch.
M—0-1 ma meter, 1-1/2" O.D.
xtal—8.0 to 8.2 mc.

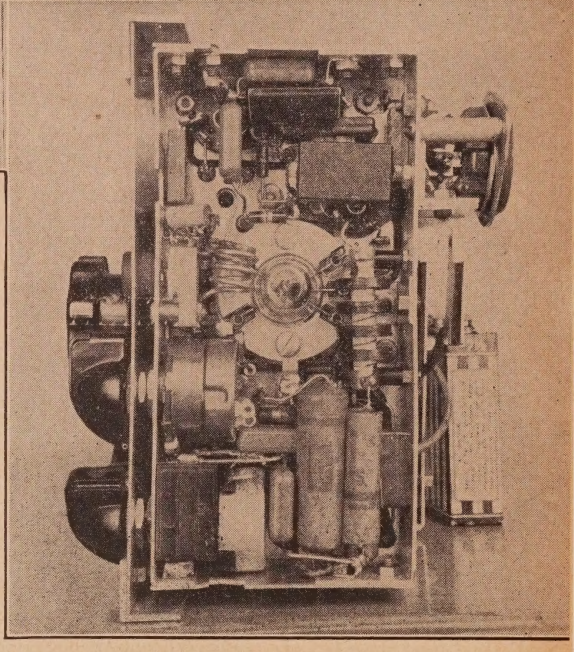
The second detector is transformer-coupled to the first audio stage using still another low drain 1L4. This transformer is a midget 3:1 surplus unit somewhat similar to the UTC series. The secondary is shunted by an 800-μμf condenser (*C10*) to prevent fringe howl. The first audio output is resistance coupled into the 1S4 audio output stage. The output transformer is one of the small T-1 units removed from an ARC-5 receiver. It matches the plate of the 1S4 to HS-1 earphones very nicely.

Receiver Alignment

The first step in setting up the receiver is make sure the second detector is regenerating. If the circuit has been wired correctly there should be a hissing sound in the earphones when the voltages







Above: Rear left. Round can is receiver output transformer. Top right: Rear right, showing left to right 958A oscillator, 1L4 audio, 1S4 output, and send-receiver switch. Right: Bottom view of receiver showing mixer tube and grommet through which mixer grid is adjusted.

are applied. This step also shows if the audio stages are working. Alignment starts at the plate of the i-f stage. Tune the slug of the i-f plate until there is a slight drop in the hiss level of the second detector. This indicates primary resonance in *T2*. Tune to either side of this dip, or until the hiss is back to the original level; this prevents a strong signal coming through the i-f stage from pulling the detector out of oscillation.

The next step is to set the tuning range of the oscillator. The coil *L4* is spread or compressed until it covers the approximate range 133 to 138 mc, or until *C16* will tune the 2-meter band at the i-f difference. For mixer alignment use either a signal generator or a weak signal from your own transmitter. As the 2-meter signal is tuned in, there should be a sharp decrease in the hiss of the second detector. Tune *T1* for minimum hiss level and maximum signal output. An antenna is then coupled to the mixer coil through a two-turn loop and with a stable signal being received the mixer grid trimmer *C1* and the slugs of the first i-f transformer are repeaked for maximum response. The final tune-up of the mixer must wait until the unit is mounted in the carrying case, at which time the stage is peaked using the 18-inch quarter-wave antenna.

Transmitter Circuit

The transmitter section of the portable presented greater difficulties than the receiver because the choice of low drain tubes was quite limited. After considerable thought the transmitter was developed into a three tube crystal controlled with a doughnut mechanical design. Looking at the schematic, *Fig. 1*, the reader will immediately appreciate what is meant by that last statement. Starting out with an 8-mc crystal, one-half of a 3A5 tube is used as the oscillator with the output at the crystal frequency. This is followed by a 3A4 tube which is a tripler to 24 mc which in turn feeds into another 3A4 tripling to 72 mc. The second tripler output feeds back into the remaining section of the 3A5. Although the tube manual ratings carry the 3A5 only as far as 40 mc, the tube does perform adequately above this frequency. Doubling from 72 mc it still gives usable output in the 2-meter band. A final amplifier had been originally planned, but a 60 ma, 2-volt bulb coupled to *L8* will light to near full brilliancy, so the additional stage was dropped in favor of lower battery drain.

The grid current of the two 3A4 tubes is about 0.13 ma which meets the minimum drive require-

ments of the tubes with about a microamp or two to spare. The second section of the 3A5 draws a grid current of about 0.4 ma.

Since the 3A5 twin triode is both the oscillator and the final amplifier the transmitter components must be arranged so that the r-f circuits circle back among themselves and place the second tripler plate near the second half of the 3A5 tube. With a little forethought the average constructor will not find this too difficult. Needless to say, all leads are kept as short as possible to prevent losses and economize on space. The upper deck is the transmitter. In one corner of this deck is the 1S4 modulator. Both the microphone transformer and the modulation transformer were obtained from war surplus and standard units may be substituted if the builder desires. Heising modulation can be used by replacing the transformer, *T6*, with a small filter choke. Note that both the microphone input and the receiver output connect to the octal power plug.

Transmitter Adjustment

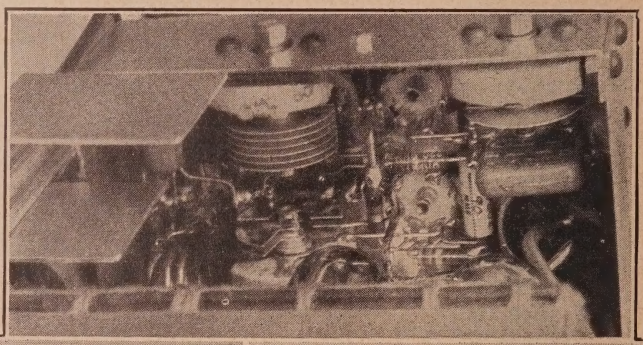
Before tuning up the transmitter, remove all plate voltages except that of the crystal oscillator. With the crystal in place connect a 1-ma meter across the 2000-ohm resistor *R16* and tune the oscillator plate tank until there is indication of grid drive to the first 3A4 tripler. *C17* should be adjusted slightly on the high frequency side of maximum 3A4 grid drive. Repeat this operation with plate voltage applied to both the oscillator and the first tripler and the meter across *R19*. Tune *C20* for maximum grid crurent. In both cases the meter should then read about 0.13 ma. Plate voltage is then connected to the second tripler and the built-in meter switched to read the final doubler grid current of the 3A5. As the tripler plate tank *C23* is tuned the maximum drive should be about 0.4 ma. The meter is then switched to read doubler plate current and *C26* is tuned to resonance.

Once the little rig is set up in its case a two-turn link is pushed into the cold end of the final tank. When loaded the plate dip is very small and sometimes it is more convenient to place a wavemeter or field strength meter near the antenna and tune for maximum deflection of the external meter. Once the transmitter is roughly tuned the only device needed to repeak the stages is the built-in meter. This is switched to read grid current and all preceding stages are tuned for maximum drive.

Power Supply

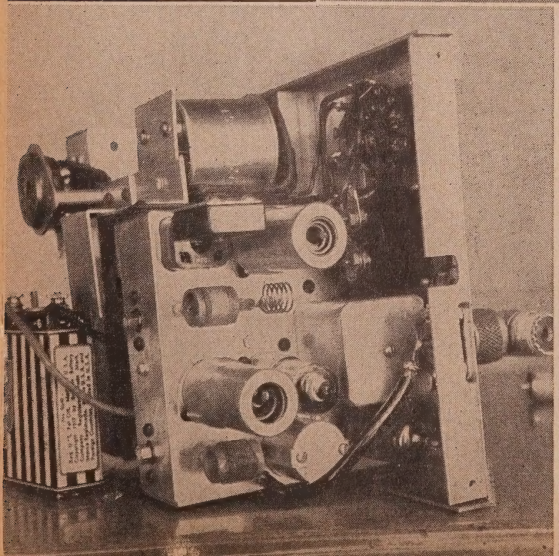
The use of dry batteries was ruled out because of the current drain of the unit. Attention was then turned to some very fine pieces of surplus gear in the form of lightweight storage batteries. For the filament supply a single two-volt Willard battery was chosen and with all tubes plugged in the filament voltage is adjusted to 1.4 volts by a 1-ohm adjustable wire wound resistor. For the plate voltage, a pair of midget vibrator supplies was used. These are Navy surplus and have the part number CRF-20221-A. A small 6-volt rechargeable battery

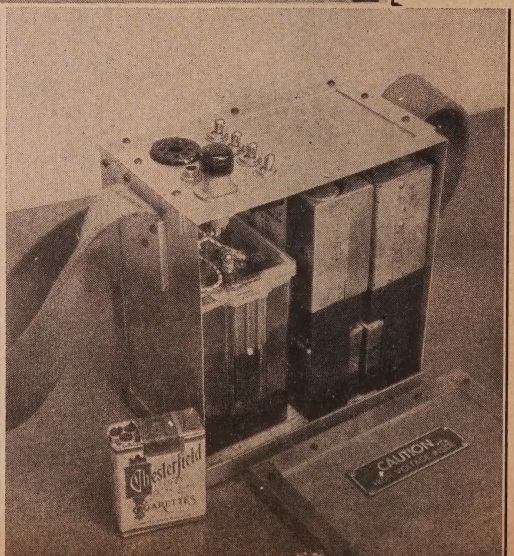
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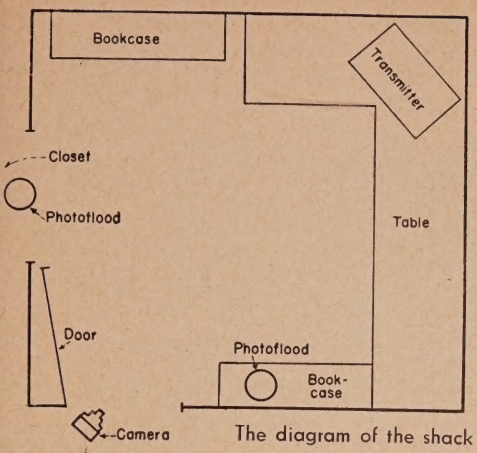


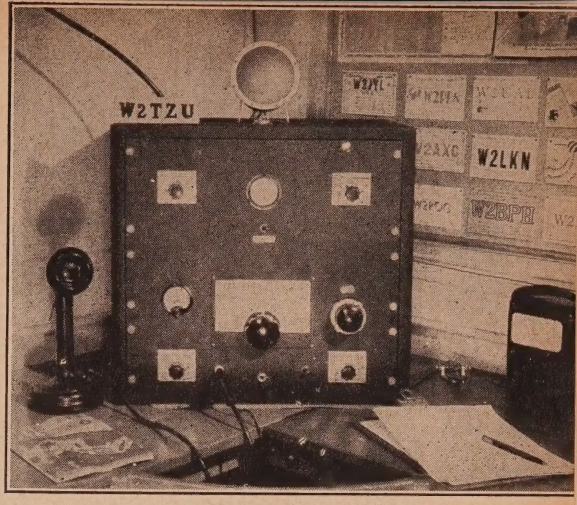
Right: Bottom view of transmitter wiring. Final tank is just visible in lower left-hand corner of subchassis. Below: Top view of transmitter. From the arrangement of the coils some idea of the doughnut layout can be visualized.

Below: Battery box switches control filaments, two vibrator supplies and microphone. Transmit-receive function is controlled from the switch on the rig itself.









The diagram of the shack at W2TZU shows how the accompanying photograph was set up.

Picture Your Rig

JULIAN N. JABLIN, W2PQP*

YOU WANT A photograph of your station. You haven't much equipment—probably just an inexpensive camera—but you would like to make a photo of your rig to show to other hams, to send to radio magazines, or to show "before" and "after" when you have built that kilowatt final.

We made a shot of W2TZU's converted SCR-522, using as little equipment as possible, just to show you how you could do a similar job. The final result is no glamour shot, and wouldn't take any prizes for technical excellence, but it shows what we wanted to show, and it is good enough for magazine reproduction. If you follow the steps we took, you should equal or better the accompanying picture.

Set up the Camera

We had trouble with this one—we couldn't get back far enough to get the rig and some of the QSL cards in. Finally we took the camera out into the hall and shot through the door. This gave us just what we wanted from side to side, but included too much of the space under the table and too much over the rig. However, we knew that in having an enlargement made, we could have all the excess cropped off. That's what happened in the print we had made.

The camera was a small folding Kodak, with adjustments for distance, shutter speed and lens opening. We did not use a tripod—to duplicate the conditions you'll be likely to find, we set the camera up on a small kitchen step-ladder. Then we measured the distance from camera to rig, and set the focus. For information on how to set the focus, lens and shutter on your particular camera, consult the instruction manual or any camera salesman.

*162-11 86th Rd., Jamaica 2, N. Y.

Second, Set up the Lights

This took us the most time. We used two #2 photofloods, in table lamps from which the shades had been removed. One, as shown in the diagram, went into a closet and the other was set on a bookcase in the corner. The trick here is to set up one lamp first, moving it around to avoid "hot spots" of light on shiny surfaces. Watch out for highly polished panels, dials and meters. If you can see bright reflections when you look at the rig from the camera position, move the light around until they are eliminated. Then, set up the second lamp so that it lightens the shadows cast by the first. Again, watch out for hot spots. Be sure that no direct light falls on the camera; if possible, set the lamps behind the camera, a few feet to either side of it.

Take the Picture

Here's where you will have to experiment, as conditions vary too much from case to case to make any specific rules about setting lens and shutter. However, if your camera has a lens opening of 4.5 or 6.3, leave it all the way open, and make a series of exposures, doubling the time in each from one minute to about ten minutes. If the number on the lens opening is larger than 6.3 (f7.7 or 11) make the times of the exposures longer. Use panchromatic film, and follow the instructions packed with it. Keep a record of the exposure times you have used, together with a rough sketch of the camera and light set-up, so that you can pick the best time and duplicate the set-up for future pictures. If the roll is under-exposed (the man who develops it can tell you about that) shoot another, using longer times; if it is overexposed, use shorter times. When you

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POWER HOUSE *Portable*

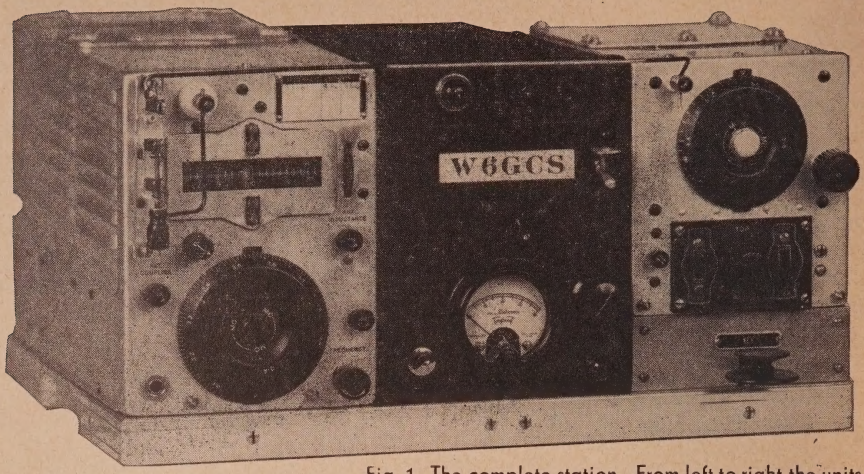


Fig. 1. The complete station. From left to right the units are: transmitter, a-c power supply, and receiver. The hand key is mounted underneath the receiver.

CLYDE C. LARY, W6GCS*

A completely self-contained station made from surplus SCR-274N units.

This article does not deal with the conversion of the individual transmitters and receivers of the SCR-274N, but rather is a suggested method of incorporating the converted units into an efficient portable station.

Fig. 1 shows the portable station ready for operation simply by plugging in the a-c line cord and connecting up an antenna. To the left is the transmitter, in the center is the power supply built into an old transmitter cabinet, and to the right is the receiver covering the corresponding frequencies of the transmitter. The baseboard is a solid piece of white pine, one inch thick, twelve inches wide and fifteen and one-half inches long. Under each corner is a rubber foot. The chrome metal trim on the front of the baseboard serves not only to beautify, but as a common ground for all three units.

The receiver is raised to match the height of the other units by building a small shelf from two pieces of white pine, $\frac{3}{4} \times 1\text{-}5/8 \times 12$ inches. A small metal panel is fitted to the front underneath the receiver and in this space is placed the hand key with the knob extending about one and one-half inches out from the panel. The tail room in this shelf can be used to hold a key-click filter which is generally necessary for the SCR-274N.

The antenna changeover switch is mounted on the upper left-hand corner of the transmitter. This switch is a simple SPDT knife switch obtainable in most dime stores. A No. 12 wire runs across the face of the units from the switch to the receiver antenna post.

The Power Supply

A fly-cutter hole has been cut in the lower center of the front panel to take the $2\frac{1}{4}$ inch, 0–200 d-c milliammeter. Inside the power supply cabinet the meter is just under and clear of the deck of the chassis. This meter is connected in series with the high-voltage lead to the plates of the final amplifier tubes.

At the lower left of the panel is a key lock switch of the ordinary auto ignition type. It prevents anyone, other than the holder of the key, from putting the station on the air accidentally or intentionally. Turning this switch on connects in the a-c line to the primaries of the three heater transformers. The a.c. is applied to the primary of the plate transformer through a switch on the upper right side of the front panel. Since there is no room for a time delay relay within the power supply cabinet this switch has been arranged to prevent the application of the high voltage to the rectifier tubes before they are properly heated. The movable lock must be swung to the right side before this switch can be actuated.

At the right of the milliammeter is a DPDT rotary switch which throws the high voltages either to the transmitter or the receiver. Some care must be exercised here to select a switch with adequate insulation or substitute a relay.

* *400 Sierra Drive, Visalia, Calif.*

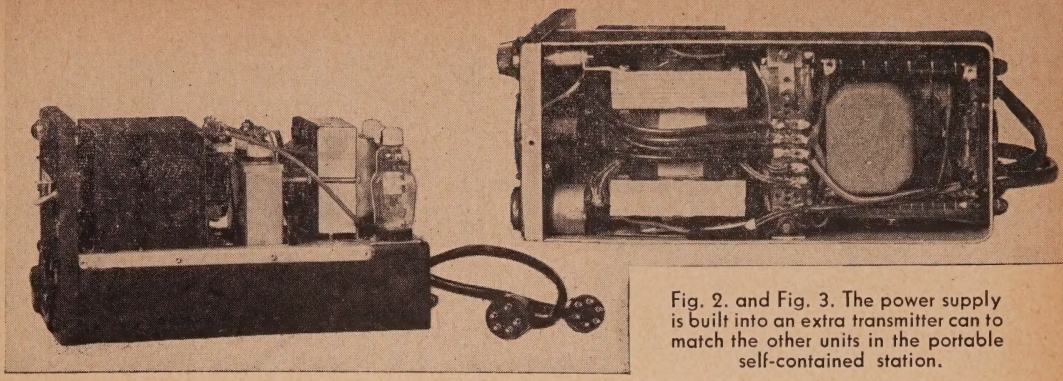


Fig. 2. and Fig. 3. The power supply is built into an extra transmitter can to match the other units in the portable self-contained station.

Fig. 2 and *Fig. 3* show the side and bottom of the power supply. On the top of the deck near the front panel is the plate transformer. Next is the 3-μf oil-filled condenser and then the choke, and finally the two 816 mercury vapor rectifiers. These tubes are mounted in the holes that were once occupied by the oscillator and magic eye tubes. The center hole (where the calibrating crystal was located) is left open for ventilation.

On the underside of the chassis is mounted the two 24-volt heater transformers and 2½-volt 10-ampere filament transformer for the rectifier tubes. On each side of this transformer are the two 50-watt resistors, mounted to the back of the chassis through 2½-inch carriage bolts. The 117 v. a-c line enters through a female socket on the back skirt of the chassis; beside it is the a-c fuse.

The heater and high-voltage leads are cabled out through rubber grommeted holes on each side of the a-c plug. Tube base connectors are used and the leads are sufficiently long to reach the sockets on the backs of the transmitter and receiver.

Operation

Practically no difficulties should be encountered either in setting up these units or getting them on the air. For loudspeaker reception we have cut a hole in the rear of the receiver can and a two-inch speaker is mounted over it. A small output transformer is mounted at the side of the speaker. When in operation the front middle slide on the lid of the receiver is opened for sound release.

With the power supply shown in *Fig. 4* the measured voltages were as follows:

Final plate	650 volts
Final screen	275 volts
Oscillator plate	235 volts
Receiver	260 volts

With the transmitter in operation the milliammeter should read about 180 ma.

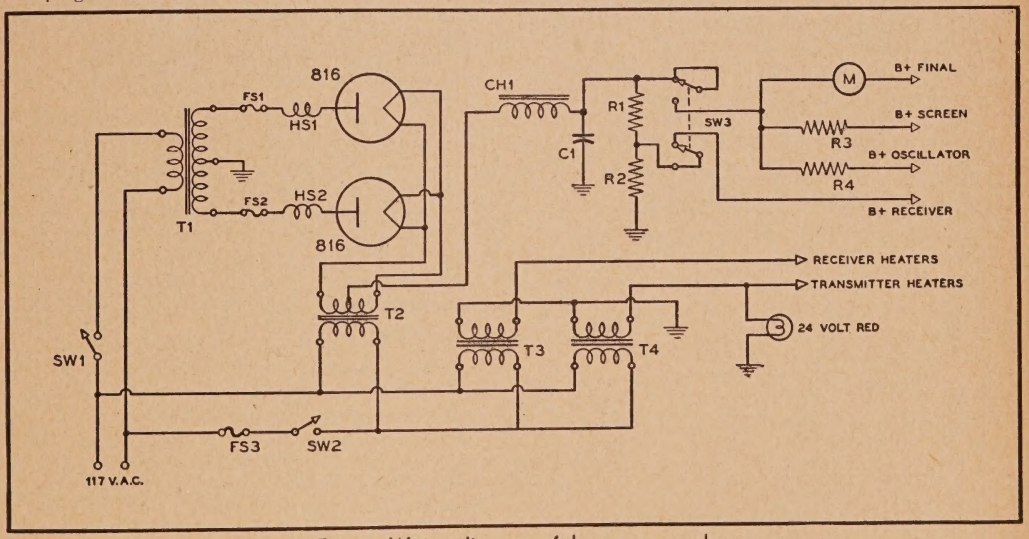
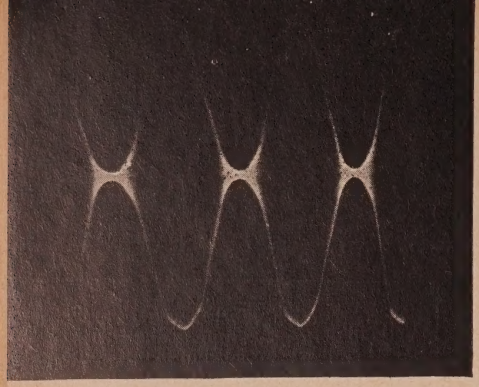


Fig. 4. Wiring diagram of the power supply.

C1—3.0 μf, 2000-volt oil filled.
R1—6000 ohms, 50 watts.
R2—50,000 ohms, 50 watts.
R3—18,500 ohms, 25 watts.
R4—20,000 ohms, 25 watts.
T1—Power transformer 1500 volts c.t. (Stancor 3535).
T2—Filament transformer 2½ volts, 10 amps c.t. (U.T.C. 53S).
T3, T4—Filament transformers, 24 volts.
HS1, HS2—Hash suppressor (Millen).
FS1, FS2—Fuse, 500 ma (Littlefuse).
FS3—Fuse, 6 amps.
CH1—Filter choke, 20 henry, 250 ma (INCA D-4).
SW1—Effort switch (see text).
SW2—Key lock auto ignition switch.
SW3—DPDT switch h.v. insulation.
M—milliammeter, 0-200 (Triplett).



An r-f signal modulated approximately 100% by an unclipped 1000 cps audio signal.

Clipper and Filter

K. L. KLIPPEL, WØSQO*

AMATEUR RADIO PUBLICATIONS recently have carried a number of articles on speech clipping and filtering in an attempt to aid the amateur in obtaining higher average modulation level without an accompanying increase in signal bandwidth. While in general these articles are quite good, it is felt that a little more light on the subject should be shed, particularly with regard to the pitfalls and their unhappy results.

The advantages of clippers and filters are:

1) To raise average power supplied to the side bands.
2) To prevent overmodulation.
3) To reduce spurious sidebands beyond the bandwidth needed to convey intelligence.

These advantages can all be realized with correct design and application of the clipper and filter, but the mere use of them will not guarantee results. An attempt will be made to analyze the entire picture, using a small amount of mathematics, with the results shown graphically, where the problems become readily visible.

Let us assume that a speech amplifier is fed with a sine wave and heavy clipping follows. The waveforms will appear as shown in *Fig. 1.*

The resulting waveform is practically a square wave. Through mathematical means the square wave can be analyzed and when this is done it is seen that a square wave is a resultant wave of odd harmonics plus the fundamental. Fourier analysis shows the basic equation to be $f(x) = b_0 + \frac{2}{\pi} sin\ x + \frac{2}{3\pi} sin\ 3x + \frac{2}{5\pi} sin\ 5x + \ldots \frac{2}{n\pi} sin\ nx$ where b_0 is the average height of the wave, and x is the fundamental frequency.

It can then be seen that these odd harmonics, of which the square wave is comprised, decrease in amplitude as they get higher—the decrease being directly proportional to the order of the harmonic we select. That is to say that if we call the amplitude of the fundamental frequency 1, then the 3rd harmonic is 1/3 as large in amplitude as the fundamental, and the 5th harmonic is 1/5 as large and so on out to infinity. Since the amplitude of the higher order harmonics is so low, we will neglect their effect and in the following discussion will consider only the fundamental, 3rd, 5th, and 7th harmonics. The resultant waveforms shown in *Fig. 2* and *3* will be used as a basis for the following filter discussion.

These higher order harmonics, while down in amplitude, are still large enough to cause unwanted sidebands. For instance, the 7th harmonic (7000 cps), assuming 1000 cps fundamental, is 1/7 as large, or only 17 db down; whereas the 5th harmonic or 5000 cps, is only 14 db down from the fundamental. This, of course, cannot be tolerated, so some sort of filter must be used to attenuate all frequencies above, say 3000 cycles. This means, then, that all frequencies above 3000 cps modulating the carrier are reduced so as not to interfere. One of the simplest and best filter systems for the job is an "M" derived low-pass filter. It is advisable to use a two-section filter to do a good job and a three-section filter for an excellent job of filtering, but for this discussion we will consider a single section. Let us examine the waveforms then as they pass through the amplifier, clipper, and filter.

**Collins Radio Co., Cedar Rapids, Iowa,*

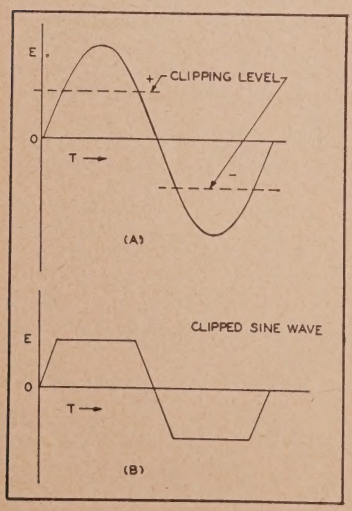
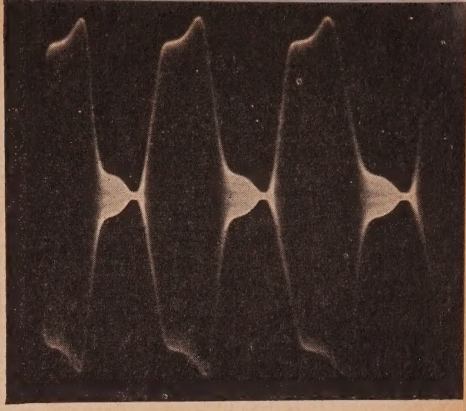


Fig. 1. Sine wave before and after heavy clipping.

Examining the Clipped Waveforms

The sine wave is amplified then clipped and filtered. To prevent overmodulation the clipper has been set so that the peak voltage after clipping shall be of such value as to cause the modulator to deliver sufficient audio power to modulate the carrier 100% and no more. While the peak power of the sine



An r-f signal modulated approximately 100% by a 1000 cps audio signal that has been clipped 10-12 db.

Distortion Problems

A mathematical and graphical analysis of the advantages and disadvantages of speech clipping.

wave of the same maximum amplitude is the same as that of the squared wave, the average power of the square wave is much higher, resulting in higher average sideband power. This, of course, is the desired situation because the receiver detector is an power sensitive device.

Under the above conditions, overmodulation would be prevented if the waveform remained as shown in *Fig. 1b*. Unfortunately, such is not the case. The average power of the wave is decreased by going through the filter, and phase distortion can cause the peak amplitude to exceed the value needed for 100% modulation. The cause of these two things is not obvious but the following illustrations should help to explain what actually does happen and what to do about it.

First, the problem of varying average power will be discussed. Assuming a constant resistive load, average power, when discussing waveforms, can be considered to be directly proportional to the area under the waveform when presented graphically, so a comparison of two areas will show up power variations. The waveform shown in *Fig. 1b* is a clipped sine wave, being very nearly square, and has high average power. Now let us examine the waveform as it comes out of the filter. If we assume 400 cps as the fundamental frequency, then the fundamental, 3rd, 5th, and 7th harmonics lie within the pass band of the filter (0-3000 cps) and the waveform in the output will be quite square as shown in *Fig. 2*, thereby containing high average power. Now assuming 1000 cps as the fundamental frequency, we find that the only harmonic that falls within the pass band of the filter is the 3rd or 3000 cps, which is right at cut off, so assuming no phase distortion the output waveform will look as shown in *Fig. 3*.

It can readily be seen by comparison of areas under the two curves that the average power has been reduced considerably, so in practical language this means that the lower frequencies modulate the carrier to a higher average power than the higher audio frequencies beginning about 700 cps or so. This is inherent in the system.

It is good practice to use some sort of a high-pass filter, or smaller than normal audio coupling capacitors to attenuate the lower audio frequencies from 60–200 cps, because they add very little to the intelligibility.

Filter Distortion

A little-recognized source of trouble that can cause overmodulation is the phase distortion of the filter. In order to understand the problem it is necessary to evaluate the phase shift through the filter as functions of frequency and cut-off frequency.

If the phase shift changed at the same rate as the frequency, no phase distortion would appear. That is to say that if a 400 cps signal had 4 degrees of shift, and a 2000 cps had 20 degrees shift, phase distortion would not be present. Unfortunately, an "M" derived filter (or any filter arrangement that provides a sharp cut off) does not exhibit these characteristics. The phase shift varies, but not at a constant rate. As the frequency approaches cut off the phase shift begins to increase rapidly. The proof

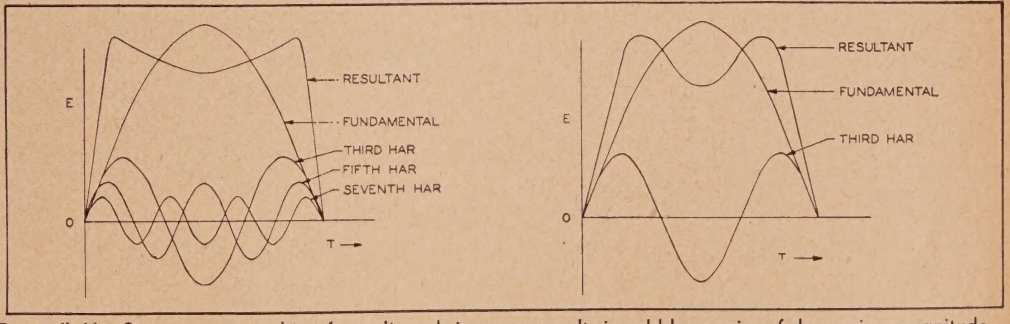


Fig. 2 (left). Square wave resulting from clipped sine wave results in odd harmonics of decreasing magnitude.
Fig. 3 (right). Waveform of Fig. 2 with the principal magnitude harmonics used as a basis for clipper and filter distortion problems.

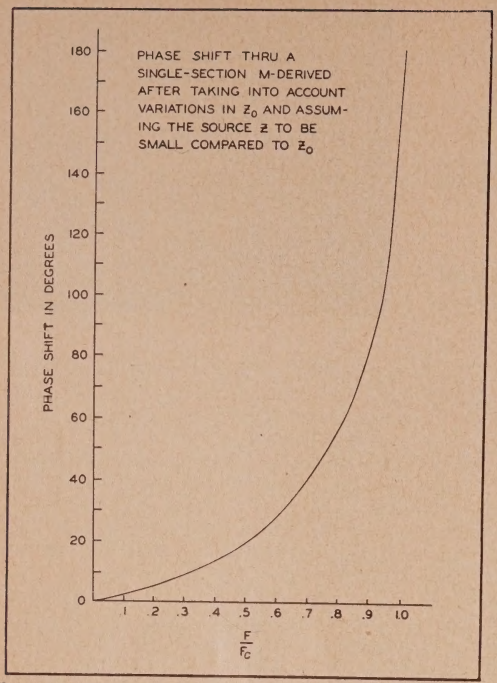


Fig. 4. Phase shift through a single-section "M" derived filter.

of this lies in the basic equation:

$$\theta = arc\ tan \frac{-\left(\frac{f_c}{f}\right) sin\ n\beta}{\sqrt{\left(\frac{f_c}{f}\right)^2 - 1}\left[(1 + cos\ n\ \beta)\right]}$$

where θ = the phase angle in degrees
f_c = cut-off frequency
f = test frequency
n = number of filter sections

$$M = \sqrt{1 - \left(\frac{f_c}{f_h}\right)^2}$$

where f_c = cut-off frequency
f_h = frequency of highest attenuation

$$\beta = arc\ tan \frac{2M\sqrt{\left(\frac{f_c}{f}\right)^2 - 1}}{M^2 + 1 - \left(\frac{f_c}{f}\right)^2}$$

The above expressions appear rather complicated, but anyone who can work algebra and use trig tables can solve them. The results of their solution for different values of frequency over the pass band of a single-section filter where "M" is equal to 0.5 (from $\frac{f}{f_c} = 0$ to $\frac{f}{f_c} = 1$) are shown graphically in *Fig. 4.*

It can be seen from the graph that the shift is fairly constant from $\frac{f}{f_c} = 0$ to $\frac{f}{f_c} = 0.5$ and from $\frac{f}{f_c} = 0.5$ to $\frac{f}{f_c} = 1.0$ the phase shift rate of change is very high. Perhaps the best way to present the results of this phase shift is to show it graphically. The filter under discussion will be assumed to have a cut-off frequency of 3000 cps. *Figure 5* shows the case where $\frac{f}{f_c}$ lies between 0.1 to 0.33 and where the phase shift is quite proportional to frequency. In this case the resultant waveform is symmetrical, and has a peak value approximately equal to the peak value of the fundamental, so no overmodula-

(*Continued on page 96*)

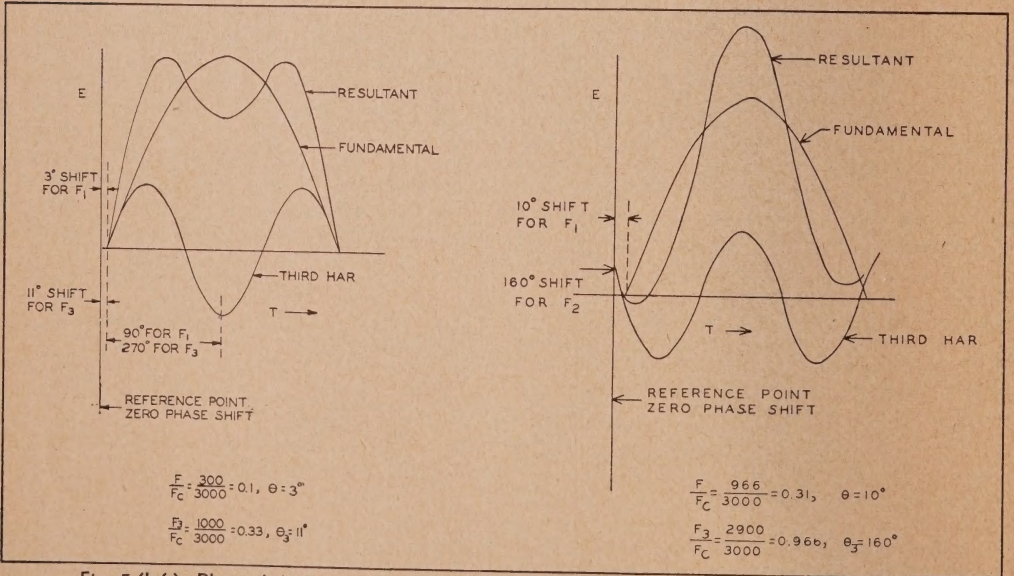


Fig. 5 (left). Phase shift produced by "M" derived filter with 3000 cps cut-off where F is 300.
Fig. 6 (right). Phase shift produced by "M" derived filter with 3000 cps cut-off where F is 966.

Monthly DX Predictions

OLIVER PERRY FERRELL*

THE NEW CRPL book on the ionosphere and the methods of predicting radio transmission was released during the second week of August. This book is called "Ionospheric Radio Propagation," or National Bureau of Standards Circular 462. It is available from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. The price is $1.00.

For the first time, it places in the hands of the average ham the means to compute such factors as the lowest useful high frequency, lowest required radiated power, noise grade and signal absorption using the best data available. The methods shown in the book are based upon research not only done by the CRPL, but also by the Radio Propagation Unit of the U.S. Army Signal Corps and cooperating foreign agencies. At this low price, no one can go wrong in buying "Ionospheric Radio Propagation" and subscribing to the monthly basic radio predictions, if they are interested in DX, or making DX schedules.

The book is not only useful for making accurate predictions, but it incorporates a good fundamental section on the structure and origin of the ionosphere. In general, it is not completely digestible at first reading and anyone attempting to make their first predictions should not be too disappointed if they run aground somewhere in their first or second tries. Considerable thought and concentration are needed to align the eight to fourteen steps in computing the median received field strength. Off-hand, however, it does appear that in several places the methods of operating the graphs and monograms could have been better outlined and somewhat simplified. "Ionospheric Radio Propagation" also commits the error of publishing a set of odd-size absorption maps. This requires two sets of overlays, one for use with the monthly predictions and another complete set for use with this book. This creates many needless and uncalled for mistakes, not forgetting the much more time required in computing each path. Readers may also be mystified by several incomplete figure captions and descriptions, for example, the unexplained cyclic bursts of huge fields in Figures 3.15, 3.16, 3.17, and 3.18. Few readers will be able to guess that they are probably due to the manual operation of the ionospheric recorder. But all in all, the authors are to be congratulated for some competent handling of some very difficult subjects.[1]

Assistant Editor: CQ.

Prediction Graphs Omitted

As reported in the September column the system of graphic presentation used for the Monthly DX Predictions is about to be changed. This step was desirable in order that the Predictions might be brought up to date. Also, to better serve their intended purpose it was decided that they should be confined solely to the amateur band frequencies.

Unfortunately, the new presentation could not be prepared in time for the closing date of this issue. Next month, however, a feature story explaining the new presentation and showing some of the newly devised systems for predicting amateur band useability will be published.

Packaged Prediction Data

A plan is now being given consideration by the Editors of *CQ* for the preparation of a *Propagation Work Data Package.* The basic idea is to simplify some of the complex nomograms and computations in "Ionospheric Radio Propagation" down to terms of amateur band usage. This is possible since the DXing amateur is mostly interested in the peak times of possible DX openings and the comparative signal strengths to be expected. Redesigning the absorption nomograms into factors of field strength, distance and absorption (*Ad*) permits separate easily read graphs to be constructed for each amateur DX band. Additional data not shown in "Ionospheric Radio Propagation" will also be included in this work package.

Because of the wear and tear on certain graphs and charts it is believed that arrangements will be made to mount them on heavy cardboard, coated with a liquid plastic to preserve the surface. Also to be included in the package will be work sheets for recording the necessary steps in computing the MUF, Kd, J, Q, Ad, LUHF and field strength factors. Blank field strength graph paper will probably be included. The package will contain an instruction sheet listing only those steps necessary in prediction of amateur band DX openings.

The prediction work package is designed particularly for amateur radio clubs and since it will be custom-made to order, it will probably be fairly expensive. The present estimated price is about $12.00. The package will also be available to interested individuals. Anyone desiring further information should write to Prediction Package, c/o CQ Magazine, 342 Madison Ave., New York 17, N. Y.

1 As in the usual case of Government publications the book was written by the staff of the originating laboratory. From the CRPL, they included: A. G. McNish, T. N. Gautier, R. Bateman, K. A. Norton, H. P. Hutchinson, H. V. Cottony, A. H. Morgan, R. Silberstein, W. B. Chadwick, J. W. Herbstreit and E. L. Schultz.



Conducted by VINCE DAWSON, JR., WØZJB*

PERHAPS THERE have been more than we v-h-f men taking a vacation during August, for 6-meter reports show the openings to be few and far between. In contrast, 2 meters has put on a spurt of new activity, especially in several remote localities, and some nice 200-400 mile hauls have been made.

August 1 was the last big full-scale 6-meter opening. Double hop was observed and the boys in Oregon and Washington once again got a crack at those in the southeast section of the country. Since then the band was scattered and erratic, although unusual as it may seem, the 10-meter F2 layer started back in several weeks in advance. Quite good 28-mc DX was worked from August 15 on to August 25 as this is being written. If this is any prognostication, it might be reasonable to expect 6-meter F2 openings sometime in late October. Although the best authorities only predict somewhat better conditions than existed in 1946, it shall certainly be interesting to watch and see what does happen at 50 mc.

On a yearly comparative basis there was an undeniable drop in "length of openings" as well as frequency of openings over certain paths. Strangely enough, on a total basis there were more openings during 1948 than during 1947, but for a very large part they were of short duration. There is some indication that most of the sporadic-E occurred too far north to affect the usual W9-W1 path that was so prominent in 1947. On the other hand in the southwest, there were many more openings, though nearly all of them were weak and rather shifty. An analysis taken from the Watson Lab project will be prepared and published sometime this coming winter.

Maybe some of the 6-meter woes can be traced to the unusual solar activity during the past spring. During this period the sunspot numbers ran as follows:

February, 1948	—	107.3
March, 1948	—	103.8
April, 1948	—	222.5
May, 1948	—	194.8
June, 1948	—	203.6

This shows the rather unusual sequence when as the sunspot number decreased from last fall and winter, it suddenly more than doubled during the latter part of the month of April. Since that time it has remained extraordinarily high, bringing into effect a double peak in the sunspot numbers. Should the high numbers continue (contrary to all predictions) F2-layer 50-mc openings would be more than possible this coming fall.

A Research Project for 2 Meters?

In the report "Meteorological Factors in Radio-Wave Propagation" considerable attention is given the new field of radio climatology. C. M. Durst defines it as, " . . . the study and mapping of those regions where the horizontal propagation in the atmosphere of radio wave . . . is abnormal and the indication of the degree of the frequency with which the effects are marked." We wonder how many 2-meter men have considered that they hold the key to the solution of this problem.

The situation here is almost exactly like that that formulated the sporadic-E project. Quantitative measurements and observations must be made. The most feasible, if not the only method, is through the combined efforts of the radio amateurs throughout the United States, Canada and Mexico. Carefully collected and screened amateur reports and observations can provide a working basis for correlation with weather data.

At this time we are privileged to report that such a program has been given very favorable consideration by various research agencies. Before attempting such an undertaking it is necessary to gain some idea of the feelings of the 2-meter operators. If you operate 2 meters, would you cooperate in such a venture? What are your ideas along this line?

The 50-mc Scene

XE1KE, Mexico City, D.F., Mexico reports the band open into Texas and Oklahoma on July 25, 26, 27, August 1 and 10. Mostly the signals were weak to fair showing that band was slowly going dead for the season. B. J. is quite anxious to see if the long haul South Americans start coming through in October. Ferrell says he should start hearing the first Argentina signals during the last week of September. Here's hoping you're both right! Reports from Buenos Aires indicate that activity is at a new high down there.



WØNFM, Solon, Iowa, apparently drained the local bank recently and bought a new car—especially to drive up to the Milwaukee meeting. Clair worked Nevada on August 2nd when everyone else was asleep and now has 47 states. He still needs West Virginia, a not too difficult problem, if activity keeps up. A new 12-element H array is up and is doing a very good job.

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

W4EQM, Langdale, Ala., says the band was rather a disappointment this year, although Bill did manage to add Vermont and Wyoming bringing his all-time total to 43 states. XE2C was worked on May 18.

W8NSS, Dayton, Ohio, hasn't managed to get on as much as he used to and probably as much as he would like, due to extra work and other things the XYL can dream up. Carl has 44 states and promises to get on 2 meters within the near future.

W6IWS, Brookdale, Calif., says the August 1 opening was a corker, but he was too busy hunting out new states to log everything heard. The band from all reports was really loaded. Both Dakotas were added that night, as well as Kentucky. This isn't bad for a QTH down in a valley practically surrounded with mountains. The antennas at W6IWS consist of six half-waves in phase with reflectors and three fixed beams, one aimed on azimuth 360°, another on 060° and a third on 095°. The power is 75 watts.

"Down New Hampshire way," according to the Boston way of speaking, W1LSN, Exeter, also notes the decreased number of good openings. Local activity and the good ground wave contacts are missing, too. Probably most of it is due to severe TVI, which particularly plagues the 6-meter boys in the New England and Middle Atlantic States. However, it is about time more net activity was organized, something on the order of the Atlantic net described by W3MFY in our last column.

Herb Spoonts, W5LIU, really started having troubles when the 6-meter rig failed, antenna started to fall apart, the draft is coming up, etc. But Herb has managed to weather it and is on his way to Texas Tech at Lubbock. Not much time for v-h-f with studies and co-eds and all. Herb says that two years of operating on 6 meters was great fun and he feels he has learned much of good operating habits, fighting spirit (50.004 mc and 10 watts), and now has plenty of patience. Good luck!

W7BQX, Sequim, Wash., recently erected a lazy H with reflectors. On the average it is about two S points better than the older 4-element beam. Up towards Vancouver it brings their S4 signals up to S9 and a little over. It hasn't worked out too well on the sporadic-E openings, which seems to say that the angle of radiation is too low (is there such a thing?). Ernie missed Tennessee on August 1 because he was out fishing. Didn't get any fish either.

VE5NC, Saskatchewan, had better openings this year than last. With limited operating and only 10 watts, Basil heard or worked 31 stations from July 10 to August 15. This compares with only 5 stations heard last year during the same period.

W7DYD, Bothell, Wash., heard XE2C on July 26, but was unable to raise him. Herb believes that August 1 was the best opening of the year. 16 states, 49 different stations were heard during the four-hour period. W7DYD has 41 states, picking up Tennessee during this opening.

W5GNQ and W5HTZ in south central Oklahoma both agree the openings were not up to those of 1947. However, these boys keep active with fairly good contacts to Oklahoma City which is about 100 miles to the north. Both have decided to try 2 meters.

W7KVU, Bozeman, Mont., a converted DX man from W6QD's column, says that 6 meters proved rather interesting. John has been on 50.012 mc with 80 watts into a folded dipole. A Lester converter into an NC-240-D is used for receiving.

A first-rate v-h-f hamfest is going to take place during the Southwestern Division Convention, October 2 and 3, at the Alexandria Hotel, Los Angeles, Calif. At latest reports crying towels for that DX we missed will be passed out by W6UXN, W6OB, W6OLO, W6PUZ, W6ANN, W6AOR, W6VMT and W6WNN. Sounds like quite an affair, if you read this in time, why not plan to attend this meeting and see all the other loons that stick it out on 6 meters year after year?

The spook, W7QLZ, Phoenix, Ariz., comes up with a few good words about the past season. Clyde says, " . . . there were as many if not more openings on 50 mc than in the last two years, but the openings on the whole were very spotty and of short duration. There seemed to be a great deal of layer shifting and signals would burst through for five or ten minutes, then suddenly shift to another section several hundred miles away. Noticeable this year was the lack of double hop into the W1, W2, W3 and W8 areas. But, there was more activity east and west between W6-W7 and W4."

" . . . peculiar thing noted this year . . . during the June openings . . . (was) that on about a dozen nights after the band had apparently folded up, stations like W6IWS, W7HEA and W7FJD would be heard for several hours about S1 and S2 with the very hoarse fade characteristic of aurora. Audio would be unreadable, but the average signal strength would be the same for hours. W6IWS mentioned this effect and also that my signals came in best on his north beam."

One of the first big two-meter openings of the season came off on August 26. W2MO, Livingston, N. J. worked W8WJC, Everett, Ohio using horizontal polarization and W8UKS using vertical polarization. Numerous other New Jersey, eastern New York and Connecticut stations were heard and worked over this 450 mile path. This gives W8WJC at least 15 states on two-meters.

What probably would have been one of the biggest W1, W2, W3 to W9 and WØ 6-meter openings occurred the morning of August 27. Only known active stations at the time were W1DJ, W2BYM and W9ALU, while Ferrell was listening in from Philadelphia. The band opened shortly after sunrise and remained open until mid-afternoon. Both Mel, W2BYM and Ferrell heard Hod, W9ALU the loudest they had all season. Once again those who desert the band missed another tremendous opening.

While everyone is reporting their successes on 6 meters, W7NIV, Hawthorne, Nev., has yet to hear a sporadic-E signal. Mel has some good quipment going, but he and W7TJY, W7KLK and W7PST all seem to be in the same boat. Signals just don't seem to get out. Barring any completely unknown factors, this is certainly unusual, since Hawthorne is within the ideal working distance of the boys in northern Washington and southern British Columbia. The takeoff on this path is across a lake, and while mountains obscure the paths towards California, the skip would also be prohibitive for work in this direction. Working the other way, W7QLZ and W5ELL certainly would hear these boys if they were on when the band was open.

A stranger in our midst has been W5AGG/portable mobile. Who is he? None other than OA4AE. Buz is on both 6 and 10 with a converted 522 and a PE-103A. From Watertown, Wisc., a few words regarding the project from W9NJT. Don is using a homemade converter into a BC348-Q. Running about 150 watts to push-pull 24G tubes on 50.240

50 MC HONOR ROLL

	S.	C.		S.	C.
WØZJB	48	4	W6IWS	37	3
WØNFM	47		W9VZP	37	3
WØUSI	47	3	W1LSN	36	
W9DWU	46		W6AMD	36	4
WØDZM	46		W9UIA	36	
WØQIN	46		W4FNR	33	
W7BQX	45		W5GNQ	32	3
WØBJV	45				
WØCJS	45		W2RGV	28	6
W8NSS	44		WØHBA	21	
W4EQM	43		W8LBH	19	
W8QYD	43				
W5AJG	42	7	XE2C	16	3
W7DYD	41		W6ON	10	

mc. From another Watertown, this one in South Dakota, WØHBA is on with 100 watts to an 829B final. Collins 75A receiver and VHF-152 converter, with R9er. W4EQR comments in wonderment about W4CNK and his portable mobile 6-meter rig. A 6AG7, 6V6 into an 815 final, modulated by 6L6s. All this and a PE-103 are going into a *Crosley*. A new receiver is under construction at W4EQR, crystal controlled, to be used especially as the i-f channel from the VHF-152A.

Monthly Review

Sixty-two reports were received from members of the Watson Lab Sporadic-E Project work group during the first three weeks of August. This brought the total of known participating members to over 100. An important announcement concerning the project is in the offing, but cannot be given here at this writing. Possibly we will be able to say something about it "off the record" at the Milwaukee Convention. But, in any case, work group members will be notified directly very soon.

As in our usual practice we list below the openings on 6 meters as reported to us through the project. The great number of stations involved precludes the listing of individual stations, except in unusual or outstanding instances.

July 20—Screening of reports shows only one contact, W8LBH-WØCJF at 2330 EST.

July 21—North-south paths between W1, W2 and W3 to W4 open from 1800 to 2130 EST. Some noticeable drifting with W4-W5 paths open from 2225 to 2250 EST and eastern W5 to W8 from 1830 to 2215 EST.

July 22—Fair signals from VE1 to W3 and W4 between 1700 and 1900 EST. W6IWS heard a few weak W7 signals around 2150 EST.

July 23—Widely scattered fair openings with W1, W2 and W3 to W4 from 1640 to 2040 EST. W8 to W4 after 1830 EST. W5 and WØ into W6 and W7 from 2000 to 2215 EST.

July 24—Short morning opening over the W1, W2 to W4 paths. Scattered signals from W5 to W6 from 1330 to 1910 EST. WØ to W4 and W7 from 2040 to 2350 EST. XE1KE heard W5EYV, while VE6MO worked WØAZE around 1915 to 2100 EST.

July 25—Scattered W2 and W3 signals into W5 and WØ during morning and afternoon. Fair opening from XE1 into W5 from 1650 to 1845 EST. Weak W7 signals heard by W6ANN around 1300 and again around 2315 EST. W7HEA reports weak W6 signals during same periods.

July 26—Very good wide spread evening opening beginning around 1800 EST. Double hop signals from W6 and W7 into W4 and W8. Good XE1 to W5 opening during same period. "CQ de KLCK" on 50.3 mc reported on both coasts of the continent at the same time.

July 27—Good XE1 to W5 opening from 1610 to 1815 EST. W1 and W2 into W9 and WØ from 1715 to 1930 EST. Some lower W6 to upper W7 from 2150 to 2230 EST. W7HEA works W4CDC on double hop at 2115 EST. VE5NC and W9VZP at 1902 EST. Strong W5 signals into WØ from 1930 to 2050. WØCJS reports that all signals appeared to come from overhead, no beam directivity noted.

July 28—W4EQM heard W5VY weakly at 2044 EST.

July 29—W7 and VE7 into W5 and W6 from 2100 to 2200 EST.

July 30—More W7 and VE7 into W6 from 2100 to 2150 EST.

July 31—Dead.

Aug. 1—XE1KE works W5EEX at 1115 EST. Good opening with considerable double hop from W7 and W6 into W4, W5, W8, W9 and WØ from 2030 until 2240 EST.

Aug. 2—W7QLZ hears erratic signals from across the mountains into California. W6OB and W6DPF worked between 1245 and 1340 EST. WØNFM hears W1CLS at 2030 and later works W1RO. Only reports received.

Aug. 3—Dead.

Aug. 4—W7QLZ works W6OB in short burst at 1350 EST W7LYA hears W6VEU at 2142.

Aug. 5—Dead.

Aug. 6—Dead.

Aug. 7—Dead, although ionosphere storm begins in late evening, some aurora noted.

Aug. 8—Tremendous aurora opening with W3OJU working 31 stations, WØKVF working 14 stations. WØUSI works W9QUV, W9QKM, W9PK, W9RQM and WØKPQ. W8NQD worked W9QKM, W3OJU, VE3ANY, W9ECH, W4FWH, VE3ADJ and W3CIR/1.

Aug. 9—One of the worst ionospheric storms continues with aurora again during evening. W9ALU hears W8TOB. W3OJU hears or works W8TOB, W8APG, W1CGY, W1LLL, VE3AET and VE3ATN.

Aug. 10—Severe ionosphere storm continues with new fury. Aurora visible at W7KVU. Blanketing sporadic-E observed with W1, W2 and W3 stations working into W9 and WØ from 2000 to 2045 EST. XE1KE hears W5GLD weakly at 1850. Scattered to fair W5 signals into WØ and W7 from 2030 to 2325 EST. W5WX works VE5GQ at 2200 EST.

Aug. 11—Weak to scattered signals between W5 and WØ and W7 from 1850 to 2105. W5FSC hears W8NSS at 1850 EST. No signs as yet of severe ionosphere storm abating.

Aug. 12—Weak W6 to W7 opening 2040 to 2130 EST.

Aug. 13—W8NQD works VE1TR at 2107 EST. W6 to W5 and W7 scattered from 2100 to 2210.

Aug. 14—Ionosphere storm has now subsided. Fair W9 to W5 opening from 2040 to 2115 EST.

Aug. 15—W3OJU hears VE1QZ from 2050 to 2135 very weakly.

Aug. 16—Aug. 25. Band is now dead. Long live 6 meters!

Because of the many requests, we are continuing the 50-mc Honor Roll. All Project and non-Project 50-mc operators are invited to write us their latest standings. The new method of listing will be in order of States Worked. It will also show countries worked, without regard to individual prefix.

The 144-mc Scene

The 2-meter band has been given a nice shot in the arm around Kansas City. WØDSR, Greenleak, Kansas, 135 miles to the northwest has been putting a consistent signal into that area during the past month. WØDSR has a 16-element H area for horizontal polarized work and a 24-element vertical, both about fifty feet in the air. On one of the fair July openings W9MBD heard WØDSR at a distance of 390 miles and WØMZH in Kansas City at 260 miles. WØDSR is only running 20 watts, but is tuning with a triple conversion receiver nightly from 2000 to 2200 CST. Attention St. Louis gang particularly!

The hot spell during the latter part of August brought forth some good DX with WØRNC, St. Joseph, Mo., Aug. 22 working the 260-270 mile path into WØJVE and W9MBD, Collinsville, Ill. WØRNC also heard around 2200 CST, WØIFB at 240 miles and Zearing, Ill., W9ZHB at 290 miles. Best DX heard was W9HGE, Beloit, Wisc., at 2210 CST. 362 miles away. The antenna at WØRNC is a six tier stacked array with reflectors. Shortening the feedlines about 50 feet has apparently worked wonders at this station.

W6WNN says that on both August 10 and 12

(*continued on page 76*)



Conducted by HERB BECKER, W6QD*

World-Wide DX Contest

IT WON'T BE LONG NOW! In about a month from the time you read this (the stateside boys, that is), the first weekend of the *World-Wide DX Contest* will get underway. The dates for this weekend are October 29, 30, and 31, and will be for phone only. The brass pounders will have their fling at it the following weekend, November 5, 6, and 7. For complete rules and regulations, just snoop around elsewhere in the magazine, and I think you will find it. Don't forget . . . we have printed up a batch of contest log forms, and there are plenty of them. There are enough so that you can make a duplicate or carbon copy as you go along, thus eliminating the work of recopying after the contest is over. For these forms, send a stamped, self-addressed envelope direct to Radio Magazines, Incorporated, 342 Madison Avenue, New York 17, New York. Larry has them all in New York (he won't let me have any). Be sure to specify the number of sheets you think you will require. We also have reprints of the DX Contest Rules which can be had for the asking. Get some and send them out with your QSL cards.

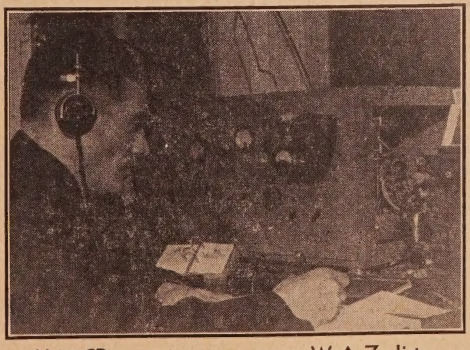
W.A.Z.

Five more DX men join the ranks of those who have Worked All Zones, and we want to congratulate them on this achievement.

56	W6KUT	Ed A. Andress	40	151
57	W6DI	Guy Dennis	40	176
58	W4CYU	Robert Hecksher	40	182
59	W6MEK	Frank Valentich	40	177
60	W6PZ	Fred B. Gallien	40	124

None of the above really need any introduction. W6KUT got a little late start after the war but made up lost time. W6DI is, as you know, one of the hard working members of the DX committee. We don't know if Guy tried to put one over on us but in checking over his 40 cards we found he tried to slip a Zone 5 card in for his Zone 4 contact. We told him that surely he knew his zones since he is checking the Marathon entries each month. If your Marathon totals get fouled up . . . just blame it on to W6DI!!! W4CYU did a good job in getting his 40 together before he left for a month's vacation in W6. Bob dropped in the other day and picked up his cards, after we tried to hold out one of his choice ones. Then W6MEK has been in there pitching for years. Both he and W6PZ live in Oakland which already has a few others making W.A.Z.

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



UA9CB, prominent on many W.A.Z. lists.

Marion & Prince Edward Island Added

Here is another new one to add to your official Country List. . . . "Marion and Prince Edward Islands." As you know by now, Marion Island is located about 46° South and 43° East. When you spot this on your map, you will also notice Prince Edward Island slightly to the north. Since they are both under British control, and due to their close proximity to each other, grouping them together seems logical. Any of you fellows who have claimed this one prior to August 20 should submit it again and it will be duly recorded.

Effective immediately, will you fellows please change the country "Mongolia," as it is now shown, to read "Mongolian Republic (Outer)." There have been a great many questions raised about C8LS in Inner Mongolia counting as a separate country. The wording on the present Country List, where the country is shown as Mongolia, naturally would raise the question in your mind as to whether it is Inner or Outer Mongolia. Inner Mongolia is another Chinese province as is evidenced by the C8 licensing area.

It looks like Hungary won't be such a toughie much longer. According to *HA1KK*, licenses are expected shortly and the entire picture in that country is brightening. Furthermore we have a letter from the Hungarian Short-Wave Radio Amateur League announcing new officers and the resumption of the HA QSL Bureau. It is expected to have excellent participation from Hungary in the *CQ DX Contest*. HA QSL Bureau address is in the QTH list.

Contest Rules Reprints Available

If any of you fellows want reprints of the rules for the *World-Wide DX Contest* . . . simply write to my boss in New York and he will shoot you a mess of them. Some of the boys have been sending them to DX stations overseas and in this way they should be thoroughly acquainted with the contest by the time it rolls around.

KV4AD pulled the switches on August 3 and is no more. He had been on the air for two years and gave many a phone man a country. As a little sidelight (very little I assure you) W6DI one of our committeemen, was the third from the last QSO for KV4AD. He'll soon be a W and then he, too, will get a demonstration of brotherly love as practiced by the DX fraternity.

I'm glad to see GW4CX in the Honor Roll with 38 and 120. He says he chased *AC3SS* for an hour with no success. Willis relates that GW4CK will be another one for the Honor Roll as soon as he can fill out the forms and get them in to us.

W6AM tells me that *HC1ES* of Quito has just returned from the jungle and will write an article for *National Geographic*, probably on the head hunters. He intends to return to the jungle to live with the head hunters for a year. Don wanted to know if I thought he would sign HC1ES/head hunter. I told him if he did and was on phone . . . that would be a good way to lose his.

KL7KV recently visited W7DL and says, "Gee that guy takes his DX seriously." Says DL is planning a new rotary 100 feet up. No neighbors, I guess. KL7KV says every now and then a few Ws get sore at him because he won't QSL direct. He can't do this as there are too many of them . . . too expensive and takes too much time. But . . . he does QSL 100% through bureaus and usually before he receives the card from the other guy. Don't see much wrong with this system, do you? By the way, some of you may remember him years ago as W6EMY.

AC4YN gave a bunch of the boys the jitters around the latter part of July when he came through for a few mornings. The first couple of days he worked a flock of W6s and W7s and said he would gun for the east coast gang around 1200 GMT. However, as far as I know he didn't connect with any of them. The third a.m. he was on, I think it was, he worked a number of west coast fellows on phone. Reg said that very soon, probably by the time this appears in print, there will be another AC4 on the air in Lhasa. He will sign *AC4RF* (these, of course just happen to be the initials of Reg Fox). I rather suspect the new station might be none other than *AC3SS* since he indicated some time ago that he was headed for Tibet just about this time of year.

It was good hearing *ZP3AW* working the boys right and left . . . a la VP7NG in the contest. He said he would QSL all contacts through ARRL but it would be about six months before he could get around to it. I also heard him giving one or two of the fellows a piece of his mind for a little plain and fancy frequency climbing.

C8LS is in China. He is not in what some of you may think a separate country. It is true that he is located in Inner Mongolia but this is a Chinese province. C8LS is in Zone 23, however.

VU7BR is now located in Bordeaux, France, according to F8BS. He is doing some reconstruction work on bombed-out petroleum plants, and is trying to get a license to operate from France while there. F8BS says the R.E.F. tried to get the French government to issue a separate prefix to Corsica

WORLD—WIDE DX CONTEST RULES

1. Contest Period: 0200 GMT October 30 to 0200 GMT November 1 for phone and 0200 GMT November 6 to 0200 GMT November 8 for c.w.

2. Bands: The contest activity will be confined to four bands, 3.5, 7, 14, and 27-28 mc amateur bands.

3. Divisions and Sections: The competition will be divided into two divisions, c-w and phone. Each of these two divisions will be divided into two sections, the one-operator and more-than-one-operator section. Thus, there will be: (1) one-operator c-w section, and (2) more-than-one-operator c-w section; (3) one-operator phone section, and (4) more-than-one-operator phone section. Stations in each section will compete for awards only with others in the same section. C-W stations must work c-w stations, and 'phone stations must work 'phone stations only; however, stations in the one-operator section, and stations in the more-than-one-operator section of both c-w and phone divisions may contact each other. Stations may enter in more than one section, but logs must be submitted for each section.

4. Equipment: There will be no limit to the number of transmitters and receivers allowed, and competitors may use the maximum transmitter power permitted under the terms of their licenses.

5. Serial numbers: C-W stations will exchange serial numbers consisting of five numerals, the first three being the RST report, and the last two being their own zone number. Stations in Zones 1 through 9 will prefix their zone number with zero (01, 02, 03, etc.). Phone stations will exchange serial numbers consisting of four numerals. The first two being the readability and strength report, and the last two being their own zone number. Phone stations in zones 1 through 9 will prefix their zone number with a zero (01, 02, 03, etc.).

6. Contacts: Contacts between amateur stations on different continents shall count three points; contacts between amateur stations on the same continent but not in the same country shall count one point; contacts between stations in the same country, for the purpose of obtaining zone and/or country multipliers, shall be permitted but no points will be allowed for these contacts.

7. Multipliers: Two types of multipliers will be used: (1) a multiplier of 1 for each zone contacted on each band (2) a multiplier of 1 for each country worked on each band.

8. Scoring: The contest score will be the sum of all contact points multiplied by the sum of the zone and country multipliers.

9. Awards: Certificates will be awarded to section winners in each division of:

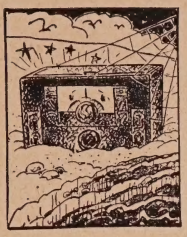
(1) Each U. S. call area
(2) Each licensing area of Canada and Australia
(3) All other countries

Certificates will also be awarded to each operator of each winning station in the more-than-one-operator section.

10. Zones and Continents: The W.A.Z. boundaries as defined in "CQ-DX" and in *CQ* for January, 1947, and the recognized continental boundaries as used for W.A.C. will determine zone and continent boundaries. The W.A.Z. maps are reasonably accurate, but should any question arise as to the positive location of a station, the official definitions will be final. The latest official country list as published in *CQ* for May, 1948, with any revisions announced since then will be used to determine country multipliers. Copies of the country list are also available from the *CQ* Editorial Office upon receipt of a stamped self-addressed envelope.

11. Eligibility: The contest will be open to all amateurs but *CQ* staff members are not eligible for awards.

12. Disqualifications: Falsification of logs or illegal operation in any manner will be cause for disqualification. The decision of the judges will be final in all cases.



With another winter practically upon us, the serious DX fans in the fraternity are preparing their stations for the increase in activity which accompanies the colder weather. Now is a fine time to give the equipment in the shack a good going over, paying particular attention to the condition of the receiver. During our travels this past summer, we observed that quite a few receivers required only a normal amount of simple maintenance to bring them back to their original factory condition.

Some amateurs still are far from securing all in the way of performance their receivers are capable of producing, simply because so little care is applied to the receiving antenna. Random lengths of antenna wire are good enough for local reception, but for DX work some attention to impedance matching will considerably improve overall results. Even a random length of wire may be tuned to resonate at a desired frequency right at the operating table by a simple LC parallel circuit, which is then link coupled to the usual low impedance receiver antenna input. This expedient will insure a good match between antenna and receiver with a corresponding improvement in signal-to-noise ratio. A lazy man's parallel circuit of this type may be made up with a fairly large variable condenser and a relatively small coil so that any three bands may be tuned without changing coils or taps.

Low impedance doublets and folded dipoles are even more satisfactory than resonant single wires matched as above due to the inherent noise reduction properties of their feeders; however, operation at frequencies other than those for which these antennas are cut will produce poor results. The ultimate in receiving antennas is a rotary beam, as most leading DX men will attest. One beam we observed pulled a DX station out of the noise level to produce a good S-9 signal, while at the same instant other stations at the same frequency were for the most attenuated, due to their different relative locations, far enough to allow a perfect QSO to take place uninterrupted. Why not be fair to your receiver, and look into the antenna situation before the start of CQ'sWorld Wide DX Contest?

Speaking of DX, we'd like to mention in closing that an extremely interesting paper has appeared which presents data indicating a close relationship between radio transmission phenomena and the position of spots on Old Sol's face.[1] A new approach to rapid DX predictions seems in the making; and if some means can be devised to circulate a "sun spot map" as rapidly as the weather maps, amateurs will be further equipped to search out the elusive ones while conditions are ripe.

—Seth Card, W1DRO

1 Audrey Arzinger, H. E. Hallborg, and J. H. Nelson, "Sunspots and Radio Weather," RCA REVIEW, Vol. IX, June 1948. Published by RCA Lab. Div., Princeton, N. J.

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but so far "no luck." He also informs us that there is to be a French Arctic expedition and the call will be *F9LG*. (Now don't ask me if that is a new country). F8BS goes on to say that he received a letter from *CZ1A* in Monaco who says he is unlicensed and wants to remain anonymous. That we'll do.

WØYXO is off the air. Ken was messing around with one of the guy wires one day while a breeze was blowing. Result: the 2½" pipe on which the rotary was mounted, folded up and clunked down on his roof. And he had to saw the boom into little pieces to get it down. Ken says that not many of the folks around his house seem to want him to put the "thing" up again in the same place.

W8NBK says *PJØX* is OK and is really located in PJ. NBK is handling all his QSLs . . . both ways. W8ROX wants to know if *K2UN* isn't a new country! What country could it be since so many different countries are represented there. Maybe PY1DH has the answer when he says, "You can add 56 countries to my list as I have just worked K2UN." Or maybe you'll like this other crack from PY1DH. . . . "worked K2UN, with W2SOX at the key and asked him to tell Gromyko that I need card from Zone 19."

The proper QTH for QSL purposes of W3LYK/Antarctica should be "W3LYK/Antarctica, via W2RPZ, 214 Munro Blvd., Valley Stream, N. Y.

W9LM got the razz from a bunch of the locals while he checked out his new "Grape Arbor" beam. The boom was 80 feet long. What next???

For those of you who have not received a card from *FM8AD* you will soon be able to get it . . . of course, providing you have worked him. The San Joaquin Valley Radio Club is buying the cards for FM8AD and W6KUT, W6PCS, and W6SRU will take care of sending them out to Ws and VEs, their QSL bureaus, that is. FM8AD is sending his logs to KUT.

Some of the odd things that happened during the past month include W6VFR working Zone 17 on phone and passing up W6DI in the Honor Roll. Guy doesn't look too good in a straight jacket either. Then, there was W6ENV warbling away on phone for, as he says, "Some unaccountable reason." And, W6OYD getting a QSL card from a ZS bearing a RST-519. . . . Then, of course, you'll pardon me if I tell you about W6QD working VO6EP and VO6J, in Zone 2, the same evening, during the past couple of weeks and receiving cards from both. . . . .



W4FU and W 8 B H W take a short breather between new countries.

Still on odd things, we can't overlook W3EPV suddenly landing in the "40 zoner's" column. This was in both July and August issues with, apparently, no one, including 3EPV himself, finding it out until W6LEE discovered it. Since this falls in the lap of W6ENV, I wondered if this was a new system for making W.A.Z. After all, if W3EPV hopped from 38 to 40, surely I could go from 39 to 40. . . . If any of you fellows want in on this deal, take it up with Andy . . . not me! I still like the one they are telling around here. Seems there was a hush-hush schedule being hatched by a couple of locals with two DX stations in a rare country. Only a few were supposed to know. Well, these two "rare ones" apparently got the itch to go on a few hours before the sked time. Result: Everyone was working 'em and the hush-hush deal blew higher than a kite. Fine thing!!!

LU8BF specializes on 10 meter 'phone DX. He is one of the QRP boys running about 60 watts into and 807. With this he has worked about 15 states. Says he has trouble with ignition noise . . . so guess spark plugs sound the same in Argentina as they do in U. S. A.

Larry (Poison Ivy) LeKashman tells me he has received a communique from *TA3FAS*, operated by W5FAS and ex-W8OSL, saying the Turkish Ministry is clamping down on amateur activities . . . so he may be silent for a while. W2IOP also heard through W2PEO that VK4DA worked C6YZ . . . and C6YZ wants to know what zone he is in. I've sent "wireless messages" to him (C6YZ) and written a letter but guess they all wind up at the wrong QTH. If any of you guys work him will you please tell him that he is in Zone 24. If he lived in Kansu Province he would then be in Zone 23, but I can't help it if he lives in the wrong province. The large zone map is not entirely accurate in respect to all the curves in the wide boundary lines. BUT . . . the definition of each zone at the bottom of the map is accurate. That is why we have each zone defined. I received about 8 or 10 inquiries every month from some of you saying that C6YZ says he is in 23. He certainly is a swell publicist. I hope he will publicize our *World-Wide DX Contest* that well.

W.A.Z. Honor Roll

To enter the Honor Roll it is necessary only to fill out the zone and country list forms available from the N. Y. office. Full details will be found on page 78 of August CQ.

1948 DX Marathon

CQ is sponsoring a DX Marathon for the year 1948. The purpose of the DX Marathon is to revive some of the interest that has been lost during the terrific last two years of DX. The rules appear in May CQ on page 74.

W2IOP is back on after being laid up with a dose of poison ivy. Now, don't laugh . . . he said 'twas no fun. Said he had the itch to get on the air but he itched so much he couldn't.

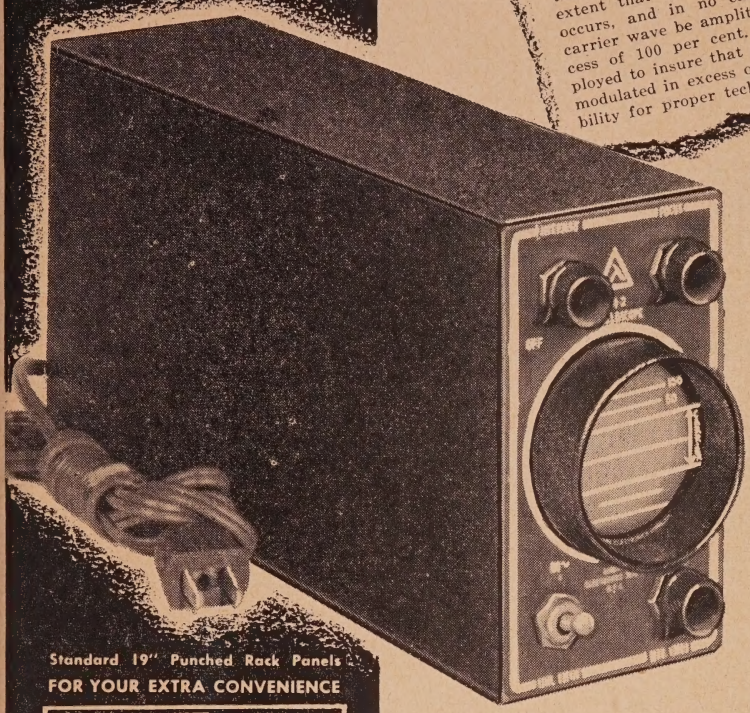
W9IU had been looking for *VS9GT* for a couple of nights and he would always QRT about the time he was set to call him. One night however, while looking for him Les decided to give him a blind call with the hope VS9GT might be looking around that spot. This first call netted him nil so he called again . . . and you guessed it . . . back he came to W9IU. The VS9 got a bang out of it too.

Just in case some of you birds haven't heard what the station *4UN* is doing and where it is . . . here is the info. In the first place it is the station of

(*Continued on page 66*)

THE F.C.C. SAYS - - -

§ 12.133. *Purity and stability of emissions.* In the case of A-3 emission, the amateur transmitter shall not be modulated to the extent that interfering spurious radiation occurs, and in no case shall the emitted carrier wave be amplitude-modulated in excess of 100 per cent. Means shall be employed to insure that the transmitter is not modulated in excess of its modulation capability for proper technical operation.



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BOX No. 55 DEPT. C10 CORONA, N.Y.

W. A. Z. HONOR ROLL

C. W.-PHONE

W6VFR	40	207
W2BXA	40	198
W6PFD	40	197
W6ENV	40	197
W6ITA	40	196
W8HGW	40	195
G2PL	40	194
W4BPD	40	193
W6ADP	40	188
W6SA	40	186
W6MJB	40	186
W6SAI	40	183
W4CYU	40	182
W6MEK	40	177
W6DI	40	176
WØYXO	40	176
W6PCS	40	175
W7AMX	40	174
W6TT	40	174
W6NNV	40	173
ZS2X	40	173
VE7ZM	40	173
W6FSJ	40	172
W2IOP	40	166
W7FZA	40	166
W6DUC	40	166
W6AMA	40	165
W6WKU	40	164
VK2DI	40	164
W6AM	40	162
W7DL	40	162
WØNTA	40	161
W7BD	40	160
W9KOK	40	158
W6OMC	40	155
W6BPD	40	154
W6PKO	40	153
W7BE	40	152
W6FHE	40	152
W6KUT	40	151
G3DO	40	150
W6SC	40	150
W6LEE	40	150
W6PB	40	149
W7GUI	40	149
ON4TA	40	148
W6ANN	40	148
W7DXZ	40	146
W9NRB	40	146
W6LER	40	145
W6BAM	40	142
W6AOA	40	139
W6TI	40	138
ON4JW	40	136
W6RDR	40	134
W6YZU	40	129
W6MLY	40	129
G5BJ	40	126
W6PZ	40	124
W6NRQ	40	123
W3BES	39	198
W2GWE	39	197
W6EBG	39	192
W2PEO	39	190
W8BKP	39	190
W3JNN	39	189
W8RDZ	39	188
W2HHF	39	184
W6SN	39	184
W3GHD	39	183
W3DPA	39	182
W5ASG	39	180
G6ZO	39	180
F8BS	39	179
W3KT	39	179
W9ANT	39	179
W9IU	39	175
W8NBK	39	174
W2HZV	39	173
W6KRI	39	173
W6ZCY	39	173
WØNUC	39	171
W2CYS	39	170
W3EVW	39	168
W4BRB	39	162
W6MX	39	162
PY1DH	39	162
W6MVQ	39	161
W9RBI	39	161
W3DRD	39	160

C. W.-PHONE

G5DQ	39	160
WØGKS	39	159
W6RM	39	159
W4INL	39	157
W1BIH	39	157
W4DKA	39	157
W3JTC	39	156
G8KP	39	156
VE7HC	39	156
W1NMP	39	156
CE3AG	39	155
W2RDK	39	154
W9VW	39	153
W6GDJ	39	152
G6QB	39	152
G5YV	39	151
G2AJ	39	151
W2COK	39	150
W6SRU	39	148
G2WW	39	147
D2KW	39	147
W8LEC	39	146
W2MEL	39	145
W1AB	39	145
W6RW	39	145
W6OEG	39	143
W8SDR	39	142
VK2ACX	39	141
W9DUY	39	141
G6BQ	39	140
W6QD	39	140
G3FJ	39	139
W6PQT	39	138
W9VND	39	136
W9LNM	39	136
G5RV	39	132
G2VD	39	132
G2FSR	39	130
W6EPZ	39	129
G3AAM	39	126
W6LRU	39	125
VR5PL	39	124
G5VU	39	124
W6EAK	39	123
G3AAK	39	122
W6UZX	39	121
G5WM	39	120
G8RL	39	120
OK1AW	39	120
WØOUH	39	119
G6BS	39	117
W7ETK	39	116
G3QD	39	116
G3TK	39	114
W6RLQ	39	108
W6UCX	39	107
W7GXA	39	106
KG6AL	39	104
W6LEV	39	103
W6MI	39	102
W7ENW	39	101
W6LN	39	101
W6AX	39	93
W6BIL	39	81
G6PJ	39	76
VE3QD	38	170
W1JYH	38	161
W3IYE	38	161
W2CWE	38	159
W3EPV	38	159
W3DKT	38	151
W4OM	38	149
W8FJN	38	147
W1ENE	38	147
W1ZL	38	145
KP4KD	38	143
W8CVU	38	142
W2PUD	38	141
W9LNM	38	139
W3KDP	38	137
W1KFV	38	134
W4FPK	38	132
G8IL	38	131
W3ZN	38	130
G5CI	38	130
W2PQJ	38	130
W4VE	38	127
G6LX	38	126
W9MZP	38	126
W9TB	38	124

C. W.-PHONE

GW3AX	38	123
WØSQO	38	123
TF3EA	38	121
W9FKH	38	120
GW4CX	38	120
W8KPL	38	117
W9YNB	38	117
W8VLK	38	117
W8WWU	38	114
W5CPI	38	113
OK1CX	38	110
G3ZI	38	107
G8IP	38	105
W6DLY	38	102
W6ID	38	96
G3BI	38	75
W2TJF	37	144
W3JKO	37	143
W4ML	37	128
W1KFV	37	121
G4CP	37	117
W2EMW	37	117
VE1EA	37	116
WØAZT	37	112
W2GUR	37	109
G4AR	37	108
W8HSW	37	104
G5MR	37	100
W2BLS	37	100
G3AAE	37	99
W2SGK	37	95
W7BTH	37	95
W6MUF	37	94
W6WJX	37	92
W2RGV	36	137
W3LVJ	36	126
WØDU	36	124
W3OCU	36	124
OA4AK	36	123
SV1RX	36	119
MD5AK	36	118
W2CNT	36	115
G2CNN	36	114
G2AKQ	36	112
W2BF	36	108
W4DIA	36	107
W6CTL	36	104
W4BK	36	101
G2AO	36	100
G6WX	36	95
W7EYS	36	90
W9FKC	36	81
GM2AAT	36	75
CM2SW	35	143
VE3AAZ	35	113
W8AVB	35	113
W3WU	35	113
W9WCE	35	112
WØEYR	35	110
W9CKP	35	109
W6ZZ	35	104
VE3ACS	35	103
G8VR	35	100
W2WC	35	99
G2AVP	35	89
W8JM	35	86
W2HAZ	35	82
D4ANM	35	80
G8RC	35	78
G3BDQ	35	74
W7FNK	35	72
W4DHZ	34	116
W4HA	34	115
W2GVZ	34	109
W9FNR	34	103
G8QX	34	99
G8KU	34	96
VK4RC	34	91
W8JM	34	89
G6XX	34	89
W3AYS	34	89
WØFWW	34	86
W2JA	34	84
W5CD	34	74
J4AAK	34	66
W4LVV	33	111
W4QN	33	104
WØGBJ	33	79

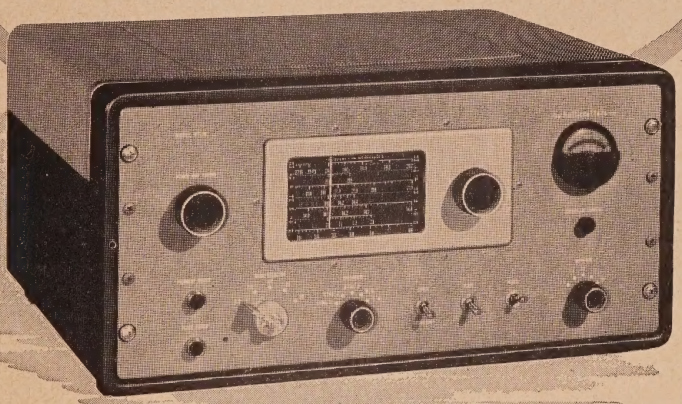
C. W.-PHONE

KH6PY	33	70
W8ZMC	33	69
G2LC	33	85
GM2UU	33	79
W8PCS	33	78
G8VG	33	78
G3BFC	33	77
W6WUD	33	61
W2NXZ	33	61
W1BFB	32	94
W2OEC	32	88
W7PK	32	83
HA1KK	32	78
W8QUS	32	75
WØFET	32	71
W2AYJ	31	103
G6QX	30	88

PHONE ONLY

W6VFR	39	142
W6DI	38	158
W8BKP	38	145
W7HTB	38	130
W4CYU	37	152
W2BXA	37	137
W1HKK	37	136
G3DO	37	125
G6LX	37	124
G2AJ	37	121
W1JCX	36	146
W8REU	36	135
W1FJN	36	128
G2PL	36	128
G6BW	36	127
W3JNN	36	125
W6PXH	36	125
F8VC	36	111
W6WNH	36	110
G5YV	36	106
G6WX	36	105
W3DHM	36	96
W6SA	36	92
F8DC	36	87
W2DYR	35	131
W1NWO	35	127
W1MCW	35	127
W9RBI	35	124
W8BF	35	120
G3FU	35	115
GM2UU	35	107
W4OM	35	106
W6CHV	35	106
W6PCK	35	103
G8QX	35	100
W9CKP	35	100
W9HB	35	89
XE1AC	34	133
W2RGV	34	111
W8BIQ	34	103
W5ASG	33	118
W2ZW	33	115
W4HA	33	105
W5LWV	33	100
W2PQJ	33	100
WØHX	33	89
W8QBF	33	87
VE3ZM	33	81
W2DRH	33	60
W4INL	32	101
W9BZB	32	95
W2HY	32	85
W9GZK	32	72
W4ESP	31	94
W9WCE	31	89
W9RNX	31	95
W8ZMC	31	87
W6UZX	31	82
W6AM	31	80
W9MIR	30	82
OA4AK	30	81
W2SVK	30	74
W8SXU	28	59
W2BF	27	52

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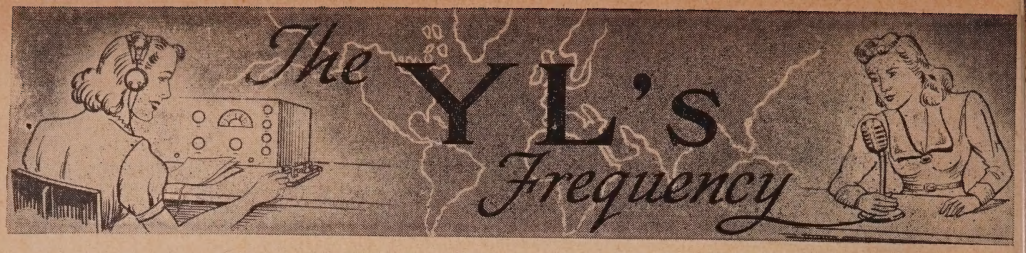
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Conducted by LOUISA DRESSER, W2OOH*

THE WEST GULF Division Convention, August 21-22, is now history. Yetive Matthias, W5DRA, who kindly acted as reporter on the spot for us, says it was a wonderful convention. Yetive made every effort to meet all the licensed YLs and XYLs attending, and among them were:

W5DQF, Madie Eidson, of Temple, Texas. She has WAC on 40 c.w. and also works 10 phone. She has two harmonics, a girl 11 (who is already interested in ham radio!), and a boy 7.

W5DUR, Bruce Groves, of Odessa, Texas. Bruce is the XYL of W5NW, director of the West Gulf Division for many years.

W5EUG, Lillian Hall, of Houston. She and her OM have been very active in a 2-meter net and have worked into Beaumont, Dallas and San Antonio.

W5GKH, Kay Putnam, of Houston. Yetive tells us that Kay was the only licensed XYL attending whose OM isn't an amateur. However, her mother is W5KOP, Ann, in Kennedy, Texas, and her brother is W5FAH. Kay keeps in regular contact with her mother on 40 c.w. She has a 35 wpm proficiency certificate, and has done some commercial operating.

W5IZK, Vivian Hug, of Dallas. Vivian is a registered nurse and there is such demand for her services that she hasn't much time to work her favorite 10-meter band. Her OM is W5CFQ.

W5MBB, Mary Busick, of Houston. Mary is Class A. She likes 10 phone, but her very young harmonic demands most of her time.

W5MJU, Pauline Beuselinch, of Oklahoma City, Okla. Pauline has twin daughters, but manages to keep active on 75 and 10 phone. She does her share of message handling and during the tornado in Oklahoma a few months ago she was very active in emergency work.

W5OTU, Anne Maring, of Brownsville. Anne is active on 40 c.w. and on 6 and 10 phone. Yetive adds that Anne and her OM had their two little daughters, 5 and 6 years old, with them at the Convention, adorable girls looking almost like twins.

As for Yetive, W5DRA, she has held her ticket since 1933. She met her OM, W5BIW, when she saw his call on the tire cover of his car and gave him a call on her auto horn. Since then they have enjoyed many years of ham radio together. This past winter they were especially active on 10 phone, but are now looking forward to working on 2, 40 and 80. Yetive and her OM have been vacationing in Houston but by the middle of September they will be back at State College, N. Mex., where Dick is working on the guided-missile program.

As you will have seen elsewhere in this issue, there are many other conventions coming up. Especially important from the standpoint of YLs will be the Southwestern Division Convention at Los Angeles on Oct. 2-3. One feature for the YLs and XYLs will be a luncheon and fashion show on Saturday, with a special table reserved for licensed YLs.

From Eleanor, W6AWW, we hear that the San Diego YL club is planning to be in Los Angeles for the convention. The club has just had election of officers, the new ones being: President, Jean Baptie, W6ZYD; vice-president, Neva Fredenburgh, W6YXI; secretary, Eleanor Baldwin, W6AWW, and treasurer, Blanche Weiss, W6BLF.

Leta, WØBDB, tells us the YL club of the St. Louis area has been meeting in town for dinner each month this summer.



Jean Hauff, W3INL

YL of the Month

Have any of you XYLs been wondering what to do about that OM of yours who spends all his time listening to dits and dahs or wrapped around a microphone, who always comes late to meals and then, when you'd like to go out for an evening, rushes off with "Xcuse me, got a sked with so and so"? That's what our YL of the Month, Jean Hauff, W3INL, tells us greeted her at the end of the honeymoon. She also tells us what she did about it:

The honeymoon ended—then back to our newly furnished apartment. After we had moved our clothes in everything seemed complete. It was with much surprise to me that my newly acquired spouse popped up with, "Excuse me. Have to run."

Later there were footsteps outside the door. As it opened I stepped back startled, trying to determine if the object was a belated Christmas tree or by some chance my husband. When he spoke, ordering me to untangle him from around the countless wires, I was relieved; it was he.

"And where do you intend to keep all this—this junk?" I blurted out.

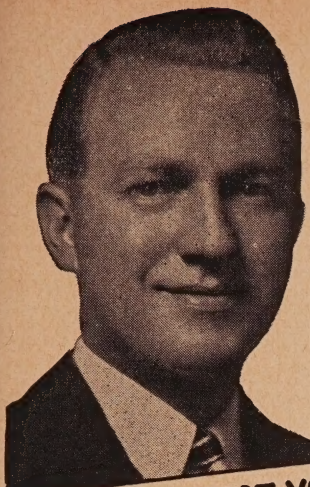
"Junk?" he questioned with a pained expression. "I've worked WAS, WAC, and DX some fellows have never heard of before with this, this *junk!*" he bellowed.

I gulped He had raised his voice to me. Should I become indignant? No, I decided, momentarily at least, I'd give in. "Sure it's a good rig," I said, "but where do you intend to keep all this—this rig?" I repeated.

"We'll make space in the bedroom," was the answer.

(*Continued on page 78*)

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



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(*See August CQ Cover*)

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Postscripts

Southwestern Division Convention

The Southwestern Division Council of Radio Clubs is sponsoring the Annual Convention at Los Angeles on October 2 and 3, 1948. Hq. will be the Alexandria Hotel on Saturday, Oct. 2. On Sunday the Banquet will be held at Farber's Park View Manor. Tickets will be $5.50. Pre-registration prize for the XYL will be a frozen food locker; for the OM, the latest in a receiver. For hotel reservations, contact Larry Lake, W6RMV, 828 7th St., Santa Monica, Calif.

Hudson Division Convention

October 2 and 3 are the dates for the Hudson Division Convention, to be held at the Ten Eyck Hotel in Albany, N. Y. Technical sessions will cover s.s.s.c., reflected-power communication and microwaves, and there will be a DX forum. Highlight on Saturday will be the banquet, with Sunday reserved for informal trips and rag-chewing. Advance registration, $5.65, or after Sept. 26th, $6. Tickets available from the Treasurer, Hudson Division Convention Committee, Box 247, Albany, N. Y.

Eastern Canada Convention

The Eastern Canada A.R.R.L. Convention will be held at the Mount Royal Hotel, Montreal, on October 8 and 9, 1948. Advance registration, $5.00 for the OM, $3.50 for the XYL. Send registrations to Convention Committee, Montreal Amateur Radio Club, Box 1, Station "D," Montreal, Que., Canada.

Boston Hamfest

The 11th Annual Boston Hamfest, sponsored jointly by the Eastern Mass. Amateur Radio Assn. and the South Shore Amateur Radio Club, will be held on Saturday, October 9th, at the Mechanics Building, Boston, Mass. Registration $2.00, plus $3.00 for those wishing to attend the banquet. Closing date for banquet tickets is Sept. 25th. Tickets available at ham stores in Boston, or write W1ALP, 91 Atlantic St., North Quincy, Mass.

Midwest Division Convention

The Midwest Division Convention will be held on October 16-17 at the Hotel Broadview in Wichita, Kans. Technical program includes lecture and demonstration on s.s.s.c. technique, mobile equipment and design, multi-element beams, etc. For entertainment there will be a buffet supper, c.w. and phone roundtables, Royal Order of Wouff Hong initiation Saturday, and a banquet with prizes on Sunday. A special ladies' program is being prepared by ladies of the Wichita club, with special prizes and entertainment. For registration write Wichita Amateur Radio Club, Box 3, Wichita.

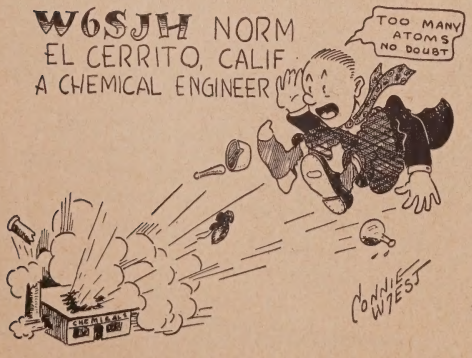
Western Florida Net

A 40-meter net has been organized for all Western Florida. All Western Florida hams wishing to join the net will receive information as to time of meeting and frequency used by dropping a card to D. W. Barnes, W4DLO, Cherry Lake, Fla.

Juicy Contacts

The Orlando Amateur Radio Club, in cooperation with the Orange County Chamber of Commerce is offering a high-grade certificate to any amateur station that works ten Greater Orlando (Orange County) stations. In addition, arrangements have been made to ship a box of selected tree-ripened fruit to anyone who works five more stations—a total of fifteen. There are sixty-odd stations active in the Orlando area who may be found on all bands, phone and c.w. When a ham has made his contacts, simply list the stations and dates and mail to the Orlando Amateur Radio Club, P.O. Box 2067, Orlando, Fla. It isn't necessary to send the QSL cards.

Dollars for Watts



Book Review

Antenna Manual, by Woodrow Smith, Published by Editors and Engineers, Ltd., 1300 Kenwood Road, Santa Barbara, Calif. 306 pages, 6¼ x 9¼ inches, including foreword and index. 155 drawings. Price $3.50.

There can be little doubt that there is a need in the amateur radio field for a useful composite text on antenna performance, operation and construction. The *Antenna Manual* seems to fall short of this goal because of the desire to be considered an authority in the whole field of radio communication. Had this book been held strictly to the vertical field of amateur radio it would have probably fulfilled the needs of the average ham. Instead, it is rather thinly spread over the fields of broadcasting, FM, television, and even T/R switching. The result is a slightly inadequate coverage of all fields, although the book and the author deserve high praise for very clear and very readable presentations of the material at hand.

Approximately one-fourth of the *Manual* is devoted to the subject of radio wave propagation. While this is in itself commendable, there is certainly reason to question the assignment of this much space with so few usable facts and figures. Many important points in propagation are glossed over as proven and established facts when only a very limited amount of questionable experimental

(*Continued on page 80*)

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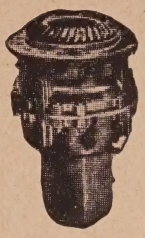
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- 7000 to 1 Gear Reduction stops free swing.
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- Powerful 1/4 H.P. motor, rugged precision gear train, and sturdy thrust bearing—will support and turn even a heavy dual beam.

Used on aircraft to control pitch of propeller blades, these dependable power units are excellent beam rotators (see pages 22, 23, 29, Nov. QST). Used, but in perfect tested working conditions, with instruction sheet..... **$8.95**

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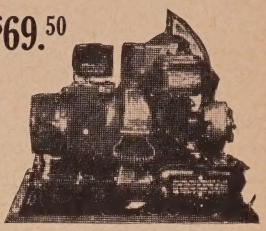


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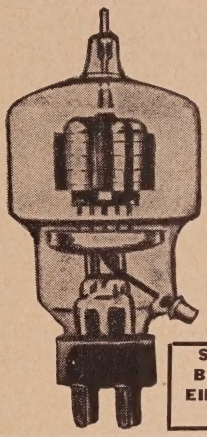
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Vertical Antenna

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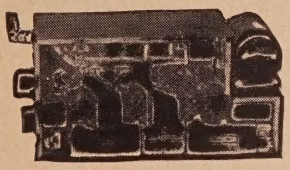
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Easy to Set-up

FOR FM, TELEVISION AND ROTARY BEAM

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BC-733 D Localizer Receiver

Freq. 108-110 Mc. Tube complement 10 tubes—1—12SQ7, 2—12SR7, 1—12A6, 1—12AH7GT, 2—12SG7, 3—717A. GOOD 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. At only..... **$3.95**

2 for $7.50

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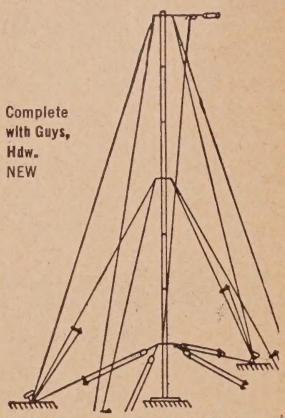
Vertical Antenna

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Ideal for erection of FM and Television Beams! Drop your coaxial cable right through the center! Brand new, export packed.

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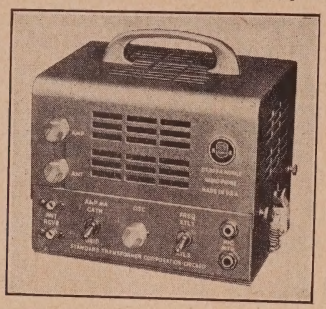
L. A. Ryan 16683

PARTS AND PRODUCTS REVIEW

Mobile Transmitter

The Stancor ST-203-A is a compact radio transmitter designed primarily for mobile operation, but also useful for fixed station service. A special mounting arrangement makes the ST-203-A quickly transferable from car to fixed location. Power is obtained from a dynamotor or vibrator supply for mobile work or from an a-c supply at a fixed location.

Features include 27.5 watt power input, AM radio-telephony, two crystal-controlled frequencies, coverage of 10 and 11-meter bands, press-to-talk

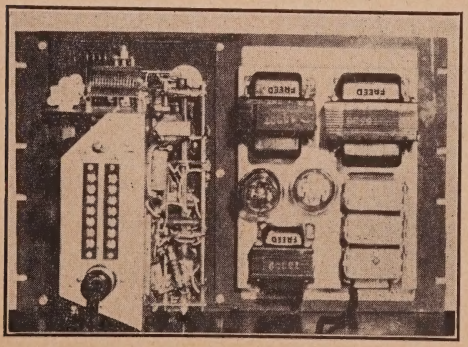


operation. The circuit lineup consists of a 6V6 harmonic oscillator working from 7-mc crystals, a 2E26 Class C amplifier, a 6J5 grounded-grid speech amplifier, and a push-pull 6V6 Class A1 modulator.

Finished in silver-gray hammertone with gray plastic control knobs and brushed metal carrying handle. Size: 8⅝" x 7⅜" x 6¾". Weight with tubes and crystals, 9¼ lbs. Furnished either as a kit or completely wired. Full details may be obtained from the Standard Transformer Corp., Elston, Kedzie & Addison St., Chicago 18, Ill.

All Band Transmitter

Harvey-Wells Electronics, Inc., Southbridge, Mass., announces that the rack-mounted TBS-50 all-band phone-c.w. transmitter is available with a

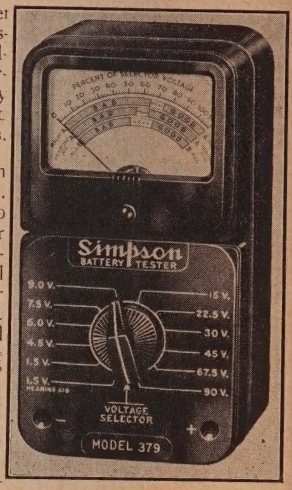


companion rack-mounted power supply. The power supply delivers 425 v. d.c. at 275 ma and 6.3 v. at 4 amps. Both the transmitter and power supply are mounted on a single standard size relay panel.

Battery Tester

Extremely accurate because it places each battery under load, a new pocket size dry-battery tester is being manufactured by Simpson Electric Co., Chicago.

Designed in accordance with the engineering specifications of leading battery manufacturers, its loading resistors have an accuracy of 1% and properly load all radio and hearing aid A and B batteries. A single rotary switch selects the voltage of the battery under test and brings into line the correct loading resistor. A percentage scale shows the exact condition of the battery in percentage of full voltage. Needle-point prods with which the tester is furnished assure positive contact regardless of the type of terminal on the battery and make it possible to easily test all batteries.



Three arcs are shown on the full 3" dial. One arc is for all radio A batteries, one for hearing aid B batteries, and one for all B batteries, whether radio or hearing aid. Each arc is divided and marked in three sections, "Good," "Weak," and "Bad." The case of the Model 379 is molded black bakelite. All figures are recessed in the panel and filled in white for greatest legibility and long wear.

Tube Reference Book

The RCA Tube Department has just brought out a revised and considerably expanded edition of the quick-reference booklet "RCA Receiving Tubes for Television, FM, and Standard Broadcast." The booklet provides quick and easy reference to the characteristics and socket connections for all RCA receiving tubes, as well as a classification chart which groups the tubes according to function and cathode voltages.

The new edition of "RCA Receiving Tubes" has been expanded from 16 to 24 pages to include data on the latest receiving-tube types as well as more information on kinescopes. The format of the booklet has been further improved to provide "at-a-glance" reference without the need for cross-reference to other pages. The socket-connection diagrams appear on the same page with the data for the tubes to which they apply. For added convenience, a bold-faced index has been placed dictionary-style at the top of each page to show which tube types are described on the page. The RCA Receiving Tubes Booklet (Form 1275-D) can be obtained from RCA Tube Distributors, or by sending 10c to Commercial Engineering, RCA Tube Dept., Harrison, N. J.

AMATEURS! GET YOUR SUPPLY OF 826'S WHILE THEY LAST!



WELLS' TUBE SPECIAL OF THE YEAR!

The 826—60 Watt UHF Transmitting Tube..... 49c

(LESS THAN THE PRICE OF A RECEIVING TUBE)

Accustomed as we are to excellent values in Government radio equipment, we were amazed at the remarkably low price at which we were able to get these 826's. The regular Amateur net price is $9.95 and worth it! So you can see why we're calling this the TUBE SPECIAL OF THE YEAR. Build your new rig around the 826. Order Plenty of spares as we doubt if you will be able to duplicate this price when our stock is gone.

UHF Operation up to 250 MC.

The 826 will perform beautifully in your 2 meter rig as well as on the lower frequency bands. Use it as a final amplifier, modulator, doubler, buffer, or oscillator. In fact, the 826 is good for practically any R. F. or audio application.

826 Specifications

Max. Plate dissipation	60 watts
Filament volts	7.5
Filament amps.	4
Max. plate voltage	1000
Max. plate current	125 m.a.
Approx. grid drive	6 watts
Max. freq. full rating	250 mc.

Power Output	Watts
Class C amp.	86
Class C plate mod.	53
Class B telephony	22
Grid modulated	25

These tubes are standard make, brand new, JAN inspected, and packed in their original cartons.

At our low price, 826's can be shipped only in boxes of 4 for $1.96. Add 25c for each box of 4 tubes for prepaid shipment to any part of the continental U. S.

Wells Extra Special 24G Sale

Type 3C24/24 G 100 Watts Class C Only 49c Each

These standard make 24G tubes are shipped in boxes of 4 for $1.96. You may combine 826's and 24G's to make up the minimum order of 4 tubes. Add 25c for each box of 4 tubes for prepaid shipment in U. S.

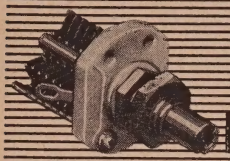
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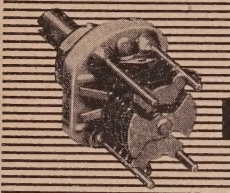
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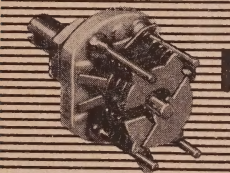
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DIFFERENTIAL

SMALLEST AIR VARIABLES EVER PRODUCED!

Pictured are three of the smallest air variables ever produced. Each of the three types is available in four different capacities.

SINGLE TYPE—Takes the place of adjustable padders for trimming RF and IF oscillator circuits. Available in four models: 1.55 to 5.14 mmf, 1.73 to 8.69 mmf, 2.15 to 14.58 mmf and 2.6 to 19.7 mmf.

BUTTERFLY TYPE—Applicable wherever a small split stator tuning condenser is required. Available in four models: 1.72 to 3.30 mmf, 2.10 to 5.27 mmf, 2.72 to 8.50 mmf, and 3.20 to 11.02 mmf.

DIFFERENTIAL TYPE—For switching capacity from rotor to either of two stators, and for shifting tap on capacity divider. Available in four models: 1.84 to 5.58 mmf, 1.98 to 9.30 mmf, 2.32 to 14.82 mmf and 2.67 to 19.30 mmf.



For Full Details Write For Latest JOHNSON Catalog

E. F. JOHNSON CO.

WASECA, MINNESOTA

DX

(from page 56)

Count Bernadotte's peace mission on the island of Rhodes in the Dodecanese. A couple of U. S. Marines are apparently operating the station which is in a truck, with a BC-610 and the antenna is a whip. W4INL happened to be their first W QSO on phone and got this dope from them. Bob needs No. 23 . . . has heard *C8YR* a few times but too many guys were on him.

W6RM says in a way, he felt sort of let down when he worked *AC4YN*. You see it's this way. Prewar, RM was located in the east and had been trying to work AC4YN for years . . . then when he came through those few days in July RM raised him with a 2 x 2 call. That's what he means when he says . . . "let down." He won't, however, trade off Red's card when it arrives, in fact, he says he may as well sell this rig now that he has worked AC4YN. There are others who feel the same way. No question about it AC4YN is almost a legend.

WØHX hasn't been on much due to his beam falling down plus taking time to install a 10 kw BC rig. Says he made about 10,000 miles in a jeep taking field strength measurements. Now, however, he is building a new rig with provisions to use c.w. Hmmmm, c.w. Strange talk for a 'phone man.

W2TJF can't work Zone 23 so he's going to move to San Diego. He will soon be a W6 . . . and before he became a W2 he was a W9. Whatdya know! Says, too, he wants to see how the W6s do it. Don't know what the man means, do you?

Speaking of San Diego, KH6PY who used to live there has rounded up a new one for the Marathon . . . KH6LF. The KH6s are surely not well represented in the Marathon or Honor Roll.

ZC6AA writes to give us the calls of the genuine stations in Israel . . . *ZC6AA, AB, AC, AE, AF, AO, AW, AZ, LA, PR, SM* and *SQ*.

ZC6LA tell us, however, that the only licensed stations at the time he wrote are *ZC6LA, LB,* and *LC* but that the others will be left alone until they can be licensed by the Postmaster General. In the meantime these three are licensed by the Chief Signal Officer. Also *ZC6XY* and *ZCUN* are U.N. stations and can be QSLd thru K2UN. ZC6LA says the first three should be QSLd to Box 4150 Tel Aviv. ZC6AA gives Box 4099 for those he mentions. Take your pick.

W1APA, who works for a fertilizer plant, is getting back after DX. Gil has about 5½ acres and expects to raise an antenna farm. Don't know if he expects the fertilizer will help or not . . . but anyway his rig now uses a pair of 810s with a kw input, the receiver being an HRO. Just happened to think that APA told me long ago that during the war when he was in the Signal Corps stationed at Camp Crowder . . . his instructor was W6BAM.

Once again (every month) we hear from *LX1AB* the QSL manager that he has returned about 100 W2 cards which were sent to LX1AX. Better doublecheck, you guys. *PY1JY* operates mostly phone and has worked 37 zones and 91 countries. He runs 300 watts and uses a 3-element rotary. While thinking about 10 meters, W4LZM has worked 30 and 73 on this band and is running 67 watts into an 815 . . . which goes into a 4-element rotary.

W2LVJ is running 60 watts into an 807 but says things are going slowly lately and he is just about set to fire up his half kw final. *(QSY to page 71)*



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Henry Radio stores in Butler, Missouri and 11240 West Olympic Blvd., Los Angeles, California have complete stocks of amateur, FM, Television, Short Wave, Communications, Recording, and other radio equipment. I promise you lowest prices, complete stocks, quick delivery, easy terms, generous trade-ins. I promise that you will be satisfied on every detail. Write, wire, phone or visit either store today.

Bob Henry
W9ARA

A FEW OF THE ITEMS I STOCK ARE:

Collins 75A	$ 375.00
Collins 32V	475.00
Collins 310B-1	190.00
Collins 310B-3	215.00
Collins 30K-1	1450.00
National NC-57	89.50
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Hallicrafters S47	229.50
Hallicrafters S51	149.50
Hallicrafters S58	59.50
Hallicrafters S55	129.50
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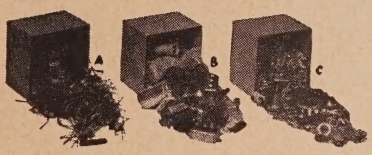
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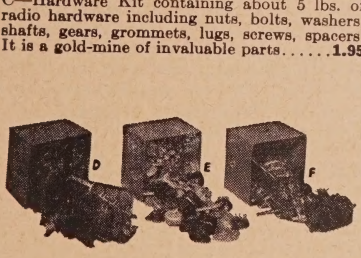
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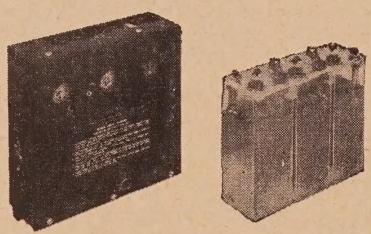
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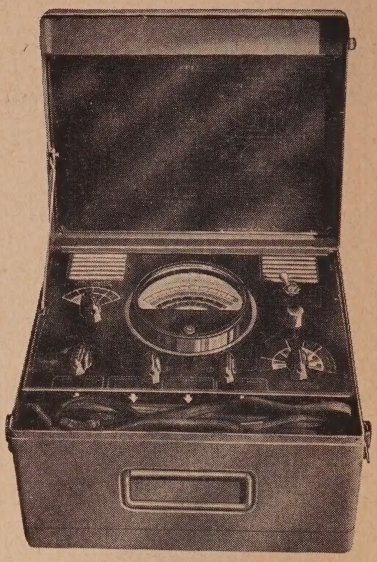
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MODEL 1-42



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The low voltage circuit tester is a self-contained trouble-shooting device for making a complete and rapid check of the generator—battery circuit, including any current and voltage regulators which may be used. Battery voltage, regulator and cut-out settings, and generator performance can all be easily determined.

This tester is enclosed in a gray heavy-gauge metal box with a strong hinged top that, when opened, is supported by a slide rod and when closed, is latched by clamps. There is a carrying strap attached to the box.

This instrument was manufactured for the Quartermaster's Corps, United States Government Ordnance Department under the most rigid specifications. It is comparable in beauty and dependability to instruments made today that sell for many many more dollars than our price. Electric Heat Control Company, Cleveland, Ohio, or the Heyer Products Company, Inc., Belleville, New Jersey manufactured these for the Army. Although the unit you receive may be made by either of these companies, it will be practically identical to the unit made by the other company and all are made under Heyer Products Company's design and according to Government specifications.

This low voltage circuit tester is 11 3/16" wide x 9 9/16" deep x 7½" high and can be used on either a 6 volt or 12 volt system. There is a metal chart attached to the lid of each unit which is easily readable while using the instrument. This chart shows settings of all controls and gives operation instructions to be used in conjunction with the operating manual which is included with the tester. One can quickly determine and correct trouble with this instrument. There are two battery leads with drive-in connectors (with spikes—lead coated) 8' long; ammeter lead (3-wire) complete with calibrated shunt, 6' long; voltmeter leads with alligator clip connectors and rubber insulators 8' long, and field rheostat leads with alligator type connectors and rubber insulators 5' long. The direct reading meter scale 4' in diameter with color-coded scales, along with the push-button switch, voltage selector (3-circuit toggle switch), meter polarity switch, utility switch, volt-ammeter scale selector switch, field rheostat, regulator test selector switch, multisection load resistor, is used to control all operations and functions of this instrument. The master meter reads 0-60 volts and 0-60 amperes. One switch box indicator has following ranges; 0-9 volts and amperes, scale deviation—0-9 range in 1/10th of a volt, 0-18 in 2/10th's of a volt, 0-60 in 1 volt and ampere division, 0-9 in .05th of a volt and ampere.

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KH6PY says he is beginning to think he has an excellent XE wave trap in his antenna, as he can't seem to hear any Mexican stations.

During the past month, Bill Hunton, W6ODD, has been on signing *W6ODD/FI8*, and after leaving Saigon, spent a day or two on Diu, Portuguese India, signing *W6ODD/CR8*. In each instance, Bill received permission for this operation, as we told you in an earlier DX column. In a letter from W6ODD, received the other day, he said many of the gang ask him about *FI8ZZ*. Bill reports that he is very QRP, using a home made rig, and seems to be a generally nice sort of fellow. FI8ZZ has been telling the boys, however, that he cannot QSL, but maybe this will be changed.

I don't have to tell you about the mad scramble for *AC4YN* during a couple of mornings in July. About all the reports I have had thus far indicate that he didn't work anyone farther than W6s and W7s, although he did say he would be on at 1200 GMT looking for other parts of the country. . . . Frequency in use was approximately 14,140, with a T9 signal. He was heard though by several Ws on the Atlantic seaboard.

Austrian QSLs

Several OE stations have been coming through with excellent signals, but the boys are having serious difficulty with the authorities. It seems that not only is ham radio frowned upon, but anyone caught will suffer serious consequences. But that doesn't keep 'em off the air. However, they have one urgent request . . . follow QSL instructions! Cards addressed carelessly fall into the hands of authorities and enable them to trace the ham that much easier. For the present W2NFR has volunteered to handle cards for *OE1AS* and *OE1AW*. Lloyd and Helen will also try to forward any other OE cards the boys have. Do not send cards direct . . . at least at the moment. Cards sent through the OE bureau are evidently not getting through for one reason or another. Anyone who has already sent a card would do well to mail a duplicate to W2NFR.

VQ3HGE had his last QSO, July 9, with a W2 and winds up in the Marathon with 39Z and 122C. Bob (W6PBV says, "Naturally, this winds up activities for VQ4EHG, *VQ5GHE*, and *VQ5HEG*.")

W2OEC, station of the Monmouth Radio Club, has been doing a good job of DX. Ronald Griffin, W6COD, an instructor at Fort Monmouth, says the station has had many operators, but most of the DX was worked by W6QKW and himself. WØRBA has cranked up his power from 80 watts to a new 813 running 250 watts and finds this additional soup has given him more countries . . . and quick, too . . . Natch!

W8BKP heard AC4YN on two mornings but says the W6 QRM was too much to let him through. . . . KH6ET tells me of the annual Mauri County Fair to be held October 8, 9, and 10. He will have an Amateur Radio Exhibit, such as he had last year, with rigs on 10, 20, 40, and 75. *KH6FF* will be on 20 and 75 'phone, while *KH6ET* will be on 10 phone. Keep an ear open for both of these calls, as they will start operating about October 3. They expect to handle messages from all the Fair visitors, and he will be looking for skeds on the above mentioned bands. A very nice special QSL card has been designed and will be sent to every station contacted.

TF3EA has some very important information. He says, "I had a QSO with W2IOP some days ago, so he is now back on. Hi!" At least this is one way of finding out that the guy is again active. . . . Why doesn't he tell me these things? . . . TF3EA says he



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expects to have a friend of *ZA2AA* visit him shortly, and hopes that he will bring the expected QSL card. He also says he will let us know the proper QTH at that time. Some cards from *ZA2AA* have been trickling through and the QSL QTH is listed with the other addresses.

Bad news for the fellows who haven't worked *VR1B* in the British Phoenix Group . . . *KB6AD* passes word along that something in VR1B's rig blew up, and since he is leaving shortly, plus the fact that he didn't care too much about hamming, he is going to leave his rig "blown up" until he shoves off. As you probably know, VR1B and KB6AD are both on Canton Island. Of course, this happens just about the time I might have had a chance to grab him. Oh well, I understand there will be another station on there . . . in about 10 years!

Hey, you guys, . . . once again, I would like to tell you that when you send in *additions* to the Honor Roll and/or the Marathon that it is not necessary to use one of our printed four-page forms. It not only is wasteful, but it makes it harder for our committee. I would also like to remind you once again that I would like to have your Honor Roll additions on a separate sheet of paper or card from your Marathon additions. Most of you fellows, I am sure, do not realize the amount of time and detailed work necessary to crank out all phases of this department each month. W6ENV handles the Honor Roll, while W6DI handles the Marathon; therefore, you can see why it would be helpful to have your Honor Roll and Marathon additions separate.

I would like you fellows to tell me about the Marathon for 1949. When you drop me a line let me know if you think we should continue it . . . even though you yourself possibly cannot get into it. We've had great interest thus far this year . . . and would like to get your ideas for next year.

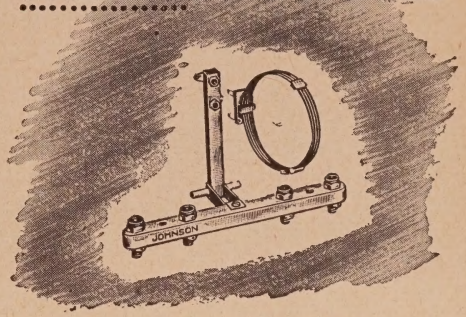
That's enough mumbo-jumbo for this sitting. Just wondering, though, if you have sent for your Log Sheets for the *World-Wide DX Contest*. Better do it now. See you next month. 73!

QTH's

CN8EO, Navy 214, FPO, NYC
CP1JI, American Embassy, La Paz, Bolivia
EQ2L, c/o American Embassy, Teheran, Iran
HA QSL Bureau, Post Box 185, Budapest 4, Hungary
KW6AG, c/o C.A.A. Wake Island
KW6AK/KX6, A.A.C.S. Navy 824, FPO, S. F.
LX1TS via SM5YG
MD4TH, Box 436 Mogadiscio, Somalia
OE1AS and OE1AW via W2NFR, 72-72, 112th St., Forest Hills, L. I., N. Y.
PJØX via W8NBK
PK2KK, Box 222 Soerabaya, Java, NEI
PK4PQ, Box 400 Rotterdam, Netherlands
PK4VD, Box 400 Rotterdam, Netherlands
SL5AB, Royal Signals, Stockholm, Sweden
ST2GH, IAL, Juba, Sudan
TR1P via 3521 East 29 St., Denver, Colo.
VP2LA, Stephen Kravchuk, PAA Comm. Dept. San Juan, Puerto Rico
VQ4SGC, Box 777, Nairobi, Kenya
VS2CC via RSGB
VS7AD, 205 Sqdn, RAF, Koggola, Ceylon
VS7PH (G3ATH) via RSGB
W3LYK/Antarctica via W2RPZ, 214 Munro Blvd., Valley Stream, L. I., N. Y.
W4FVI/KX6, A.A.C.S. Navy 824, FPO, S. F.
W8WEA/Truk, Navy 3410, FPO, S. F.
XZ2JB, Box 151 Rangoon
YR5C, Box 326 Bucharest
ZA2AA via P.O. Box 28627, Basle, Switzerland

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KL7KI	15– 23
KL7CZ	12– 12
VE8AS	11– 14

Zone 2

VO6EP	35–100
VO6J	15– 38

Zone 3

W6PFD	40–178
W6ITA	40–170
W6SN	40–166
W6ENV	40–163
W6NNV	40–153
W6KRI	40–142
W6AM	40–134
W6RM	40–131
W6OMC	40–117
W6HZT	40–115
W6WKU	40–111
W6SRU	40–107
W6FSJ	40– 92
W6PQT	39–117
VE7ZM	39–115
W6ANN	39–109
W6LRU	39–106
W6UCX	39– 94
W6GAL	38–139
W6QD	38– 86
W6LN	37– 66
W6UZX	36– 80
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W4LK	21– 46
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W1QCJ	21– 38
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W4CY	18– 36
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W4HKJ	12– 19

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Zone 8

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Zone 10

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Zone 11

PY1DH	39–134

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CE3AG	39–114
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Zone 14

F8BS	39–142
G3DO	37–111
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KG6AI	28– 51

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W2PQJ	25– 54
W1CJH	23– 52
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Zone 6

XE1AC	33–119

Zone 8

KV4AD	27– 55

Zone 10

OA4AK	30– 65

Zone 12

CE3AB	28– 76

Zone 14

G3DO	34– 93
F8DC	28– 47

Zone 31

KH6NB	24– 43

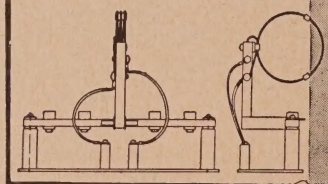
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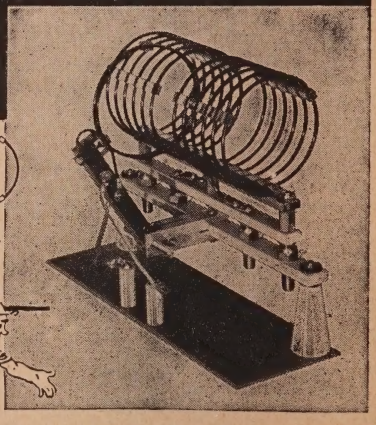
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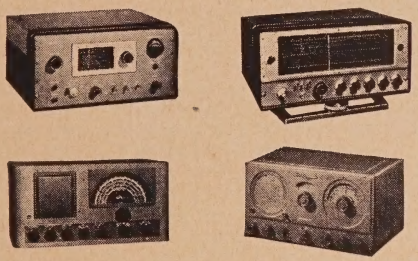
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V. H. F. - U. H. F.

(from page 52)

around noon PST the mobile telephone stations in Phoenix, Ariz. operating around 152 mc were tripping the San Diego repeater station atop Mt. Helix, near La Mesa, Calif. This is about 1000 feet in elevation and Poncho often goes up there on mobile. Attention W7QLZ and gang!

W2NLY sends in some information on that east coast to Ohio and western Pennsylvania path. Jim has heard W3RUE on several occasions and feels that if c.w. were used more often by the 2-meter gang they could get across. W2NLY has worked 300 different stations (mostly vertical) between the Philadelphia and Harrisburg areas.

W9MBL, New Castle, Ind., now has 5 states in 3 call areas. He recalls that the band was good for long hauls on July 7, 9, 10, 12, 17, 18, 19, 25, 27, 28, 30, 31, August 10 and 11. Stations being heard or worked from Pennsylvania, Ohio, Illinois, Michigan or Kentucky.

W8WRN, Columbus, Ohio, verifies most of the above dates and adds July 3 good due west with W9ZHB and WØNFM leading the pack. In addition July 23 was open north and south, while August 3 was another fairly good date.

W4CA, Roanoke, Va., takes exception to the published rumor that the W3 land boys were coming down to show them how to operate the band. He says that they try and try down his way, but topography is just against them. Anyhow, the expedition did come off with W2PAU and company sallying forth into North Carolina. Who'd they work? Never heard yet? What about it Brownie? In any case, W4CA offers the clubhouse for a site of any future expeditions into that particular area.

It might be said in passing that activity is apparently low to the south of W3JDP. The Washington multiplex stations are often heard in the New Jersey and New York areas, but nary a sound out of the Washington or Baltimore gang. It might be the summer heat and humidity. W2IL, Riverton, N. J., after packing a mobile rig on his vacation and driving several thousand miles was heard to say that in many many areas the activity was very low during most of the daytime and often on weekday nights as well.

W4KKG, Louisville, Ky., put up a 16-element vertical, only to have to change it over to horizontal to keep in the new style. W4HBE, W4KMJ and the well-known W4FBJ are also active in that area. W4KKG as president of the local club has offered a trophy cup to the best member 2-meter DX contact of the year. W4FJB is the present leader with a 450 miler under his belt.

WØWGZ, Grinnell, Iowa, now has 6 states having finally added Illinois on July 24. This was, of all things, a c-w contact. However, certainly if there is anything that needs more encouragement on 2-meters than more c-w operation we'd like to know it. In several localities the QRM gets pretty heavy during band openings.

W4LMF, Atlanta, Ga., appears to hold the local Georgia DX record with a 102-mile contact with W4LNB, Chattanooga, Tenn. The location at W4LMF (antenna 1060 feet above sea level) is fairly ideal and nearly 300 contacts have been made. The rig is a 522 with 12 watts and 3-element beam. Attention Kentucky boys, look south more often.

Last, but not least, once again I'd like to say a word for a fellow 6-meter operator, WØYKX. As

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The Tech-Master Television Kit will enable you to build a duplicate of the famed RCA 630-TS television receiver, acknowledged by engineers to be the leader in the field.

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Harvey Special **$15.00**

Pair **24.50**

many of you know, I visited Bill some time ago and found his recovery coming along very slowly. I don't think I've ever seen anyone miss the old thrills of v-h-f operation as much as WØYKX. Most of you remember Bill, how about doing it again? A card or note to Bill Copeland, Mercy Hospital, Council Bluffs, Iowa. Many thanks!

Extra: W1 area men observe caution, WØZJB may soon be back!

THE YL's FREQUENCY

(*from page 56*)

Oh! My beautiful bedroom—I almost swooned.

We did manage to conceal the apparatus behind a flowered cretonne curtain, but how was I to know that from then on my spouse was to spend the rest of his time behind that curtain? And then I sat. Sat in our lovely parlor playing solitaire and reading, being sure to do enough of each so as to produce sleep through the dits and dahs.

One night I was disturbed by someone moving about near my bed. I awoke with a start. "Who could that be?" I thought. Why, of course, it was hubby preparing for bed. As I turned to settle for slumber again my eyes caught a glimpse of the clock —6:00. Six o'clock in the morning!! Was this the time these sessions ended? I was furious. "This can't go on," I said loudly, "it's no hobby, but an obsession."

"Hummm," he replied, as he drifted into the Land of Nod.

The next day I was resolved. Resolved to fight this difficulty to the finish and win. But how?—I had it!

Fortunately for me my spouse was just beginning to experiment with radiotelephony. At first the expressions of CQ, QRM, etc., were puzzling, but I soon began to learn. When contact was made with anyone, I'd rush behind the curtain and say, "Please let me talk to that fellow. He has *such a nice* voice!"

Then I began buying radio books by the score, also being sure I had my nose stuck in these whenever it was time for meals. "Oh, I'm sorry," I would excuse myself when the OM asked impatiently if it would be possible to get something to eat, "I was so interested in this news of such and such a band that I forgot to prepare a thing We'll fill up on sandwiches."

And whenever he'd offer to take me to a movie, I'd say, "Oh, no, let's visit so and so, I'd love to meet him and I do *so* want to see his rig."

My plan was working most effectively when one day an inspiration struck the OM. "I'm going back on c.w.," he stated.

Oh, those awful dits and dahs! But it was too late to have my plan go haywire. I was determined.

In no time at all I had the teleplex rigged up. I copied and copied, while the OM stood with mouth open Then came the manual. Each evening upon his return from work he was greeted at the door with, "Please go over my radio questions with me."

By the time I was ready to take the test the poor OM was worn and tired. But the exam was passed successfully Then came the day when I received my license—I could hardly wait to pound the brass! I took advantage of it immediately, starting out at noon, on into evening. Then QSO 9 o'clock, QSO 10 o'clock, QSO 11 o'clock, and so through the night!

My moving around near the bed disturbed the OM. Sleepily he looked up and glanced at the clock —6:00 "Six o'clock in the morning!! This can't go on," he shouted. "It's no longer a hobby but an obsession!"

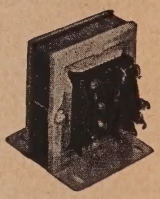
(*QSY to page 80*)

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AGAIN WE PRESENT THE R.P.S. POWER CONVERSION UNIT



"Converts *All* War Surplus d-c Receivers and Transmitters, etc., into a-c use." No rewiring necessary—installed in a few minutes—units available for any rating—a few popular model sets easily adapted to the R.P.S. Power Conversion Units: BC-453, BC-454, BC-455, BC-312, BC-348, BC-433, BC-624, BC-733, BC-946, BC-1206, R-89/ARN-5A, ARB, BC-457, BC-458, BC-459, BC-375, BC-625, BC-654, SCR-522.

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IMPORTANT—HOW TO ORDER—The input rating of your dynamotor *must not exceed* d-c *output* rating of the rectifier. For example, dynamotor series DMDX-12 v. 2 amps.—requires Rectifier No. S-295A and Transformer RPS-8883.

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Code No. Rectifier	d-c Volts	Output Amps.	Ship. Wt. in Lbs.	Amateurs Net Price
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S-167-A	14	10	3.75	10.95
S-292-A	14	40	12	29.95
S-296-A	28	1.8	1.25	5.75
S-344-A	28	5	5.75	11.50
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S-291-A	28	20	12	29.95
S-297-A	28	40	23	52.25

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50/60 Cycle—117 Volt Primary Rating

Code No. Transformer	Secondary Volts	Amps.	See Note A	Ship. Wt. in Lbs.	Amateurs Net Price
RPS-8883	18	3		3.5	$ 3.75
RPS-8884	18	5.2		5.5	4.25
RPS-8885	18	12		12	6.15
RPS-8886	18	46		35	19.65
RPS-8888	36	2		5	4.15
RPS-8889	36	6		12	6.75
RPS-8892	36	12		25	11.65
RPS-8890	36	23		32	19.25
RPS-8891	36	46		78	51.25

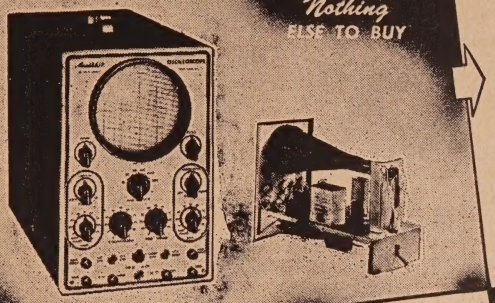
NOTE A: All transformers have 3 extra tappings—for example: 20, 19, 18, 17 volts and 38, 37, 36, 35 volts

All prices F.O.B. Los Angeles (California purchasers add 2½% sales tax). Include 25% with order—balance on delivery. Foreign orders cash. Address correspondence Dept. C7.

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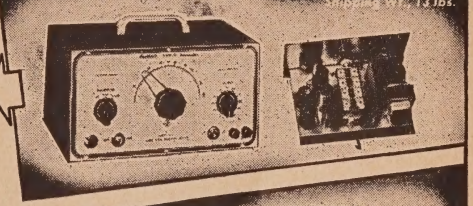
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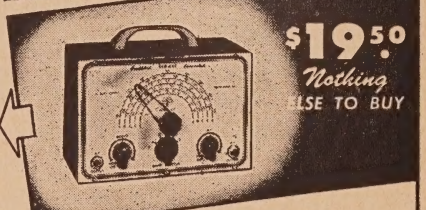


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Small portable 9" x 6" x 4¾". Wt. 6 pounds. Ideal for taking on service calls. Complete your service shop with this instrument.

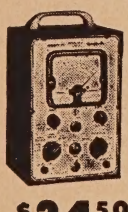


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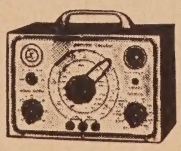
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A condenser checker anyone can afford to own. Measures capacity and leakage from .00001 to 100 MFD on calibrated scales with test voltage up to 500 volts. No need for tables or multipliers. Reads resistance 500 ohms to 2 megohms. 110V 60 cycle transformer operated complete with rectifier and magic eye indicator tubes.

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★ ★ ★ **The HEATH COMPANY**
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"Humm," I replied, as I drifted into the Land of Nod. I had won!

Not only had W3INL won; so had her OM, W3GHS. For between them they have worked a good deal of DX on 10-meter phone, with 115 countries to date, and have accomplished their heart's desire in making DXCC (how about W.A.Z. Jean?). Their rig consists of a pair of TZ40s in the final running 200 watts with a pair of TZ40s in the modulator. The antenna is a stacked 6-element affair, with the top section 45 feet above ground However, they have just completed a 50-ft wooden lattice tower, on top of which they will have their stacked 6-element rotatable beam, the top element being 70 ft. above ground. Above this they plan to have a stacked 6-element 2-meter beam, horizontally polarized. Jean happily comments: "With this 6-element beam, an ARC-5 transmitter and a 522 receiver I expect to, at long last after peddling W3GHS's a call on the air for so many years, get W3INL on the map!"

Jean adds: "In regard to my activities, I am raising a junior op, Richard, aged 7, seeing that 180 children get fed every day in a local school cafeteria, and I have many early morning hour contacts with locals on 10. It is not unusual for me to go to bed at 4, 4:30 or 5 a.m.—so you can see what my OM is up against—hi!"

BOOK REVIEWS

(*from page 62*)

data are available. This contrasts sharply with the lack of coverage of the problem of the angle of radiation, which is often the determining factor in the performance of an antenna.

Following this chapter there are sections on transmission lines and basic "sugar-coated" antenna theory. Both of these chapters are well handled and live up to their advance notices. The next several chapters deal directly with amateur antennas. The last chapters are devoted to coupling methods at the antenna and the receiver, television input circuits, measurements, navigational aids and duplexing. While the book is thoroughly readable it still falls short of the need for a comprehensive antenna handbook in the amateur field. —*O.P.F.*

DOUBLE TWIN-3

(*from page 19*)

relations desired in an antenna array are ordinarily obtained by use of transmission lines. It is a well known axiom that any line whose length is one electrical wavelength in free space, has a uniform phase shift of 360° per wavelength, 180° for a half-wavelength, and 90° for a quarter-wavelength. A change in phase between the two antennas of 0 to 90° is sufficient to control the vertical angle in 10-11 meter band operation.

To accomplish this a phasing loop was constructed as shown in *Fig. 4*. It uses a wooden frame 30 inches on a side and 7-inches deep. The frame is mounted on the wall of the shack near the entrance of the main transmission lines from the Twin-3 antennas. The line from the upper antenna is wound around the frame and joins the transmission line from the lower antenna at the bottom end of the frame. This places the two lines in series. Make sure that the two lines are properly poled.

The two antennas are then fed in parallel by taking

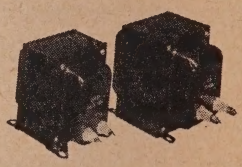


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1785-0-1785 volt 500 ma. Prim 115/230 V. 50 or 60 cy. DC rating 1500 V. 500 ma.....$23.50

1500-0-1500 volt 400 ma. Prim. 115 volt. 50 or 60 cy. DC rating 1250 volt @ 400 ma.....$15.95

1250-0-1250 volt. 300 ma. Prim. 115 volt. 50 or 60 cy. DC rating 1000 volt. 300 ma.....$11.95

Sec. #1 600-0-600 volt. 250 ma.
Sec. #2 5 Volt @ 3 amps.....$6.50
Sec. #3 24 Volt @ 3 amps.
Prim. 115 Volt 50 or 60 cy.

Sec. #1 and #2 same as above
Sec. #3 6.3 volts @ 4 amp. instead of 24 volt $6.50
Prim. 115 Volt 50 or 60 cy.

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This unit also has incorporated jacks for keying and connection for modulation. High voltage is controlled by relay when not in use, and also provisions are made for oscillator to have small amount of plate voltage; so that frequencies can be spotted on receiver. Filter condensers are oil filled and unit has less than 3% ripple, all connected, ready for operation, mounted on 7 x 11 chassis.
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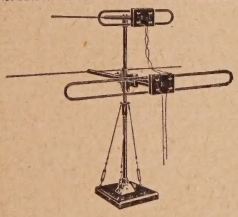
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No. 117N7-GT tube..... $2.34



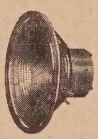
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1250 and 1700 KC, talk into the mike, and you'll hear through your own radio up to 75 feet away. For home, office, restaurants, nurseries. Uses 45 V. miniature "B" battery and flashlight cell. No. 22548R, complete with tube & battery.... $5.98

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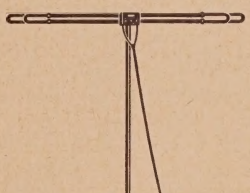
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Covers all FM bands. Heavy mounting bracket with swivel base permits antenna to be turned for best reception from any direction. Slide-in trombone type arms are calibrated and marked in megacycles. Arms and mast of light, seamless, heat-treated aluminum tubing. Easy to handle, yet tough enough to withstand winds, ice, snow. Complete with hardware, six feet of 300 ohm low-loss twin lead-in wire.

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Concord engineer, Frank W2AMJ Lester announces a new amazing versatile amplifier. It delivers 10 watts at less than 5% distortion over the entire range of 40 to 15,000 c. Variable bass and treble controls. Separate high gain channel for G. E. pickup or mike, and low gain channel for tuner. The amplifier is also designed for use with the Webster 79 wire recorder foundation unit. A complete package is being made up which includes the amplifier, Webster foundation unit and a high frequency rolloff control. The rolloff control with 6 positions for the G.E. variable reluctance or Pickering cartridge permits switching from mike to pickup. Write for info on how to adapt this equipment to your needs.

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At the start of 1948 there were 17 TV stations on the air. Today there are 31 and many new ones are scheduled to open fast, right across the country. A few of these are: Birmingham, Ala.; Phoenix, Ariz.; San Diego, Calif.; Ames, Iowa; Peoria, Ill.; New Orleans, La.; Lansing, Mich.; Syracuse, N. Y.; Nashville, Tenn.; Dallas, Tex.; Atlanta, Ga.; Jacksonville, Fla.; Indianapolis, Ind.; Portland, Ore.; Salt Lake City, Utah; Omaha, Neb.; and Louisville, Ky.

Here's the opportunity of a lifetime for servicemen. There's room to make a buck in TV. Manufacturers are turning out sets as fast as they can, and their service organizations are frantically trying to find men to install the sets. But don't be fooled. TV is a lot trickier than radio. If you figure on being a TV man in your community, now is the time to smarten up. As a starter you might look over the new Lafayette-Concord TV bulletin. It will give you a quick picture of equipment and accessories available and how much they cost. It's free. Just clip the coupon below.

the world, bar none. Does that put any butter on your bread? Mister, just ask your wife why she likes to shop at the A & P, at Woolworth's, at R. H. Macy, and she'll tell you. It *pays* to do business with the top organization. You get what you want. You get it right away. You get it for less. And you're sure of a square deal! Check these 5 important points: 1. GREATER VALUE; 2. COMPLETE STOCKS; 3. FASTEST DELIVERY; 4. ENGINEERING HELP; and 5. OLD TIME RELIABILITY. You get more than a full measure of each when you head your orders to Lafayette-Concord.

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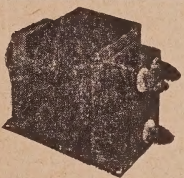
(*from page 62*)

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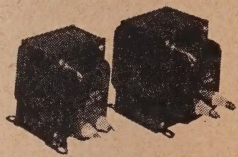
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as shown in *Fig. 4*. It uses a wooden frame 30 inches on a side and 7-inches deep. The frame is mounted on the wall of the shack near the entrance of the main transmission lines from the Twin-3 antennas. The line from the upper antenna is wound around the frame and joins the transmission line from the lower antenna at the bottom end of the frame. This places the two lines in series. Make sure that the two lines are properly poled.

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Filament Transformers 2.5 Volt @ 10 amp. 500 volt insulation (open type) $3.45
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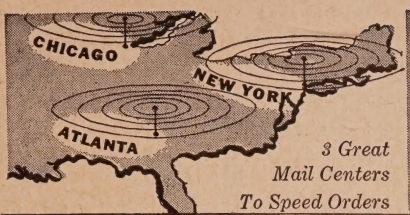
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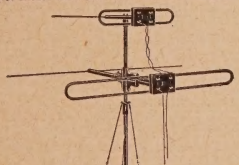
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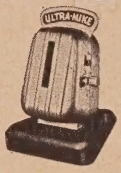


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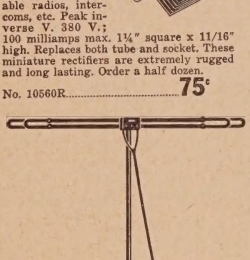
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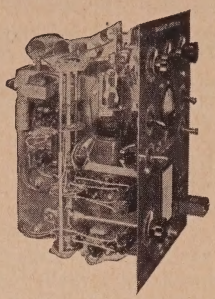
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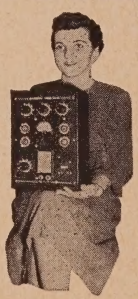
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TBS-50A, complete with tubes only

$121.25

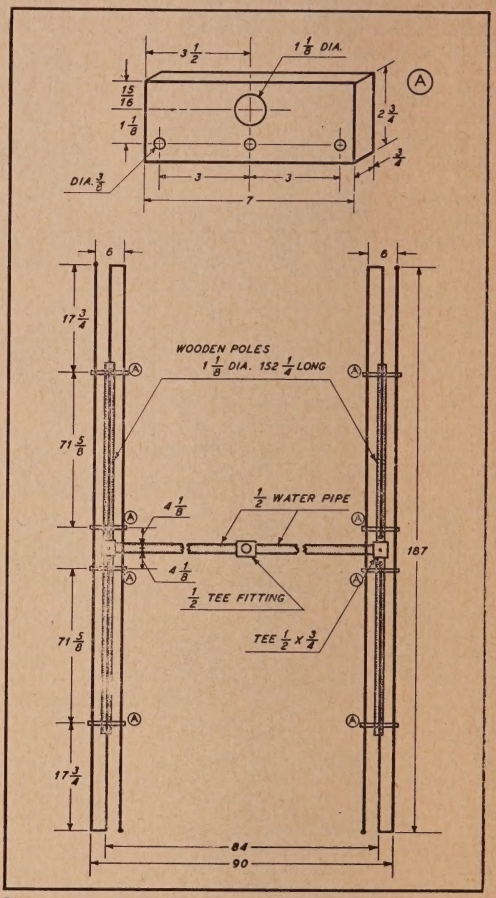


Send for catalogue describing Harvey-Wells Transmitters, Power Supplies, Preamplifiers and Rack Panels

Harvey-WELLS
ELECTRONICS, INC.
SOUTHBRIDGE, MASSACHUSETTS

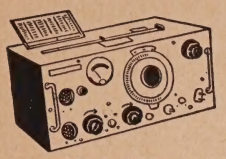
a piece of 300-ohm Amphenol ribbon, 8′ 3″ long, attaching one end to the blades of the double-pole switches and the other end to two test clips which serve as sliders on the transmission line wound around the frame. The ribbon then feeds the two antennas at a joint impedance of about 300 ohms. As the clips slide along the phasing loop there is a change in the angle of radiation with the lowest possible angle from the combination resulting when the clips are at the end of the frame near the upper antenna termination (in-phase) and highest angle when near the lower antenna termination (out-of-phase).

An important point in using the phasing loop is to have the SWR very low. The degree of match



Constructional details for a single section of the Twin-3 resonant to 28.7 mc. All dimensions in inches. Notes: Obtain the materials as indicated above. Bore out the threads from the ¾ inch sides of the ½ x ¾ inch tee fitting. This will permit the 1⅛ inch wood pole to make a snug fit. Drill one small hole in the side of ¾ inch tee, fasten each pole with a wood screw passing through this hole. Drill out wooden blocks A and varnish. These are fastened to the wood pole with screws. Eight blocks are needed. The diameter of the radiating elements is ⅜ inch.

TEST SET 159TPX



TS159 TPX

Measures frequency between 150-200 Mc., by heterodyne method. Pwr. output of XMTR can be measured directly. Measures DC voltages up to 500 V. Operates on 110 V. 400 cy. Complete with tubes, crystal, calibration chart and conversion kit for 60 cy. **$29.95**

INSTRUCTION MANUALS

BC 312, BC 342 ..... **$1.52**
SCR 281 ..... **$1.25** Mark II ..... **.75**
ZA Eqpt. ..... **.75** SCR 508 ..... **1.00**
BC 642 ..... **1.00** SX-32 ..... **.75**

VIBRATORS

TR 1210, 12 vdc, 5 pin **$1.20**
OAK V-6675, 24-32 vdc, 7 pin **1.10**
Mal. Type G534C, 12 vdc, 5 pin **1.25**
Mal. Type G629-C, 12 vdc, 4 pin **1.15**
Radiaart VR2, 6 v. DC. 6-pin special **1.40**
Mfrs. quantities in all types available.

XMTR TUNING UNITS

From BC 375: TU-9 (7.7-10 mc); TU-10 (10-12.5 mc); TU-22 (350-650 kc); TU 26 (200-500 kc). Each **$2.25**
For BC 610: TU 48 (2.5-3 mc); TU 52 (6.35-8 mc); TU 53 (8-12 mc). Each **1.75**
For BC 223AX: TU 17 (2-3 mc); TU 18 (3-4.5 mc). Each **1.95**

BAND PASS FILTER

#70473. Sharp band pass peaked at 700 cps. High-to-high impedance. Can be plugged into 'phone output of receiver for good results. Cuts out QRM New, with circuit diagram **$2.25**

ARC/5 VFO KIT 80 METERS

ARC-5, Xmtr M.O. parts and circuit for that new VFO-exciter. Kit consists of the following: 1-#6029 coil; 1-#5632 tuning condenser; 1-#4990, 1-#ARC-5 Xmtr. schematic. (Specify freq. range when ordering). Complete kit **2.75**

R.F. COILS

3C4016-7, RF coil Ass'y, 30-40 mc, for rcvr FMR-13V ..... **$ .59**
2C5395-1306/C3, Antenna Coil, 3.8 to 6.5 mc, iron core for BC 1306 rcvr **$ .45**
2C300-457, 22.5 to 25 mc. for Adcock antenna ckt of phasing box. For radio beacon equipment RC 163 ..... **$1.25**
3C302D, RF Antenna coil, 3750 to 5850 kc. p/o BC 654A ..... **$ .35**
3C351, M.O. coil, 1800 to 2250 kc, plug-in p/o Collins Xmtr 32-RA **$1.85**
3C350, M.O. coil, 1480 to 1840 kc, p/o Collins Xmtr 32 RA **$1.85**
2C5003A/C8. HF osc. coil, bands A, B, C, Rcvr BC 1003 ..... **$ .45**
2C6632 RA-1/7, RF amp. coil, 9-12 mc, Collins 32 RA Xmtr **$1.75**
2C6900-4/C3, RF amp coil, 1KW, 14, 850-18,000 kc. 3.4 Michro'hy **$2.95**
2C4528/9, BFO coil for Super Pro Receiver ..... **$ .65**
#9901, 455 kc I.F. coils, sickles, Air Trimmers ..... **$ .75**

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	**$5.75N**
DM 33	28	7	540	.250	BC 456	**$5.50**
DM 42	14	46	515	.110	SCR 506	**$6.50LN**
			1030	.050		
			2/8			
PE 55	12	25	500	.400	SCR 245	**$5.25LN**
PE 86	28	1.25	250	.060	RC 36	**$3.95**
PE 101 C	13/26	12.6/ 6.3	400 800	.135 .020	SCR 515	**$5.25N**
			9 AC	1.12		
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	.110	Mark II	**$9.95N**
			500	.050		

*N—New LN—Like New

HAND GENERATORS

GN 35: Output: 350 v. 60 ma, 8 v. 2.4 amp. less hand crank **$7.50**
GN 45: Output: 500 v. 100 ma, 6 v. 3 amp. less hand crank **$8.50**

GREAT TUBE VALUES!

01-A	$ .45	5J30	39.50	531	45.00	1624	.85
1A3	.70	6AC7	1.00	532	3.95	1629	.35
1B24	4.85	6AK5	.69	559	4.00	1961	5.00
1H5	.55	6C4	.58	562	90.00	8012	3.95
1N5	.69	6G	2.00	615	.89	9002	.65
1T4	.69	6J6	1.00	703-A	7.00	9004	.47
2C21	.69	6K7	.55	704-A	.75	9006	.47
2C22	.69	6L6GA	1.00	705-A	2.85	CEQ 72	1.95
2J21-A	25.00	6SC7	.70	†707-B	20.00	EF 50	.79
2J22	15.00	6SL7	1.00	714AY	15.00	E-1148	.75
2J26	15.00	6V6	.79	715-B	12.00	F-127	20.00
2J27	15.00	7C4	1.00	720BY	50.00	FC 258A	
2J31	25.00	7E5	1.00	720CY	50.00		165.00
2J32	15.00	7E6	.72	721-A	3.60	FC 271	40.00
2J38	25.00	10Y	.60	723-A/B		GL 562	75.00
2J39	25.00	12A6	.35		12.50	GL 623	75.00
2J55	25.00	12GP7	14.95	724B	1.75	GL 697	75.00
3J31	35.00	12K8Y	.65	724-D	2.50	ML 100	60.00
2X2/879	.69	12SF7	.49	725-A	25.00	QK 59	45.00
3A4	.65	12SR7	.72	726-A	15.00	QK 60	45.00
3BP1	2.25	15R	1.40	800	2.25	QK 61	55.00
3C24	.60	28D7	.75	801-A	1.10	QK 62	55.00
3C30	.70	30 (Spec.)	.70	804	9.95	*RCA 932	.65
3D6	.79	35L6	.69	811	1.95	VR 91	1.00
3CP1/S1	3.50	35Z5	.66	814	4.95	VR 130	1.25
3D21-A	1.50	45 (Spec.)	.59	815	2.50	VR 135	1.25
3DP1	2.25	50L6	.79	836	1.15	VR 137	1.25
3EP1	2.95	39/44	.49	837	1.95	VR 150-30	.75
3FP7	1.20	35/51	.72	843	.59	VU 120	1.00
3GP1	3.50	211	.75	860	15.00	VU 134	1.00
3Q5	.79	227A	3.85	861	40.00	WL 532	4.75
5BP1	1.20	225	8.80	874	1.95	WN 150	3.00
5BP4	4.95	250R	7.95	876	4.95	WT 260	5.00
5CP1	3.75	268-A	20.00	889R	78.50	†with cavity:	
5FP7	3.50	355-A	19.50	1005	.35	Cavity only	
5JP2	8.00	417A	22.50	1613	.95		5.00
		530	90.00	1619	.21	*Photocell	

MAGNETRON MAGNETS

For 2J21. 725-A, 2J22, 2J26, 2J27, 2J31, 2J32. and 3J31. Each **$8.00**
4850 Gauss, 3/8" bet. pole faces, 3/4" pole diam. **$8.00**
1500 Gauss. 1½" bet. pole faces, 1⅞" pole diam. **$8.00**

A complete line of Microwave Equipment in stock. 10 cm, 3 cm, 1.25 cm. Send for Microwave Flyer.

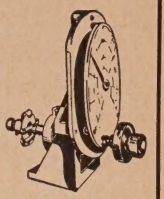
CROSS POINTER INDICATOR

Dual 0-200 microamp. movement in 3" case. Each movement brought out to 6-term. Receptacle at rear. Originally used in ILS equipment. New **$5.00**



VERNIER DIAL

Drive ratio 5:1, 2½" dial calibrated .1-1 mc. New, complete with mounting, bracket, ler, spare dial **$1.50**



SCR 610 11-10 METER PORTABLE/MOBILE RIG

SCR 610 portable transmitter-receiver, 27 to 38.9 mc, crystal controlled, using FM for efficient operation. Unit consists of Xmtr-rcvr BC 659 and power supply PE 97 . . . operating from 6 or 12 vdc. Slightly used, excellent condition **$21.00**

SPECIALS

SELENIUM RECTIFIERS. Input: 115 vac. 60 cy. Out: 120 vdc. 1.66 amps. Full Wave Bridge. F. T. & R. #DE11 ..... **$9.95**
SELENIUM RECTIFIERS. Input: 30 vac. 60 cy. Out: 24 vdc, .5 amp. Full wave bridge. GE #SC10 ..... **$1.50**
POWER SWITCH. 4 pos. 60 amps, 600 vac. Arrow H&H **$4.25**
ROTARY SPARK GAP. 24 vdc motor, 4 spark gap electrodes. p/o Xmtr BC 1081-TG **$5.50**
CODE TAPE, paper 11/16 wide, 8" diam. rolls ..... **$.50**
CABLE ASSEMBLY, 45 pr. 102' L. Telephone type WE #D166039, **$20.00** per length.
SONAR SOUND DETECTOR: Underwater detector with 7 microphone units encased in rubber sheath. Model JR **$12.50**
MN52H Azimuth control box for aircraft radio compass **$1.25**
ARC-3 Airborne radio series replacement relays. Types 55526, 55251, 55342, 55528, 55531, 55585, 55458 ..... **$.60 ea.**
FUSE HOLDER, GE type EL-1 ..... **$1.00**
AMERTYPE RECORDING FILM, 50 ft. lengths individually boxed ..... **$.35 ea.**
MODULATION TRANS. ARC $9466, push pull 807's to Plates and screens of 2 807's in parallel **$1.65**

HEADSETS

Dynamic mike and headset combination. A high quality, efficient unit, used in B-19 tank Xmtrs. Mike and phones complete, new **$2.75**
R-15 headsets: 8000 ohms impedance, rubber cushions. Comes with 8" cord and plug PL 55. New **1.95**
HEADBANDS: HB-1, HB-4, HB-30. New ..... **.25 ea**

MICROPHONE ELEMENTS

Carbon transmitter element for TS11-J, TS11-L, TS13-E, TS15-A ..... **.75 ea.**
Element for microphone T-24, 30 ohm resistance ..... **.95 ea.**

RELAYS

SPDT, 115 v. 60 cycles, 4000 ohms DCR, contacts: 5 amp. 50 v. Kurman #2221-90 ..... **$1.95**
SPST, 24-28 vdc. Heavy duty contactor, 400 amps, Leach 7220-24 ..... **$1.20**
DPDT, 24 vdc, antenna changeover, Leach 1077-BF **$1.15**

131-Q LIBERTY ST. NEW YORK 7, N. Y.

ALL MERCHANDISE GUARANTEED. Mail orders promptly filled. Rated Concerns Send P O
Manufacturers' Quantities In Stock
All prices F. O. B. New York City. Send Money Order or Check. Shipping charges sent C. O. D.
COMMUNICATIONS EQUIPMENT CO.

PHONE DI-9-4124 CABLE "COMSUPO"

between the phasing loop and the short piece of 300-ohm ribbon may be checked best with a twin-lamp standing wave indicator.[4] The size of the coupling loop should be about 8 inches. If both main feed lines have a low SWR and are balanced the flash light bulb nearest the transmitter termination will be bright and the light nearest the clips to the loop will either be dark or burning very dimly. Should both lamps burn bright or have the same brilliancy, it is an indication that standing waves are present.

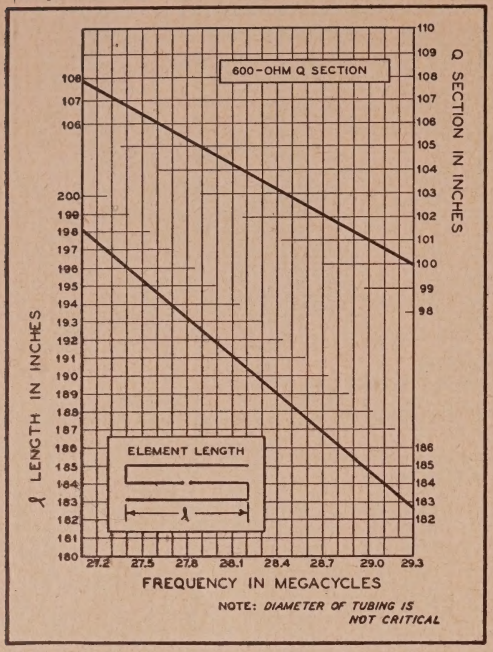


Table of dimensions for element lengths and Q section lengths.

Alternate Feed Systems

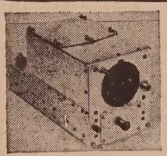
If mechanical conditions do not permit the use of the standard 600-ohm feed, as previously outlined, each single Twin-3 can be made to operate quite satisfactorily by any one of the four methods shown in *Fig. 4*. It should be remembered that the transmission line loss in types other than the open line is considerably greater, especially when the length is very long. Also, it naturally somewhat prohibits the use of the phasing loop to change the angle of radiation when ribbon type leads are employed.

The length of the 300-ohm ribbon for the *Q* sections is based on the formula

$$L_{ft} = \frac{205.5}{F_{mc}}$$

The improved Twin-3 of this type has been used on 10 meters at W8RNC for about eighteen months. The results have been excellent. During a ten-month period, over 600 DX phone contacts were made with most reports above S9. Although the antenna may seem complex, it has proved, without a doubt, to have been well worth the additional effort.

4 C. Wright, "The Twin-lamp," *QST*, Oct., 1947, p. 22.



BC—454 COMMAND REC. W/Schematics
3 to 6 Megacycles. Price—NEW.....**$5.95**
TUNING CRANK for Receivers. Price.....**50c ea.**

TRANSFORMER FOR RECEIVERS
115 Volt, 60 cycle Primary; Sec. 250-0-250 Volt 50 MA; 6.3 Volt and 24 Volt, with AC Schematic. NEW **$2.95**
TRIPLE RECEIVER RACK for C/Rec.....**$1.50**

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

BC—696 COMM. TRANSMITTER
W/Schematics; 3—4 Megacycles. NEW.....**$18.95**
USED.....**$14.95**

BC-MODULATOR
For Command Transmitters. Price—NEW.....**$2.50**

TRANSFORMER FOR COMM. TRANSMITTER
Primary 110 Volt, 60 cycle. Sec. 525-0-525 Volt, 250 MA; 12-12 or 24 Volt 3 amp., 5 Volt 3 amp. NEW **$9.95**

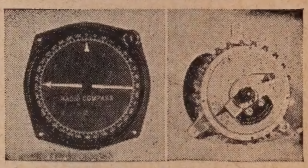


THREE FOR ONE DOLLAR SPECIALS:
3-IF Trans. F/Comm. Rec. 1st, 2nd., or 3rd 1415 Kc.
3-IF Trans. FM wide band 28, 30, 32 Mc.
3-IF Trans. FM narrow band, & Cond. Assy. 2.65 Mc.
3-IF Trans. Standard 455 Kc or 465 Kc.
3-Mica. Condensers—.01 or .001 2500 WVDC 5000 Test.

BC—223 TRANSMITTER
Frequency coverage 2000 KC to 5250 KC. Four pre-selected Crystal Frequencies or M.O. Control. Uses 801 OSC. 801 PA-2-46 Modulator, and 1-46 speech amplifier. Output 10 to 25 Watt on C.W. phone or tone. Complete with Tubes, Freq. Charts, Schematics, Tuning Units in Cases, Cables, Shock-mounted Base. Less crystals and power supply, operation 12 or 24 Volts. Price—NEW.....**$29.50**

BC—223 TRANSMITTER TUNING UNITS
TU-17 Frequency 2000 KC to 3000 KC
TU-18 Frequency 3000 KC to 4500 KC
TU-25 Frequency 3500 KC to 5250 KC
Price—Each—NEW.....**$4.50**

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**

ALUMINUM TUBING For ANTENNAS, Etc.

SIZES	ALLOY	THICKNESS	LENGTHS	PRICES—Per Ft.
⅜"	½ Hard	OK for bending	12'	$ .11
½"	½ Hard	OK for bending	12'	.13
½"	Hard	Not for bending	12'	.16
⅝"	½ Hard	OK for bending	12'	.14
⅝"	Hard	Not for bending	18'	.16
¾"	Hard (24st)	Not for bending	12'	.18
1¼"	Hard (24st)	.058 Wall	12'	.24
2"	Hard (52SO)	.049 Wall	12'	.25

B 19 MARK II TRANSMITTING & REC. SET—Complete with all spare parts including 15 spare tubes. Set ready to operate from 12 or 24 Volts DC. Frequency Range 2 to 8 Mc (40 and 80 meters). Separate 235 Mc Trans. & Rec. and two tube amplifier. Price—NEW.....**$59.50**

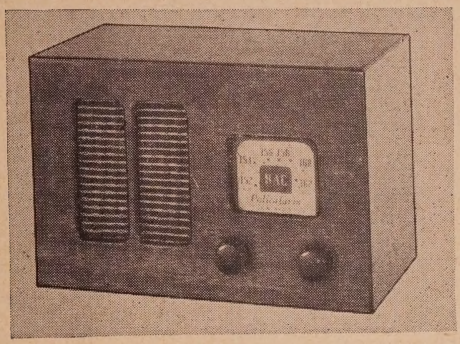
ANTENNA MAST MOUNT
Multiply Mast Mount—Can be mounted on chimneys, on gable, slanted, or flat roofs; or on sides or corners of brick or frame walls. Ideal for holding all popular types of antenna in sizes up to 1¼" diameter. Made of aluminum, with plated steel hardware. Complete with banding for chimney mounting—NEW: **$4.50.** Complete—less banding—NEW.....**$3.00**

3-Throat Mike Ext. Cord CD-318
3-Mica. Condensers—.025 or .0005 600 WVDC 1000 Test
3-Miniature Relay 24 Volt DC 1 x ¾ x ⅝ Throat Mike Carbon T-30

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

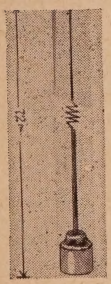
IT'S SATISFACTION or YOUR MONEY BACK at R&M RADIO

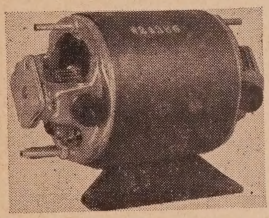


POLICALARM $39.50
FM RADIO

Here's what you've been looking for. Ideal table or desk model radio that receives 152 mc to 162 mc FM covering police, fire dept. radio telephone, interurban telephone and taxi two-way radio. Makes a swell monitor for cab operation.

6-VOLT DYNAMOTOR





IDEAL FOR MOBILE OPERATION
(300 VDC 80 mills) 6 vol DC input (250 VDC 100 mills) 4 to 5 amps.
$7.95

Just the dynamotor for that glove compartment 10 meter job. Sturdy, well made. 4"x4"x5" mounting space.

MOBILE WHIP ANTENNA
(or dipole) **$2.89**

Solid spring steel; nickel plated; has broad response, antenna matching base.
TWO for **$4.50**

• **SAVE C.O.D. CHARGES** and speed your order by remitting in full or 25% deposit. Please don't send money for postage; we ship "transportation charges collect". These prices supersede all previous prices. Write every month for BARGAIN BULLETIN.

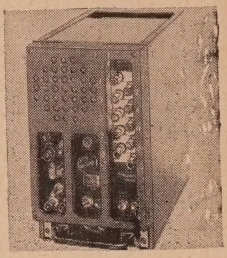
ALL EQUIPMENT F.O.B.

25 WATT FM-TRANSMITTER-RECEIVER
$29.50 *for special combination*

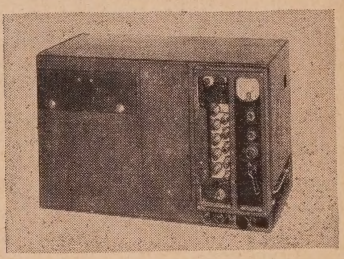
For mobile or fixed station use; easy conversion to 10 and 11 meters.

Schematic diagram and information—how to convert to 110 v. AC and amateur use.

BC-603 RECEIVER
(alone)
$14.95



10 tube, superhet FM receiver; Foster Seely discriminator, 10 channel; pretuned, push-button selector; optional manual tuning; adjustable squelch control; speaker mounted in receiver; freq. range 20 to 27.0 mc. Few small changes in RF patterns will cover 10 & 11 meter bands. POWER REQUIREMENTS — Receiver 260-280 v. at .08 amps DC, 14 v. at 3.5 amps. AC.



BC-604 TRANSMITTER
(alone) **$19.50**

10 channel, crystal controlled, selected by push button. Xmtr. has 7 1619 (2.5v 6L6's) for exciter and FM modulator; 1 1624 (2.5v 807); final amplified 85 watts; crystal oven for 10 crystals, freq. range 20—27.9 mc. 1 0-100 MA meter measures grid, plate, and ant. current. Price excludes crystals.
POWER REQUIREMENTS — Transmitter 500 VDC at .22 amps. DC, 14 VAC at 4 amps. AC.

12 v. Dynamotor for receiver $9.95
12 v. Dynamotor for Xmtr. $12.50

1 box of 80 crystals for above, when purchased with trans., $10.00 per set.

R&M RADIO COMPANY
1426 N. QUINCY ST. DEPT. CQ-108 ARLINGTON, VIRGINIA

GOLD-PLATED SPECIAL

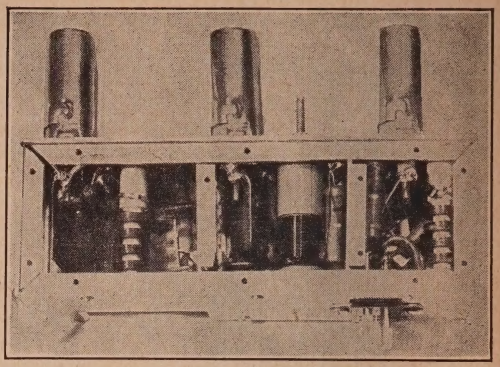
(from page 28)

The tracking trimmers are mounted so they may be adjusted from the top of the ganged doubler chassis. A right angle bracket at the front of this chassis permits it to be secured to the main chassis by 6-32 bolts.

Tube shields are not used on the 6AQ5s because they transmit excessive heat to the chassis. In rare cases, where TVI may be caused by direct radiation from one of the drivers, a tube shield at the offending stage will then be necessary.

The mounting for the plug-in coils, in the final amplifier, is supported by homemade brackets soldered to the stator terminals of the B & W butterfly. The neutralizing lead for the 4-65 is brought from the socket grid terminal through the chassis using a polystyrene feed-through located an inch from the lower rear right butterfly stator terminal. A piece of #10 wire one inch long then runs from a lug on the feed-through and is bent toward or away from the stator terminal as required for neutralization. The leads to the grid and plate meters are shielded and by-passed as shown in the circuit diagram. All grounds are made as short and direct as possible to the same point. Ventilation holes cut in the final compartment are covered with copper screen.

Position of the plate trap may be seen in the photograph. The rear plate on the rotor is bent at one corner so that, at maximum capacitance, it will short to the stator and take the trap out of the circuit, if desired.



Side view of isolator-modulator chassis. Left section is the 6AU6 isolation stage, center is the 6AK6 3.5-mc doubler, and right is the 6AK6 phase modulator. At lower left is the "securing" bracket. The cut-out for the v-f-o plug may be seen at the left rear bottom. Jones power plug is at right bottom.

The front panel is a standard 7/8" x 19" x 12¼" size made of aluminum in preference to steel because of its superior r-f shielding qualities. Dimensions for location of various controls are not given because they may be more accurately located by the builder according to his exact positioning of the v.f.o., chassis, etc.

A template is furnished with the 70E-8 oscillator. It calls for the vernier dial cut-out to be made at a

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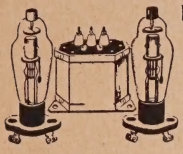
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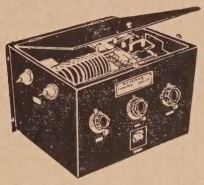


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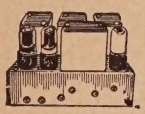
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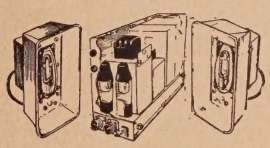
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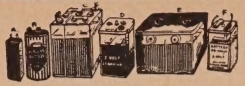
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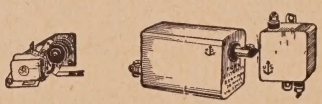


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30 degree angle each side of center. This should be made a 40 degree angle instead, in order to permit at least three marker numerals for every scale on the vernier dial to be seen at one time, thereby assuring rapid determination of frequency. The v.f.o. should be mounted so that the bottom of the oscillator case is between 1/32" and 1/16" from the top of the main chassis. It should not touch the chassis at this point.

In mounting the main chassis and the final amplifier compartment, clearance of ¾" must be allowed at the panel edges for mounting in either a cabinet or rack. ½" should also be allowed at the top and bottom of the panel.

The size of the panel coil door is 4¾" x 3¼" and is cut out of a separate aluminum panel. A ⅛" aluminum lip should be made around the door opening on the rear side of the panel to complete the shielding of the crack between the edges of the door and the panel opening. Two small hinges are installed at the bottom of the door and a small homemade catch at the top holds the door securely closed. The microswitch interlock is mounted so that the switch breaks the circuit when the door is opened ⅛" from the top edge.

The position in which the final tank butterfly must be mounted is such that the rotor shaft is above the bottom level of the door. This necessitates the use of universal type couplings (Millen 39001) to a panel shaft far enough below the door level to permit installation of the tuning knob. The control for the plate trap is also connected through universal couplings. Controls for the output link and the 3.5-mc doubler trimmer are connected through National type TX-11 flexible shafts. All panel bearings are brass and all shafts are steel.

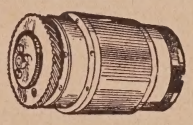
The two large knobs are the National HRT. The smaller ones are the National HRS 3. From the photograph it will be seen that the skirts have been removed from the trap and coupling knobs, and homemade pointers have been substituted for the skirt on the bandswitch and deviation control knobs.

Jewels for the bandswitched lights are the Drake slotted type 24 CSP, 11/32" o.d. with ¼" shank. They are smaller than the usual pilot jewel and when they are mounted with centers 7/16" apart, they will fall practically opposite each scale on the slide rule dial.

Operation and Adjustment

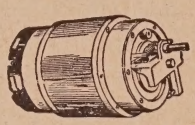
With the filament switch on, all the filaments should light and the two VR105s for the v.f.o. should glow. One of the bandswitch pilots should light, according to the position of the switch. Check the switch in all positions to be certain the lights are correctly wired.

Check the operation of the v.f.o. by running a short antenna from a receiver to the vicinity of the oscillator. Listen for the signal in the 1600 to 2000-kc range. If the oscillator is functioning, rotate the bandswitch to the 3.5-mc position, close the doubler plate switch and place the anti-capacity control switch in the "up" position. The screen keying VR105 should now glow. Set the v.f.o. at about 3700 kc and tune it in on the receiver at this frequency. Adjust the 3.5-mc 6AK6 doubler plate



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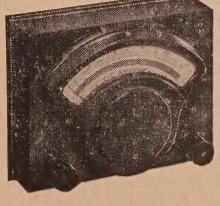
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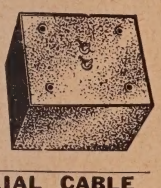
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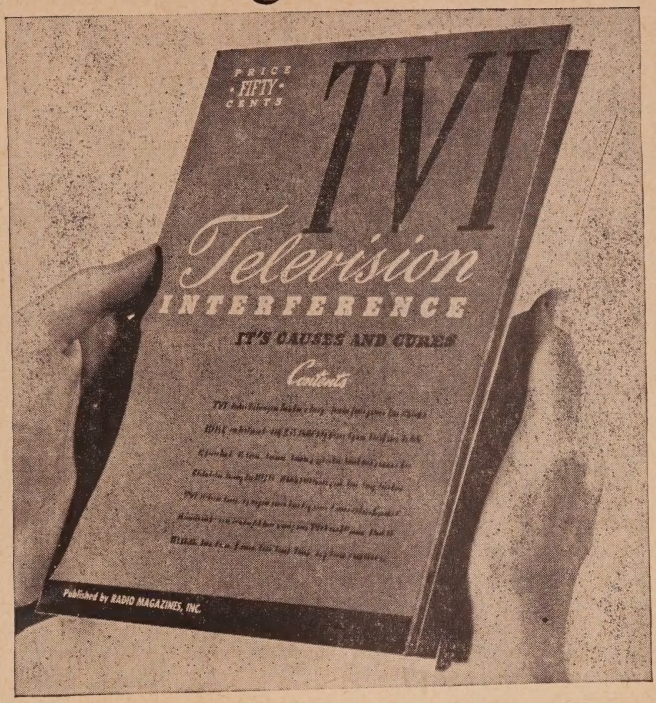
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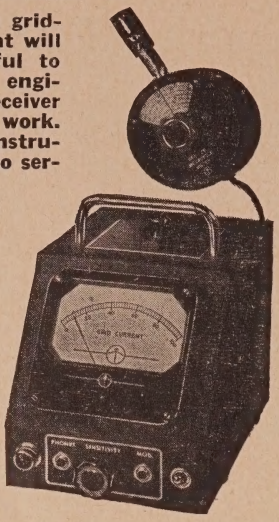
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tuning slug and the trimmer capacitor until either the signal strength heard is the greatest or, if the 3.5-mc 6AQ5 amplifier happens to be near resonance, maximum grid current of the 4-65 is observed. Ultimate L/C ratio should result in low C.

With the v.f.o. still set at 3700 kc, set the trimmer of the ganged 3.5-mc 6AQ5 amplifier at about half capacitance and adjust the tuning slug of this stage for maximum 4-65 grid current. Run the v.f.o. down to 3500 kc and then up to 4000 kc. The 6AK6 trimmer should be readjusted for resonance every 100 kc. Note whether or not the grid current on the final is constant over the range. If it drops at 3500 kc, bring it to maximum by adjusting the 3.5-mc slug. If the slug must be moved so as to increase the inductance, set the v.f.o. back to 3700 kc and slightly decrease the capacitance of the 6AQ5 trimmer. Then readjust the slug for resonance. Check again at 3500 kc and make these adjustments, together with re-trimming of the 6AK6, until uniform grid current is obtained over the range. If, when first checking the tracking, the tuning slug must be moved so as to decrease inductance, the capacitor trimmer will have to be increased and the foregoing procedure followed in the same manner. This process of alternately adjusting the slug-tuned inductance and the fixed tank capacitance (in this case the trimmer) is a simple procedure for obtaining the correct fixed to variable tuning capacitance ratio for proper tracking.

Next, with the v.f.o. set at 7200 kc and the bandswitch at the 7-mc position, tune the 7-mc doubler slug for maximum 4-65 grid current. Peak up by adjusting the compressor type trimmer connected across the grid of the 7-mc doubler. This trimmer, together with the input capacitance of the 7-mc stage input circuit, makes up for the capacitance of the 4-65 input circuit formerly connected across the 3.5-mc amplifier tank. Adjust the tracking of the 7-mc doubler for uniform output from 7000 to 7300 kc using the same procedure as with the preceding stage.

The same steps are taken, in order, for the 14 and 28-mc stages. For 21 mc, it is necessary to adjust only the 21-mc slug, because the capacitance ratio will already have been set by the adjustment at 14 mc.

For c-w operation, the 6AK6 3.5-mc doubler trimmer may be left set at one position for all bands, except the 3.5-mc band where it will have to be reset about every 200 kc for satisfactory grid current to the final amplifier. This grid current, without plate potential applied to the 4-65, should be about 20 ma on all bands.

Calibration of the 70E-8 v.f.o. should now be made according to the instructions furnished by the manufacturer.

Adjust the Final

Set the tap on the 4-65 screen VR control resistor for maximum resistance. Set the bandswitch for 3.5-mc operation and plug in the 3.5-mc plate coil. Because the 100-$\mu\mu$f butterfly does not have sufficient capacitance to resonate this coil at the low frequency end of the band, a 25-$\mu\mu$f air padder is mounted permanently across the coil. Place the plate trap in its "shorted" position. Connect a

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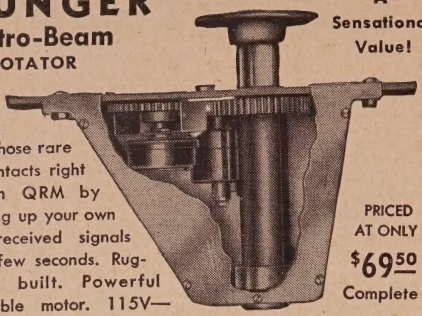
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dummy antenna load (a 200-watt lamp bulb is satisfactory) and apply plate voltage by closing the final plate switch and by placing the anti-capacity control switch in the "down" position. The 4-65 will draw a plate current of about 10 ma. Rotate the phone deviation control just far enough so its attached switch closes. This will short the key jack and will apply bias to the low power 6AQ5 control tube, thereby furnishing drive to the final. This grid drive will operate the final 6AQ5 screen control tube and screen voltage will be applied, causing normal plate current to flow at the 4-65 plate. Resonate the final tank in the usual manner and adjust the output coupling for 110 to 125 ma plate load at resonance. The 4-65 variable grid leak and the tap on the VR screen control resistor should be adjusted so that, at a plate load of 125 ma, the grid current is 14 ma and the potential at the screen terminal is 250 volts. Rotate the phone deviation control counter-clockwise until its switch opens the keying circuit. The 4-65 plate current should drop down to around 10 ma and the grid current and the r-f output should be zero.

Neutralization

No neutralization has yet been attempted. With the final constructed as described, no neutralization is required at 3.5 mc.

To neutralize, set the bandswitch for 28-mc operation and plug in the 28-mc final coil. Set the output link for minimum load and neutralize by bending the neutralizing wire so that it moves closer or further away from the right rear stator terminal of the butterfly until minimum plate current is indicated at exactly the same time maximum grid current is shown, i.e., plate current dip coincides with grid current peak.

The 50-85 mc plate trap is best tuned while observing the readings of a field strength meter tuned to the desired (or we should say, "undesired") harmonic frequency. Correct procedure has been previously described in *CQ*.[3]

Keying and Gating Amplifier

To check keying, plug the key into the "key" jack and operate it while the C.W.-PHONE switch is in the "c.w." position and while the phone deviation control is in the "off" position. The plate switches must be on, and the anti-capacity switch must be in the "down" or "transmit" position. The key should not work with this switch in either the "receive" or the "spot" position.

With the phones plugged in the gating amplifier output jack, the a-f keying monitor oscillator should be heard when the key is closed. Volume and tone controls may be set as desired. No audio tone should be heard with the C.W.-PHONE switch in "phone" position.

Connect the headphone output jack of a receiver to the gating amplifier input jack, and signals should be heard in the phones plugged in the gating amplifier output. To check the gating action of the amplifier, place the control switch in "transmit" position, the C.W.-PHONE switch in "phone" position, and listen to a signal from the receiver. When the key is closed, the signal should *not* be heard.

[3] Wilfred M. Scherer, "TVI Corrective Measures," CQ, August 1948, p. 34.

(For this test only, the C.W.-PHONE switch is on "phone" to cut off the a-f oscillator when the key is closed.)

When keying the unit on the air, no clicks should be heard anywhere on the receiver (outside the carrier limits); provided it is not overloaded by the transmitter. It is possible that a slight induction click may be heard in a receiver while it is set next to the transmitter, but this is strictly a local situation emanating from the key lead and it will not evidence itself outside of the shack.

Phone Operation

Set the transmitter on the desired frequency band, the C.W.-PHONE switch on "phone," and advance the deviation control to near maximum. Apply power and tune in the carrier with the receiver slightly off resonance. Speak into the microphone and adjust the 3.5-mc doubler trimmer (above the slide rule dial) for maximum deviation as noted in the receiver. One of the secrets of good NBFM or NBPM reception on a communications receiver is the limiting of deviation to as small an amount as possible consistent with obtaining a good audio level and maximum intelligibility. This may be achieved by properly setting the deviation control. Slightly distorted audio should be heard when the receiver is tuned right on the nose of the carrier, and slight detuning to either side of the carrier should bring in good clean audio.

The PM adjustment is most critical on the 3.9-mc phone band. It is possible to obtain slight amplitude modulation in this band with incorrect adjustment. Besides good clean audio heard on either side of carrier resonance, adjustment must be such that no increase in 4-65 grid current occurs with modulation. It will be noted that the proper adjustment (3.9-mc band) will occur when the grid current is slightly lower than that at resonance.

The trimmer adjustment is not too critical on the higher frequency bands. Also, the maximum deviation obtainable is greater, so the deviation control must be reduced accordingly.

SCRATCHI

(*from page 12*)

see what Bill really like. Golly, whiz.This Bill some dreamboat himself. He come in red jeep and things are buzzing. He say he take me riding in jeep if I like. Jeep is cute so I say yes. We go up hills, down ditches, just like rolly-coaster. Things are going most fine with much gay talk all way back to ranch house. And then there are Itchi's car tearing down road lippety split. Itchi are calling that Scratchi are right behind in amblance since hosspitall having decide he too much for them. We see amblance coming up road with dust right behind. Two men in white coats get out, take Scratchi to his bed. Then, tee hee, they driving off like crazy people. Sratchi are looking round, very happy, then he are seeing Bill and me. He are asking many questions like how are Bill getting there. Soon he finding out about Bill riding me in jeep and he are in fury like sudden.

Scratchi are sitting up in bed, calling Bill (who are realy sweet boy) a wolf in rattlesnake skin. Bill just laff and say brother hams shouldn't be mad at each other since he just come up to see how Scratchi get along. Scratchi grab big radio tube and

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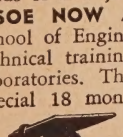
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toss at Bill. Poor Bill are knocked on head and are out like the light. I think Scratchi have no manners and I throw another big tube at Scratchi, and he join Bill in dark. Itchi only laff, sweep up mess, and say never mind. Scratchi only getting well, reason for temper.

So, Hon. Ed, I write to tell you Scratchi now in girl friend's dog-house. Maybe that Bill not so much either, since I happen to think he come from El Paso to see how much progression on Scratchi's leg. Golly whiz! When he arrive he not once ask about poor, poor Scratchi. If Scratchi not too mad when he wake up about two tubes all broken and about bump on head—also about Bill and me—maybe we still engaged. If not, Hon. Ed., maybe you single man interested in girl who just love radio?

Love,
Miss Lil O. Watanabe

MODERN WALKIE TALKIE

(*from page 42*)

clamps to the bottom of each vibrapack and provides a very neat and clean installation. *The power supply wiring is shown in Fig. 2.* Mounted on the power supply carrying case are four toggle switches which serve to turn on and off the filaments, microphone battery and vibrator supplies.

The supply *number 1* goes on immediately, but supply *number 2* does not start until the TRANSMIT switch is thrown. Section *C* of *S1* turns on the *number 2* supply and section *B* parallels its output with that of the first supply to furnish enough current for the transmitter. The current drain of the receiver is about 23 ma and that of the transmitter

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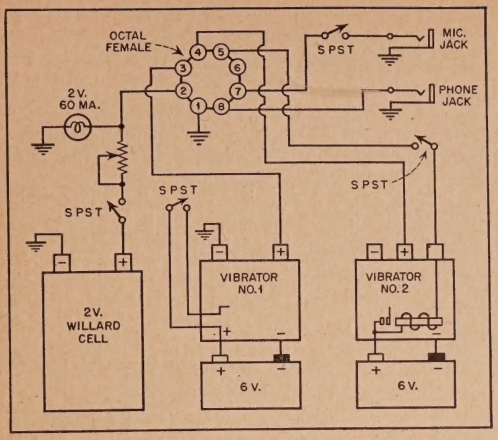
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about 45 to 50 ma at 135 volts.

The antenna was homemade by taking a small collapsible rod antenna and inserting a 6-32 brass screw into the bottom, which was already threaded. The head of the screw was clipped off and the end and the threads filed off until the body of the screw would slide into the tip of a coax connector. To prevent the antenna from grounding out against the connector shell a ½" fiber sleeve was forced over the end of the antenna and then forced into the coax connector. The tip of the brass screw projecting from the center conductor was filed or cut off and soldered. This makes a very rigid antenna the length of which may be adjusted for optimum operation.

In the field the walkie-talkie has left nothing to be desired. On one of the nights when the 2-meter band was open we operated from High Bridge Park in upper Manhattan. From this location W1JKC in Stratford, Conn., was contacted. Later in the same contact W1PEA in Norwalk, Conn., was also

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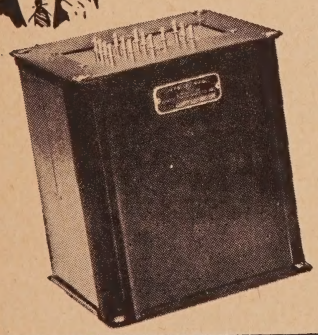
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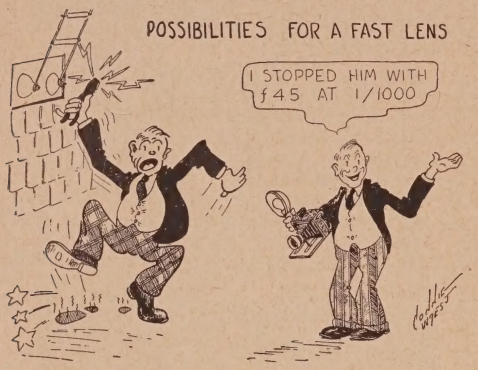
contacted and a three-way resulted. The distances here are in excess of 50 miles. However, even on an average night distances of about 10 miles are not uncommon on this low power and small antenna.

PICTURE YOUR RIG

(*from page 43*)

leave the roll for processing, instruct the clerk to leave the roll uncut, so that you can check which picture was which. The lighter negatives were exposed for less time.

Don't tilt the camera; if you can't get everything you want in the picture, raise or lower the camera, but keep it at right angles to the rig. If you have to, include more than you want, as we did, and have it cut out in the final photo.



If you have them, reflectors will shorten exposure times considerably. On the subject of lights, a third, weaker lamp will sometimes be useful in filling in shadows which you can't remove by adjusting the first two. If you don't want to bother with photo-floods, ordinary 100 watt or larger lamps can be used, with exposures of ten minutes and longer.

For publication, have glossy prints 5 x 7 or 8 x 10 inches made. Type all pertinent information about the station on a slip of paper, and paste this on the back or bottom of the print. *Never* write directly on the back of a picture.

DAI ICHI SCIENTIST

(*from page 31*)

ground that he should be a person so much sought after. After finishing his basic education in Japan, the outbreak of World War I found him with two years of work on his doctorate behind him at the Technical College in Dresden. His thesis would have been "Power Generation and Distribution." The marked progress Japan has made in its power distribution nets can be credited to Yagi and his proteges, as well as the wonderful conservation of the last ounce of water for hydroelectric generating capacity and the construction of colossal 200,000 KWH capacity high-pressure steam turbine plants.

Forced to flee Germany to prevent his internment as an enemy alien, he wandered over Europe for several months before deciding to go to England to continue his studies. There he applied himself to the study of electronics under Dr. J. A. Fleming at the University College of London. Security measures plagued Dr. Yagi's experiments, and after a short period of frustration he decided it was time to move to the United States.

In the United States he took up Physics at Harvard under Dr. G. W. O. Pierce. In but little time Drs. Pierce and Yagi were in the now famous Cruft laboratories trying to throw decrement out the window and generate a continuous wave signal from the old spark transmitter in the lab. (That was in 1916, sometime before "Spark Forever 9AAW" had

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obtained his ticket, we believe.) There these two scientists performed many pioneer experiments in supersonics and acoustics.

Late in 1916 the professorship of Electrical Power Engineering at Tohoku Imperial University at Sendai lured him back to his homeland. He later became head of the physics department and spent seventeen eventful years at the University.

Continuing his penchant for probing the unknown while at Sendai, Dr. Yagi built a stable 50-mc oscillator. That was prior to 1924 and marks the beginnings of parasitic arrays. It was some time after 1924 that we had our first antenna handbook. We had our choice of "T's" and inverted "L's" flat tops and cages, the Harp and umbrellas. Paul Godley, et al, were building a Beverage antenna miles long in England and successfully using its directive gain to first receive American hams. At the same time RCA and other commercial wireless moguls were pumping hundreds of kilowatts into marvelous hunks of skywire, flat-tops hundreds of feet high, through Alexanderson and Telefunken alternators in the region of 30 kc to span the Atlantic.

All this time Dr. Yagi was playing with his 5-meter beam in true ham fashion of methodical trial and error. First he used one parasite as a director and plotted its field pattern meticulously. Then another director and a repetition of plotting its power lobes in space. With his field strength meter first on the floor and then on the ceiling and all spaces in between, Dr. Yagi worked out the bugaboo of radiation angles. Different numbers of driven elements with variations of phasing and more reflectors and directors were employed until the law of diminishing returns set the number of parasitic elements to be efficiently employed as the ultimate "Yagi Antenna."

His co-workers and students remember him at Sendai as being forever moving about the laboratory with field strength meter under one arm and a note pad under the other, taking readings, making notes. A new arrangement of his parasite elements and more readings and more notes, in sort of an enchanted aura.

His work in wave propagation furnished an inspiration and a guide for the great installations of directional antennas ushered in by the commercial use of short waves. Chireix-Mesny, Telefunken and Walmsley antennas find a lot in common with the principles of Yagi's first beams. The fantastic arrays at the great Japanese Naval Station, JND, at Yosami bear the marks of the handiwork of Dr. Yagi, as well as the early warning radar antennas of his design located on top of Fujiyama that permitted a precious hour's notice of the arrival of the ever-increasing armadas of B-29s.

Dr. Yagi made a worth-while contribution to the American war effort, too. Our first air-borne radar that the anti-sub groups used to great success in their patrol of the East and Gulf Coasts against the German maurauders were equipped with two Yagi antennas, one on each wing. And it was called just that, a Yagi, with the usual variations of pronunciation, of course. It was not until the development of wave guides and parabolic reflectors that the Yagi was displaced. But today the four and five-element parasitic beams are finding their way into Army and Air Force communications nets in increasing numbers, so it looks as if the shades of Yagi will be with the U. S. Military for some time to come.

The time Dr. Yagi looks forward to with the greatest anticipation is the date the U. S. State Department raises its ban on the mailing of technical information to Japanese Nationals. That day, when at long last, arms full of current and back dated American technical publications arrive at Dr. Yagi's home, he will post a neat little sign on his door, "Do Not Disturb," printed in at least three languages.

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RADIO CLUBS

(from page 35)

in office. Group two are willing to be nominated if they feel they have a good chance of being elected, and usually make good officers. Group three have no desire to hold office, but can often be persuaded to accept one by stressing the need for good officers. They either make excellent or very poor officers. Excellent ones when they work at the job, and poor ones when they take a what-the-heck-I-didn't-want-the-job-anyway attitude. Group four contains the rest of us. We neither want nor will accept any part of an office.

Whichever group he is in, the best officer is always the one who has the greatest interest in the club. Not the one who talks the most, or criticizes the most, but the fellow who always pulls his own oar. In fact, the fellow who does all the work anyway.

There is a tendency to hang onto good officers, once they are found, but for the best interests of the club it may not be wise to re-elect the same officers perennially. This is not much of a problem, though, because fortunately (?) one or two terms is usually sufficient for any officer.

To recapitulate: amateur radio clubs are primarily social clubs. Their organization and continued success depend almost entirely on the willingness of a few. The average member's interest is summed up in the remark of one, "Sure, I like to attend the meetings, and chew the rag and have a good time. But after the meeting I want to forget about it until I get my notice that it is time for the next one."

This is not your attitude, or you would never have read this far. Now that you know some of the problems involved, do you still want to start a radio club? I hope so. Good luck to you.

Appendix

AIMS and NAME I

To promote mutual interest and fraternal good will among those interested in Amateur Radio, and good relations with the general public, a club to be known as is hereby founded. This constitution shall be our governing law.

MEMBERSHIP II

All persons of good character with a genuine interest in amateur radio shall be eligible for membership. The club shall, by by-law, provide rules governing election of members.

OFFICERS III

The officers of this club shall be: a president, vice-president, and a secretary/treasurer. Their duties are those usual for such officers. They shall be elected at a regular meeting, and shall serve for a period of one year, or until their successors are elected. Vacancies may be filled at any regular meeting.

MEETINGS IV

Regular meetings will be held at a time and place prescribed by by-law. Special meetings may also be called.

COMMITTEES V

The members of this club may delegate such of its rights and duties as it sees fit to an executive committee, composed of elected officers and members. Other committees may be appointed if deemed necessary.

DUES and ASSESSMENTS VI

Dues in the amount set by by-law shall be assessed members to defray operating expenses of the club. Special assessments for extraordinary expenditures may be levied by a two-thirds vote of the membership.

RULES VII

Robert's Rules of Order, Revised, shall be the final authority in resolving all disputed points in club procedure.

AMENDMENTS VIII

This constitution may be amended by a two-thirds vote of the membership. Proposed amendments shall be submitted in writing at a regular meeting, and voted on at the next regular meeting.

QUORUM I

51% of the members shall constitute a quorum.

CONSTITUTION and BY-LAWS II

The secretary/treasurer shall have custody of the constitution and by-laws, and shall note all amendments, additions and corrections thereto. He shall have them with him at all meetings, and shall permit them to be examined by members on request.

MEMBERSHIP III

Applications for membership shall be submitted in writing, with an initiation fee of , and each applicant shall signify his willingness to abide by the constitution and by-laws. Applications shall be investigated by the committee, and its recommendations reported at the next regular meeting. A two-thirds vote of a quorum shall be necessary to elect to membership.

DUES V

Membership dues shall be a year, payable in equal monthly payments. A 20% reduction is authorized on all dues paid a year in advance.

OFFICERS VI

Candidates for office shall be members in good standing, and shall be nominated by a nominating committee, or from the floor in the regular meeting immediately preceeding the regular meeting, when the elections are held. Officers begin their duties immediately upon election.

AMENDMENTS VIII

These by-laws may be amended by a two-thirds vote of a quorum. Proposals for amendments shall be submitted in writing at a regular meeting, and voted on at the next regular meeting.

ZERO BIAS

(*from page 15*)

field days outings for youngsters—there are a hundred things that could and should be done. Amateur radio needs new blood and too many youngsters never even heard of ham radio. Talks and demonstrations in front of local boy scout troops and in schools would be welcomed by their adult leaders.

At the end of the war figures on the number of prospective amateurs went up as high as a quarter million. The actual number today is closer to 100,000. The increases haven't measured up to expectations and it isn't because amateur radio has lost any of its glamour. The trouble is that lots of youngsters who might have entered the hobby were deprived of their contacts during the war. It's up to us to help them now. What we need is lots more teenagers raising the roof at hamfests and lots more 6L6s and 807s shuttling around on all bands. Let's get a breed of ham on the air that still considers trans-continental contacts big stuff, and we'll be doing our bit toward insuring the future of amateur radio.

DISTORTION PROBLEMS

(*from page 48*)

tion occurs. *Figure 6* shows the case where $f_{fundamental} = 966$ and $f_{3rd} = 2900$. At this value the phase shift for $f_{fund.} = 10°$ and for $f_{3rd} = 160°$. The resultant waveform shows quite clearly that the new peak amplitude considerably exceeds that of the fundamental—in this case the rise is 30%. Practically speaking then, this means that the voltage applied to the modulator grids will exceed, by

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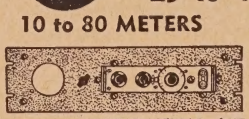
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30%, that necessary to modulate the carrier 100% and this overmodulation will result in spurious signals. Laboratory tests prove quite conclusively that the theory and practice agree very well.

Contrary to what many may think, the fact that speech rather than a sine wave will be transmitted does not appreciably change the picture. This is because the speech is clipped, and still presents a square wave to the filter. This square wave may be broken down, as shown, into sine wave components. Of course, the clipped speech wave varies rapidly in character because of the nature of speech, but an instantaneous examination will show the above conclusions to be fairly accurate.

Now that we are aware of the pitfalls that confront us, the next problem is to work out a simple practical solution. Perhaps the simplest and most reliable approach is as follows:

1) Connect an oscilloscope to the Class C output to examine the modulated r-f envelope.
2) Back off the speech clipper to render it ineffective.
3) Feed a low frequency a-f signal (around 300 cps) into the speech amplifier input.
4) With the final r-f amplifier operating at normal load, turn up the audio gain until about 80–85% modulation is indicated on the scope.
5) Advance clipping level control until it just begins to clip the peaks at this modulation level.
6) Turn up the a-f gain control so that the audio level at the clipper is about 10–12 db above the no-clipping level. This point can be determined by listening tests as 10/12 db is the point conceded to be about the maximum allowable before the speech distortion becomes objectionable to the ear.

By following the procedure outlined the signal emitted is sharp, clean, and of high average power.

The filter, being at low level, is generally followed by a driver transformer and a modulation transformer. A slight amount of phase distortion may result from the phase shift in the transformers, but with reasonable quality transformers, the phase distortion in the 200–3000 cps voice range is negligible.

After experimenting with low level and high level clipping systems, the author concludes that the average amateur possessing little test equipment is much better off to use the high level negative peak clipper followed by a splatter suppressor, such as that sold by Thordarson. This arrangement like the low level one, has some pitfalls, but that again is another story. What do we use at WØSQO? High level clipping, of course—I don't own a scope and hate mathematics.

CRYSTAL REACTANCE SYSTEM

(from page 38)

lator. *L*, in combination with *C11*, is the series reactive element, the trimmer condenser being included as a convenience in adjustment. The 90° voltage is developed across *R15* and is applied to the modulator grid by *C10*, a coupling capacitor, while *R10* is employed to isolate the r-f from the a-f component.

The unit is designed to plug directly into the crystal

socket of a c-w transmitter so that the coupling leads must be kept as short as possible and separated from one another. 300-ohm Twin-Lead will serve well for this purpose. It is also necessary that the crystal oscillator circuit be of the type in which the crystal is connected between grid and ground. In some instances it might be desirable to include the oscillator on the same chassis as the exciter, the r-f output then being coupled directly into the main transmitter at a convenient point.

Operation and adjustment is relatively simple. Short circuit *L* to ground and tune the oscillator in a conventional manner. Tune in the signal on a receiver with the b.f.o. operative and note the pitch of the beat note. Remove the short circuit and the frequency should drop. The amount of change will be dependent upon the values of *L* and *C11*. These, in combination should be adjusted to provide about a 6 kc change. The total swing may be controlled by adjustment of *C11* or the gain control; however, *C11* will set the maximum limit. Deviation obtainable with this system far exceeds the maximum swing required in amateur communication; it is necessary for this reason that the deviation be checked by any of the common methods described in texts on the subject.

The circuit constants specified are for fundamental operation on the 75-meter band. By multiplication in succeeding stages or by changing the crystal and the series tank, output on the higher frequency bands is attainable. This system has been employed in several transmitters at W2QQN from 75 meters to 10 meters. In all cases, either 3.9-mc or 7-mc crystals were used, and the desired output obtained by multiplication. When multiplication follows the exciter the deviation must be reduced proportionately.

There has been considerable discussion concerning the relative merits of narrow-band frequency modulation, but no one can dispute that NFM provides a simple inexpensive method of putting a medium or high power c-w rig on phone. Properly adjusted, an NFM signal can never be accused of taking up any more space in our crowded bands than an AM signal.

The writers are indebted to a number of stations worked on both 75 and 10 meters whose comments, critical and otherwise, and their assistance in on-the-air tests helped considerably in the development of this exciter.

117L7 UTILITY RECEIVER

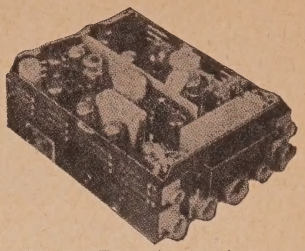
(*from page 30*)

ground without regard to the line polarity. It should have a capacity of not less than .002 μf with a d-c working voltage of not less than 500 volts.

In addition to 80 meters, this unit may be made to cover the 40 and 20-meter bands by substituting the appropriate LC grid circuit values. As one approaches the vicinity of 14 mc, some hum at the power supply frequency is encountered. The reception capabilities of any receiver are difficult to predict due to many unknown factors. A two-hour initial test, employing a 30-foot indoor antenna on 80 meters, resulted in logging all the U. S. districts and some of those in Canada and Mexico.

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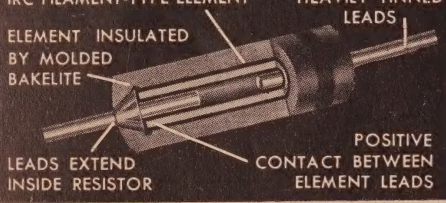
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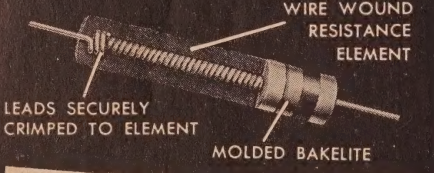
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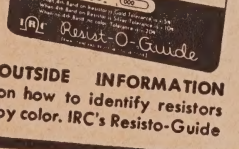
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Tube Type	Max. Plate volts	Max. Screen volts	Max. Grid volts	Max. Plate Ma.	Max. Screen Ma.	Max. Grid Ma. (Note 1)	Max. Plate Dissipation (watts)	Max. Screen Dissipation (watts)	Power Output (watts) (Note 2)	Max. Freq. in Mc. (Note 3)	Grid Bias Calculator Factor (approx.) (Note 4)
RCA-6AG7	375	250	—75	30	9	5	9	1.5	7.5	30	22
RCA-6AK6	375	250	—100	15	4	3	3.5	1	4	60	9.5
RCA-6C4	300	—	—100	25	—	8	5	—	5.5	60	18
RCA-6F6	400	275	—100	50	11	5	12.5	3	14	30	7
RCA-6L6	400	300	—125	100	12	5	21	3.5	28	30	8
RCA-6N7	350	—	—100	30 (per plate)	—	5 (per grid)	5.5 (per plate)	—	14.5 (total)	30	35
RCA-6V6GT	350	250	—100	47	7	5	8	2	11	30	9

Note 1: 100,000 ohms maximum grid resistor
Note 2: Based on 70% plate efficiency
Note 3: Maximum frequency for full power output and input
Note 4: For pentodes, this is the grid-screen amplification factor

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